

Transatlantic Differences in Labour Markets

A Test of the 'Krugman Hypothesis' for the United States, Britain, and Western Germany

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Abstract: Rising wage inequality in the U.S. and Britain and rising continental European unemployment (with rather stable wage inequality) have led to a popular view in the economics profession that these two phenomena are related to negative relative demand shocks against the unskilled in the industrialised world, combined with flexible wages in the Anglo-Saxon countries, but institutional rigidities in continental Europe ('Krugman hypothesis'). However, empirical evidence on these questions is sparse.

This paper tests the Krugman hypothesis based on several large individual data sets without making restrictive assumptions on supply behaviour as some previous studies. In addition, I use a more sophisticated categorisation of low-skilled workers, which turns out to be important in the distinction between German workers with and without apprenticeship training. I find evidence for the Krugman hypothesis when Germany is compared to the U.S. However, supply changes differ considerably between countries, with especially Britain experiencing enormous increases in the supply of skills which can explain the relatively constant British skill premium.

1 Introduction

The last quarter of the 20th century has seen a significant increase in wage inequality in the United States and Great Britain. However, this phenomenon has not been observed for Germany (*cf.* Gottschalk and Smeeding, 1997; Steiner and Wagner, 1998; Fitzenberger, 1999; Katz and Autor, 1999). In Germany (and other continental European countries), a significant rise in unemployment has occurred in the 1990s, which contrasts with the fall in British and U.S. joblessness rates during the same period. This difference in wage inequality and unemployment developments across the atlantic led to a view which is sometimes called the ‘Krugman hypothesis’ (Krugman, 1994). It states that the rise in wage inequality in the Anglo-Saxon countries and the rise in unemployment in continental Europe are ‘two sides of the same coin’, namely a fall in the relative demand for unskilled workers.¹

This paper tests whether the low skilled experienced a negative net demand shock in the U.S., Britain, and western Germany in the 1990s and whether relative wage behaviour for the low skilled was rigid in western Germany but not in the Anglo-Saxon countries. If there is something to the Krugman hypothesis, then Germany – the country with increasing average unemployment – should have experienced a change in the unemployment/non-employment structure such that the relative unemployment likelihood of the unskilled has increased. The U.S. and Britain, however, should have seen a stable (or converging) unemployment but a flexible wage structure.²

¹ The main reason for this fall in relative demand for unskilled workers seems to be skill-biased technological change, rather than trade/globalisation (*cf.* Berman, Bound, and Machin, 1998; Machin and Van Reenen, 1998; Acemoglu, 2002). See Card and DiNardo (2002) for an alternative view.

² Figure 1 plots unemployment rates for the U.S., Britain, and Western Germany since the 1960s/1970s. Although there are some issues concerning comparability mentioned in the note to the figure, one may argue that the increase in British and German unemployment in the 1980s was more like a ‘catch-up’ to standard U.S. levels. It was British, not German unemployment that became exceptionally high during this period. However, in the 1990s both British and U.S. unemployment fell markedly, whereas German unemployment ratched up again. From a macro

Many economists adhering to the Krugman hypothesis would advise Europeans to deregulate their labour markets and possibly weaken the power of trade unions. However, almost any observer of continental European society and politics might agree that such a dismantling of Europe's post-war institutions and consensus would entail high transaction costs in terms of social and political strife. Therefore, I argue that an empirical verification of the Krugman hypothesis is important, because its acceptance may lead to strong policy conclusions.

Surprisingly, there are not very many papers testing the claims of this hypothesis and the existing evidence shows mixed results. In this paper, I show that the assumption of the absence of supply shocks made in some of the previous literature is not justified. Indeed, there were substantial changes in both the age and education structures of the working age population as well as the labour force in all three countries I investigate. More importantly, these changes clearly *differed* between the three countries. Therefore, I develop a methodology that does not rely on the assumption of no supply shocks nor does it assume that demand shocks can be proxied. My approach thus differs from Card, Kramarz, and Lemieux (1999) and Krueger and Pischke (1997). So do my results: Contrary to these authors, I find support for the Krugman hypothesis. Although being conceptually related to Nickell and Bell (1995; 1996) and Gottschalk and Joyce (1998), my methodology is not restricted to only two skill groups ('high' and 'low'), but distinguishes between the age and education dimensions. As to education, I show that by preserving national specificities in the empirical analysis, an important difference arises between low-skilled Germans with and those without apprenticeship training. The previous literature which has attempted to harmonise educational categories across countries was not able to detect this

perspective one might wonder whether this divergence is just a temporary cyclical phenomenon. However, it is the fact that the U.S. and Britain experienced significant increases in wage inequality since the 1970s/1980s, whereas Germany did not, which evoked institutional explanations for rising continental European unemployment and made the Krugman hypothesis so widely accepted.

difference (*cf.* Blau and Kahn, 1996; Kahn, 2000; Acemoglu, 2003). This is not surprising given that data from the OECD's adult literacy survey (IALS) demonstrate that skill contents of 'similar-sounding' schooling types differ a lot between Germany and the U.S. (Freeman and Schettkat, 2000). Pupil test scores reported for the U.S., Britain, Switzerland, and Germany suggest the same (Nickell and Bell, 1996). For judging transatlantic differences in labour market developments, it can therefore be counterproductive to attempt to harmonise diverse educational systems, at least for the purposes of this paper.

The paper is structured as follows. Section 2 describes the data sets used. Studies that analyse a wider spectrum of countries often must compromise on data quality (*cf.* Blau and Kahn, 1996; Gottschalk and Joyce, 1998; Kahn, 2000; Acemoglu, 2003). The Luxembourg Income Study (LIS), for example, contains micro data on many countries, but often only monthly wages for household heads. Furthermore, one has at most 4 waves available for a two-decade period. Hence it is impossible to trace the developments in the 1990s in a robust fashion with these data. Similar reservations apply to the International Social Survey Programme (ISSP) data, where in addition the sample size per country is rather small (about 1,000-2,000 observations). Therefore, for each country investigated in this paper, I use at least one data set with 150,000 workers or more in the labour force. I also check the sensitivity of my results using more than one data source for both Britain and western Germany.

Differences in the changes of the labour supply structures between countries are documented in Section 3 both in the age and the education dimensions. It is in the middle and in the second half of the 1990s when German and Anglo-Saxon unemployment rates diverged. Thus, although the major increase in U.S. and British wage inequality occurred in the 1980s and early 1990s, any test of a hypothesis linking unemployment to the wage structure should consider what

happened during the decade of the 1990s. This is done in Section 4, which presents a ‘microeconometric’ test of the Krugman hypothesis in the form of statistical inference on changes in the wage and unemployment as well as non-employment structures. Consistent with the Krugman hypothesis, the results support the view that the rise in German unemployment was accompanied by insufficiently flexible wages in face of negative demand shocks against the unskilled. The affected groups are young workers and those with an education below apprenticeship training. Whereas the U.S. has seen an almost continuous increase in *between* education wage inequality, Britain has not. This difference can however largely be explained by the massive supply changes effected by British educational policy. In addition to the microeconometric test to provide evidence on the Krugman hypothesis, I also use a ‘macro’ approach based on Katz and Murphy (1992) in the discussion paper version (Puhani, 2003) which also yields results consistent with the Krugman hypothesis. Section 5 concludes.

2 Data

For the United States, I use the Current Population Survey Merged Outgoing Rotation Group (CPS-MORG) files. This is a representative and comfortably large data set frequently used in the related literature. For Britain and western Germany, I use two/three different data sets, namely the (large) British Labour Force Survey (BLFS), the British Household Panel Study (BHPS), the German Socio-Economic Panel (GSOEP), the (large) German Labour Force Survey (*Mikrozensus*, GLFS), and a (large) German administrative data set (IABR).

The optimal data set for my purposes would (1) be representative for the whole population of a country, (2) contain a definition of labour force states in accordance with the International

Labour Office (ILO) definition, (3) have accurate information on hourly wage rates, and (4) contain enough observations to guarantee precise statistical measurement.

The U.S. CPS fulfills virtually all these criteria, although wages would be measured more accurately with administrative data. There has been a recoding of the education variable in 1992, which is treated as suggested by Jaeger (1997). Furthermore, I exclude all imputed earnings whenever they are flagged. However, I checked that the inclusion or exclusion of the flagged imputed wages made virtually no difference to my results (*cf.* Hirsch and Schumacher, 2002).

The British Labour Force Survey (BLFS) is similar to the CPS, but there is no wage information before 1993 in the BLFS and until 1996, only a fifth of the interviewees were asked their labour income. In 1997, this share increased to two fifths. As the BLFS is a quarterly survey, I use all interviews of a calendar year to form an annual sample. As a result, some persons are observed more than once in a calendar year (wherever applicable in the analysis below, standard errors are corrected for clustering). The BHPS has a much smaller sample size than the BLFS, but no clear advantages, expect that it can be used as a robustness check. As the provided education variable in the BHPS is coded slightly differently than in the BLFS, I recoded the BHPS variable to make the two data sets better comparable. In both British data sets, people on government schemes are identifiable in each wave and are counted as out of the labour force.

For Germany, the data situation is more complicated (*cf.* Zimmermann and Wagner, 2002, p. 113). The GSOEP fulfills all criteria except (4) (and (3) in the sense that it does not contain administrative wage data). Although the ILO definition of the labour force state is not implemented exactly in the GSOEP, non-workers are asked whether they ‘certainly want to work again in the future’, and whether they could ‘start working immediately’. However, before wave 1996, one does not know whether somebody is currently searching for work. The administrative

IABR data is strong on criteria (3) and (4) except that this data is top-coded, excludes very low-wage workers, as well as civil servants. Also, hours of work are not reported, only a full-time/part-time indicator. Moreover, this data set does not meet requirements (1) and (2), as it is only sampling workers and people registered with the labour office who receive some form of unemployment benefit. One does not know whether these persons are really searching and are available for work in the short term, as required by the ILO definition of unemployment. Nevertheless, for what it measures, the IABR has the most accurate wage data available for Germany. As this data comes in spell form, I sample people on the 10th of April each year. The German Labour Force Survey (GLFS) meets criteria (1), (2), and (4), but fails on (3), as it only measures after-tax (hourly) income within intervals. This income can come from any sources, not just labour. Also, the top interval is open (implying top coding). Hence, as none of the German data sets comes close to being optimal for my purposes, it is worthwhile to consider all three data sets for Germany to check the robustness of the results. If feasible, I create a gross hourly wage variable (including overtime). This is possible in all countries and data sets except the IABR and the GLFS: in the IABR, I only use full-time workers as hours of work are not available; in the GLFS, I create a net hourly income variable for employed people as a proxy for the hourly wage. Wages of apprentices are excluded in all German data sets for the wage regressions below. In all countries and data sets, wages of self-employed workers are excluded in the analysis of wage structures, but self-employed workers are counted as employed in the analysis of unemployment and non-employment.

I measure skill in the age and education dimension. Age is discretised into 5 groups, namely 16-25, 26-35, 36-45, 46-55, and 56-65 years. Education is discretised into 4-6 groups depending on the data set and country. In order to acknowledge diversity in the educational

systems between countries, I preserve the national education categories instead of allocating American labels to non-American degrees. This would be especially difficult in Germany, which operates an apprenticeship system which has no direct equivalent in the U.S.³

As some of the previous literature assumes the absence of relative supply shocks, Section 3 provides a descriptive analysis of supply structures before the empirical methodology is developed in Section 4.

3 Differences in Supply Changes Across Countries

The graphs in Figure 2 demonstrate that, first, *even within a decade*, there were substantial supply side changes within the analysed economies (the results presented in the following are robust to the choice of the labour force instead of the working age population as the proxy for supply). Second, these figures show that the supply side changes *differed* between the three countries. This is true both in the age and in the education dimensions. The assumption of no relative supply changes in the methodologies of Card, Kramarz, and Lemieux (1999) and Krueger and Pischke (1997) is thus not justified. The left panels in Figure 2 display the changes in the age distribution based on the largest and most representative data set for each country. Whereas all countries have experienced changes in the age distribution, the sharp decline in the number of people between 16

³ Numbers of observations for each data set and sample unemployment and non-employment rates for different skill groups (using sampling weights as provided in the respective data sets) are reported in the discussion paper version of this paper (Puhani, 2003). Although west German unemployment in my sample was not massively higher (if at all) in 1997 than in Britain, the data confirm the trends from the OECD data of Figure 1. Especially remarkable is how the vast difference in youth and low-skilled unemployment between the Anglo-Saxon countries and Germany has shrunk during the 1990s. Yet the data also confirm the point made by Nickell and Bell (1995; 1996) that the rise in continental European unemployment also affected high-skilled workers. Most of these general trends are also supported by the non-employment rate figures. An interesting difference, though, is the fact that the non-employment rate of prime-aged workers and persons with a degree did not increase that much in Germany, but the unemployment rate did. However, these raw changes in unemployment rates do not take changes in the composition of the labour force into account, *i.e.* like the evidence in Nickell and Bell (1995; 1996), they do not provide *ceteris paribus* comparisons. These *ceteris paribus* comparisons will be provided in Section 4 of this paper.

and 25 years of age in the British but more so in the German working age population is striking (the same holds for the labour force). This finding is robust across the various data sets used for these countries, whereas the change in the American age structure is rather different from both the British and the German ones. An equally important observation can be made on changes in the educational structure in the right panels in Figure 2. It is shown in the graphs that all countries have experienced skill upgrading in their working age populations (the same holds for the labour forces). Indeed, all data sets show an increase in the share of workers who have a degree as well as a decrease in the share of workers with the lowest level of education. However, it is very clear just from visual inspection of the graphs that these changes were most dramatic in Britain, caused by educational reforms (*cf.* Machin, 1996; 1998). The share of workers with no qualification in the working age population (as well as in the labour force) decreased by about 10 percentage points in Britain within less than a decade.

In the light of these results, the following section will apply a methodology to test the Krugman hypothesis without making any assumptions on the nature of supply (or demand) shocks.

4 Differences in the Changes of the Wage, Unemployment, and Non-Employment Structures

4.1 Identification of Relative Net Demand Shocks and Relative Wage Rigidities

The methodology applied in this section identifies relative *net* demand shocks (*i.e.* ‘increasing’ and ‘decreasing’ labour markets) and wage rigidities. Conceptually, it draws on Nickell and Bell (1996) and Gottschalk and Joyce (1997) in that it uses unemployment/non-employment as a measure of quantity rationing (*i.e.* the failure of the market to clear) in the presence of wage

rigidities. However, unlike these previous studies, I consider several classes of skill in both the age (as a proxy for experience) and education dimensions and control for these as well as other labour market characteristics (gender, region) in a regression framework in *both* the wage *and* unemployment models. As a sensitivity check, I also use non-employment (instead of unemployment) as a measure for quantity rationing. The modelling approach does not exclude that there is competition between heterogeneous types of labour.

Theoretical Justification – Net Demand Shocks

In order to make out increasing and decreasing labour markets, I develop a model that shows how ‘net demand shocks’ can be identified from the observation of wage and unemployment/non-employment changes. The framework rests on a neoclassical model of the labour market:

$$S_t = S_t(\mathcal{W}_t, \mathcal{Z}_t) \quad (L \times 1 \text{ vector of labour supplies})$$

$$D_t = D_t(\mathcal{W}_t, \mathcal{Z}_t) \quad (L \times 1 \text{ vector of labour demands})$$

where D_t and S_t denote vectors of labour demand and supply for L different labour markets, respectively. $\mathcal{W}_t$ is a vector of wage rates (later proxied by earnings) and $\mathcal{Z}_t$ is a vector of demand and/or supply ‘shift factors’, like the size of the labour force, technological change or foreign demand.

Unemployment or non-employment can arise due to a real wage rigidity that causes quantity rationing (*i.e.* the failure of the market to clear). Unemployment due to rigid wages can be expressed as a function of the vector of wage rates and supply/demand shift factors as

$$\mathcal{U}_t = \frac{(S_t - D_t)}{S_t} = 1 - \frac{D_t(\mathcal{W}_t, \mathcal{Z}_t)}{S_t(\mathcal{W}_t, \mathcal{Z}_t)} = \mathcal{U}_t(\mathcal{W}_t, \mathcal{Z}_t) \quad (1)$$

($L \times 1$ vector of latent unemployment rates).

In practice frictional unemployment may be higher for some groups than for others. In order to net out this effect, it is useful to observe *changes* in unemployment and wages between two points in time t (1991 in this paper) and $t+\tau$ (from 1992 up to 2001 in this paper). Using a Taylor expansion one obtains

$$\Delta_t^{t+\tau} \mathcal{U}^l \approx \underbrace{\mathcal{U}_{\mathcal{W}}^{l,l} \cdot \Delta_t^{t+\tau} \mathcal{W}^l}_{\text{own wage effect}} + \underbrace{\sum_{j \neq l} \mathcal{U}_{\mathcal{W}}^{l,j} \cdot \Delta_t^{t+\tau} \mathcal{W}^j}_{\text{cross wage effects}} + \underbrace{\sum_j \mathcal{U}_{\mathcal{Z}}^{l,j} \cdot \Delta_t^{t+\tau} \mathcal{Z}^j}_{\text{pure net supply shift effects}} \quad (2)$$

$\underbrace{\hspace{10em}}_{\text{net supply shift effect } \xi^l}$

where $\mathcal{U}_{\mathcal{W}}^{l,l}$, $\mathcal{U}_{\mathcal{W}}^{l,j}$, and $\mathcal{U}_{\mathcal{Z}}^{l,j}$ are elements of the Jacobian derivative of $\mathcal{U}$ referring to the own wage (the wage in the same labour market), the wages in other labour markets, and the demand/supply shift factors, respectively.

Economic theory allows to impose a light restriction, which is helpful for identification in the econometric analysis: if labour supply and demand schedules are ‘upward’ and ‘downward sloping’, respectively, then $\mathcal{U}_{\mathcal{W}}^{l,l}$ will be positive, because a *ceteris paribus* increase of the own-wage will increase unemployment in the corresponding labour market. $\mathcal{U}_{\mathcal{W}}^{l,l}$ will also be positive in other cases, one of them being ‘backward-bending’ labour supply behaviour in case the slope of the demand curve is less steep than the one of the supply curve and there is no excess demand for labour. It therefore seems innocuous to impose the restriction that $\mathcal{U}_{\mathcal{W}}^{l,l}$ is positive.

As to the sign of the cross-wage effects $\mathcal{U}_{\mathcal{W}}^{l,j}$, economic theory has little to say. This is also true for the sign of the derivative of unemployment with respect to the supply/demand shift

variables, $\mathcal{U}_Z^{l,j}$, as these variables subsume a wide range of unspecified factors. Note that no assumption is made on the size of substitution or any other demand or supply elasticities. These weak assumptions come at the price of not being able to measure demand or supply shocks and wage rigidity *quantitatively*. However, as can be deduced from equation (2), observation of the signs of the changes in wage and unemployment rates between two points in time identify the *sign* of the change in the net supply shift effect (*i.e.* the net supply shock)

$$\xi^l = \underbrace{\sum_{j \neq l} \mathcal{U}_W^{l,j} \cdot \Delta_t^{t+\tau} \mathcal{W}^j + \sum_j \mathcal{U}_Z^{l,j} \cdot \Delta_t^{t+\tau} \mathcal{Z}^j}_{\text{net supply shift effect}}$$

in 7 out of 9 cases (distinguished by the sign of wage and unemployment changes, similarly as in Table 1). Note that a negative net demand shock is equivalent to a positive net supply shock, *i.e.* $\xi^l > 0$. A negative net demand shock implies a ‘decreasing’ market, that is, at a given wage, demand is falling faster than supply.

Relative Net Demand Shocks

However, the question posed by the Krugman (1994) hypothesis is not whether low-skilled workers experienced a negative net demand shock, but whether they faced a *relative* negative net demand shock. A relative negative net demand shock for a labour market l means that the net demand shock experienced by this market is more negative than the one affecting the reference market r (the latter refers to an ‘average’ market and is defined to be the *1991 sample mean* of the labour force or of the working age population in this paper). Identification of relative net demand (or supply) shocks is based on observing relative wage and unemployment changes:

$$\left[\Delta_t^{t+\tau} \mathcal{W}^l - \Delta_t^{t+\tau} \mathcal{W}^r \right] \text{ and } \left[\Delta_t^{t+\tau} \mathcal{U}^l - \Delta_t^{t+\tau} \mathcal{U}^r \right].$$

The identification of relative net demand shocks also requires an additional assumption, namely $\mathcal{U}_{\mathcal{W}}^{l,l} \approx \mathcal{U}_{\mathcal{W}}^{r,r}$. Using a Taylor approximation as for the derivation of (2) one can write:

$$\begin{aligned} & \left[\Delta_t^{t+\tau} \mathcal{U}^l - \Delta_t^{t+\tau} \mathcal{U}^r \right] \approx \\ & \mathcal{U}_{\mathcal{W}}^{l,l} \cdot \Delta_t^{t+\tau} \mathcal{W}^l - \mathcal{U}_{\mathcal{W}}^{r,r} \cdot \Delta_t^{t+\tau} \mathcal{W}^r + \sum_{j \neq l} \mathcal{U}_{\mathcal{W}}^{l,j} \cdot \Delta_t^{t+\tau} \mathcal{W}^j - \sum_{j \neq r} \mathcal{U}_{\mathcal{W}}^{r,j} \cdot \Delta_t^{t+\tau} \mathcal{W}^j + \\ & \sum_j \mathcal{U}_{\mathcal{Z}}^{l,j} \cdot \Delta_t^{t+\tau} \mathcal{Z}^j - \sum_j \mathcal{U}_{\mathcal{Z}}^{r,j} \cdot \Delta_t^{t+\tau} \mathcal{Z}^j \end{aligned} \quad . \quad (3)$$

Imposing $\mathcal{U}_{\mathcal{W}}^{l,l} \approx \mathcal{U}_{\mathcal{W}}^{r,r}$, which means that the own-wage effects on unemployment are similar in labour market l and reference market r , yields:

$$\left[\Delta_t^{t+\tau} \mathcal{U}^l - \Delta_t^{t+\tau} \mathcal{U}^r \right] \approx \mathcal{U}_{\mathcal{W}}^{l,l} \left[\Delta_t^{t+\tau} \mathcal{W}^l - \Delta_t^{t+\tau} \mathcal{W}^r \right] + \xi^{l,r} \quad (4)$$

where

$$\xi^{l,r} = \sum_{j \neq l} \mathcal{U}_{\mathcal{W}}^{l,j} \cdot \Delta_t^{t+\tau} \mathcal{W}^j - \sum_{j \neq r} \mathcal{U}_{\mathcal{W}}^{r,j} \cdot \Delta_t^{t+\tau} \mathcal{W}^j + \sum_j \mathcal{U}_{\mathcal{Z}}^{l,j} \cdot \Delta_t^{t+\tau} \mathcal{Z}^j - \sum_j \mathcal{U}_{\mathcal{Z}}^{r,j} \cdot \Delta_t^{t+\tau} \mathcal{Z}^j$$

is the relative net supply shock.

Hence, by observing relative wage and unemployment changes, $\Delta_t^{t+\tau} \mathcal{W}^l - \Delta_t^{t+\tau} \mathcal{W}^r$ and $\Delta_t^{t+\tau} \mathcal{U}^l - \Delta_t^{t+\tau} \mathcal{U}^r$, and noting that equation (4) holds, even without knowledge of $\mathcal{U}_{\mathcal{W}}^{l,l}$, the sign of the relative net supply shock $\xi^{l,r}$ (which is the negative of the relative net demand shock) can be identified. $\xi^{l,r}$ is the basis for the classification into ‘increasing’ ($\xi^{l,r} < 0$) or ‘decreasing’ ($\xi^{l,r} > 0$) markets of labour market characteristics in Table 1 as will be shown in the following subsection.

Empirical Implementation

In order to take the above concepts to individual data, I define a labour market l by its characteristics $\mathbf{x}_l$ (*e.g.* age, education, gender, region; the subscript l will be dropped hereafter), and denote the reference labour market r by $\bar{\mathbf{x}}$ (the 1991 sample mean of the labour force). $\mathcal{W}$ and $\mathcal{U}$ are defined as expected values of the wage rate W and the unemployment indicator $U = 1(\text{unemployed})$, respectively. $1(\bullet)$ is the indicator function which takes on value 1 if the argument is true and 0 otherwise. Hence I define

$$\begin{aligned} \left[\Delta_t^{t+\tau} \mathcal{W}^l - \Delta_t^{t+\tau} \mathcal{W}^r \right] &\equiv E \left[W_{t+\tau} - W_t | \mathbf{x} \right] - E \left[W_{t+\tau} - W_t | \bar{\mathbf{x}} \right] \\ \left[\Delta_t^{t+\tau} \mathcal{U}^l - \Delta_t^{t+\tau} \mathcal{U}^r \right] &\equiv E \left[U_{t+\tau} - U_t | \mathbf{x} \right] - E \left[U_{t+\tau} - U_t | \bar{\mathbf{x}} \right]. \end{aligned}$$

In order to identify labour market *characteristics* associated with relative earnings or unemployment changes, I parameterise the distributions of W and U in the following way:

$$E \left[\ln W_t | \mathbf{x} \right] = \mathbf{x} \boldsymbol{\beta}_t$$

$$E \left[U_t | \mathbf{x} \right] = \Phi(\mathbf{x} \boldsymbol{\gamma}_t)$$

where $\Phi(\bullet)$ denotes the cumulative distribution function of the standard normal distribution. A transformed version of the (dummy variable) coefficients of these non-linear parametric regression models forms the basis for the classification of each labour market characteristic x_k (*e.g.* young age or low level of education) to its contribution to relative wage and unemployment changes. This contribution is measured by the changes in the transformed (denoted by an asterisk) coefficients over time: $(\beta_{t+\tau,k}^* - \beta_{t,k}^*)$ and $(\gamma_{t+\tau,k}^* - \gamma_{t,k}^*)$, respectively. The transformed coefficients (as well as their standard errors) are calculated as in Haisken-De New and Schmidt

(1997): $\beta_t^* = (\mathbf{I} - \mathbf{W})\beta_t$, $\gamma_t^* = (\mathbf{I} - \mathbf{W})\gamma_t$, where $\mathbf{I}$ is the identity matrix and $\mathbf{W}$ is a matrix containing weights, which in my case are the *base period* (1991) *sample means*. This transformation sets the ‘base category’ for all dummy variables equal to the *base period sample mean*. It can be shown that due to the non-linearity of the log-linear wage regression and the probit model, this transformation is necessary to interpret changes in the coefficients over time as contributions to rising relative wages or unemployment likelihoods. Hence, instead of classifying each conceivable labour market defined by all dummy variable groups, one can just classify each labour market characteristic x_k into one of the nine cells defined in Table 1, depending on whether it contributed to a rising, constant, or falling relative wage rate or unemployment likelihood. This is the approach taken in the following subsection.

4.2 Empirical Results on Relative Net Demand Shocks and Relative Wage Rigidities

In order to focus the discussion on the test of the Krugman hypothesis, Table 2 to Table 5 present the classification results for the age and education variables as defined in Table 1.⁴ Around 5 different categories in both the *age* and *education* dimensions are distinguished rather than only allowing for 2 skill types as in the previous section and the studies by Nickell and Bell (1996) or Gottschalk and Joyce (1997). This is important because the low-skilled group is not as homogeneous in Germany as it is in the Anglo-Saxon countries, as more than half of the German population has received vocational training (apprenticeship), whereas only 20 percent have

⁴ The choice of 1992 as the base year in the CPS is due to the definition change of the education categories between 1991 and 1992. In the following, I will also discuss results for 1991 and 1993 as the base year when considering the *age* dimension of skill. The results are robust with respect to the choice of base year. The year 1993 is chosen as base in the BLFS because there is no information on wages before this year.

obtained only ordinary school education. This latter share is much higher in the Anglo-Saxon countries, at around 50 percent in the U.S. and even higher in Britain (*cf.* Figure 2).⁵

The classification results are based on two-sided t -tests with the null hypothesis that there were no changes in the coefficients of the wage nor the unemployment/non-employment equation for a certain characteristic, *e.g.* age 16-25 years, between the base year 1991 and the reporting year mentioned at the top of each column. Sizes of 5 percent of these t -tests correspond to a *level* of 10 percent (which is the upper bound of the true size, the lower bound being 5 percent) of the Bonferroni joint test of the null hypothesis $(\hat{\beta}_{t+\tau,k}^* - \hat{\beta}_{t,k}^*) = (\hat{\gamma}_{t+\tau,k}^* - \hat{\gamma}_{t,k}^*) = 0$. As I do not want the level of the joint test to exceed 10 percent, I only consider 5 percent critical values for the t -statistics. This testing procedure allows for correlations in the error terms of the wage and unemployment regressions without imposing functional forms on their joint distribution.

Depending on the test results each skill characteristic is classified into one of the nine fields as exhibited in Table 1 (tables and figures of detailed estimation results are presented in the discussion paper version, Puhani, 2003; figures of estimated education coefficients in the wage and unemployment regressions are displayed in Figure 3. Classification results for the control variables gender and region are not presented here, but are available on request. The type of classification is reported as a number which is explained in the note to the tables and also corresponds to the numbers in Table 1. If the Krugman (1994) hypothesis were to hold, one would expect that low-skilled (young age, low education) categories in western Germany be classified as (1): ‘strongly rigid’, (2): ‘weakly rigid in a decreasing market’, or, if wages were somewhat but not sufficiently flexible, as (3): ‘weakly adjusting in a decreasing market’. In the

⁵ Contrary to a myth that seems to exist even in the minds of some Anglo-Saxon labour economists, German workers with apprenticeship training must clearly be defined as ‘low’ rather than ‘high’ skilled (if such a simple distinction

U.S. and in Britain, one would only expect relative wage adjustments, but no changes in relative quantity rationing (at least not to the disadvantage of the unskilled). Hence, low-skilled characteristics for these countries should be classified as (4): ‘strongly adjusting in a decreasing market’. Although there is evidence for the Krugman hypothesis in the data, it turns out that the results are not as ‘clean’.

Testing the Krugman Hypothesis with Respect to the Age Dimension of Skill

The classification results for the age groups are shown in Table 2. The low-skilled group here consists of workers between ages 16 and 25 (as they hardly have any work experience). There is only weak support for the Krugman (1994) hypothesis in this table: the evidence for the U.S. surprisingly suggests a strong relative wage rigidity (classification (1))⁶. Wages for British young workers seem to have reacted to negative net demand shocks, as the prevailing classifications (3): ‘weakly adjusting in a decreasing market’ and (4): ‘strongly adjusting in a decreasing market’ for this group indicate. Especially the larger BLFS data set suggests that the unemployment likelihood of the young fell by less than the one of the other age groups (which is apparent from classification (3) and the fact that British unemployment fell on average). This at least suggests that – in spite of relative wage losses – the British wage structure is somewhat less flexible for younger workers than for other groups. For Germany, on the other hand, classifications (3): ‘weakly adjusting in a decreasing market’ and (1): ‘strongly rigid’ dominate, which shows that increasing relative youth unemployment in this country is related to insufficiently flexible wages. If one checks the robustness of these results by using non-employment instead of unemployment

is to be made). This is demonstrated by the wage regression results of Figure 3, which show that this group receives lower wages than workers with German high-school education.

⁶ However, the results for the U.S. are somewhat more erratic when 1991 or 1993 are chosen as base year, where the ‘flexible’ classifications (4) and (6) appear besides the dominant (1): ‘strongly rigid’ if 1992 is the base. Still, in this case, the classification (1) also appears during the years 1996/97 to 2000, but not in 2001.

as the measure for quantity rationing, more support for the Krugman hypothesis emerges (*cf.* Table 3): the U.S. evidence suggests no rigidity, the preferred British data set, the BLFS, classifies young workers mostly into the ‘flexible’ class (4), whereas class (3) dominates in the large German GLFS data set.⁷

Testing the Krugman Hypothesis with Respect to the Education Dimension of Skill

Having found some weak support for the Krugman (1994) hypothesis in terms of the wage and unemployment/non-employment structures with respect to age, the question arises whether the educational wage and unemployment/non-employment structures behaved in a similar way. I will show that with respect to education, there is even more evidence for the claim of the Krugman hypothesis that rigid wages for the low-skilled may cause German unemployment. However, this only holds for the *lowest* education groups. Furthermore, in Britain, supply effects matter a lot, which is not taken into account in the simple statement of the hypothesis.

Table 4 presents classification results for the education coefficients in the three countries. I discuss the two lowest education groups in each country, which are *high school* and *high school dropouts* in the U.S., *O-level equivalent* and *below O-level equivalent* in Britain, and *apprenticeship* and *below apprenticeship* in western Germany. For the lowest education groups in these countries, there is a clear contrast between the Anglo-Saxon economies on the one hand, and western Germany on the other: The large data sets in Germany predominantly display

⁷ Choosing 1992 or 1993 as the base year in the BHPS data reveals no classification (3) in any year (only 4) for neither the unemployment nor the non-employment measures for quantity rationing. Hence, there is no further indication of relative wage rigidity in Britain from this robustness check. For western Germany, however, the finding of relative wage rigidity in the GSOEP data with unemployment as the measure for quantity rationing is robust to the choice of 1992 (but not 1993) as the base period. The same holds for the GLFS data set, where classifications (1) and (2) occur in both the models with unemployment and non-employment when 1993 is chosen as the base year (note that there is no GLFS survey available for 1992). In the IABR data, there is also some indication for relative wage rigidity if 1992 (but not if 1993) is chosen as the base period. Hence, choosing alternative base periods does not change the main conclusion that western Germany exhibits relative rigidity for

classifications (1): ‘strongly rigid’ (GLFS data) and (3): ‘weakly adjusting in a decreasing market’ (IABR data).⁸ In the U.S., by contrast, only the ‘flexible’ classifications (4): ‘strongly adjusting in a decreasing market’ and (9): ‘converging’ are observed. In Britain, the least skilled group seems not to have experienced a negative relative *net* demand shock. However, as discussed in Section 3, there was a massive decrease in the relative supply of the least educated group in Britain in the 1990s (*cf.* Figure 2), which must have netted out a relative ‘gross’ demand shock against this group. Hence, although the differences between western Germany and the United States are striking and consistent with the Krugman hypothesis, the British evidence points to the potential importance of supply side effects, which clearly differed between countries as shown in Section 3.⁹

Considering the second lowest skill groups, there is no consistent picture supporting the Krugman hypothesis: In the U.S., classifications (4): ‘strongly adjusting in a decreasing market’ and (9): ‘converging’ alternate for high school graduates. The evidence from the large British BLFS data set, however, suggests insufficiently flexible relative wages in terms of classification (3): ‘weakly adjusting in a decreasing market’. In western Germany, the evidence is not robust, with the GLFS exhibiting relative wage rigidity in the form of classification (2): ‘weakly rigid in a decreasing market’ but the IABR and GSOEP data suggesting otherwise (where classifications (6): ‘strongly adjusting in an increasing market’ and (7): ‘weakly adjusting in an increasing market’ prevail).

young workers’ wages. Although GSOEP and IABR data might suggest that the rigidity originated between 1991 and 1993, the GLFS data suggest further increases in rigidity even after 1993.

⁸ The point estimates of the small GSOEP data set also suggest rising relative unemployment for the least skilled and falling relative wages, but especially the former are mostly not significant as the classifications in Table 4 show.

⁹ The classification results for western Germany are robust to the choice of 1992 or 1993 as the base period in *all three* data sets and in both the models with unemployment and non-employment as the measure for quantity rationing (there are only minor deviations which do not alter the interpretation of the results). The same holds for the British BHPS data with 1992 or 1993 as the base, as well as the U.S. results if 1993 is chosen as the base period.

If I use non-employment as the measure for quantity rationing (*cf.* Table 5), the results are very similar except that in the British BLFS the lowest instead of the second lowest skill group displays relative wage rigidity.¹⁰

The Importance of Apprenticeship Training in Germany and Supply Changes in Britain

These differences in the results for the two lowest education categories substantiate the value of considering various dimensions of skill as well as more detailed *national* education characteristics. Unlike previous studies like Nickell and Bell (1996) and Gottschalk and Joyce (1998), I show that distinguishing between additional than just high- and low-skilled groups reveals more sophisticated results: Indeed, it seems that Krugman's hypothesis is valid only for the least skilled education groups, but probably not for German workers with an apprenticeship certificate. The relative supply of apprenticeship certificate holders has not fallen by much in western Germany during the 1990s (*cf.* Figure 2c). Taken together, this evidence is consistent with a point made by Nickell and Bell (1996) and Freeman and Schettkat (2000), namely that a large part of the 'low-skilled' in Germany may have a higher level of human capital than their peers in the Anglo-Saxon countries due to the training they receive through the German apprenticeship system. Indeed, the evidence presented here raises doubts on whether workers who have gone through Germany's apprenticeship system experienced the same relative negative demand shocks as American high school graduates. Previous studies have lumped several low-skilled groups together and therefore blurred this interesting finding: A German-style apprenticeship education seems to convey skills that are of a rather different quality than the

¹⁰ As in the case of the lowest education groups, the classification results for the second-lowest education groups are robust to the choice of 1992 or 1993 as the base period in all three German data sets; and in the British BLFS in both the models with unemployment and non-employment as the measure for quantity rationing. The U.S. results are also robust when 1993 is chosen as the base period (note that 1991 is not a useful choice due to the definition change of the education variable between 1991 and 1992; *cf.* Section 2).

American high school (which provides classroom, but no vocational training). Consequently, the major low-skilled groups in the U.S. and Germany do not seem to have experienced the same relative negative demand shocks. However, what supports the view that negative relative demand shocks against the unskilled have been experienced across the industrialised world is that German workers with an educational level below apprenticeship have been affected by such shocks. Although my classification results identify only relative *net* demand shocks for the least skilled in western Germany, the fact that the supply of this group in terms of the working age population (and of the labour force) fell (*cf.* Figure 2c) leads to the conclusion that the negative relative *net* demand shock has been generated by a negative relative ‘gross’ supply shock and an even more negative relative ‘gross’ demand shock.

Apart from relying on the classification results based on statistical inference, a look at the point estimates presented graphically in Figure 3 helps to illustrate the different experiences of the three countries. The U.S. educational wage structure displayed in Figure 3a shows how education wage inequality increased smoothly throughout the investigated decade (there might have been a short pause in this trend in the mid-1990s). By contrast, both the educational unemployment (and non-employment) structures became more equal at the same time (Figure 3a). The most striking support for Krugman’s hypothesis is revealed by comparing the changes in western Germany’s unemployment structure with the one of the U.S. (*cf.* Figure 3a and Figure 3c). The German unemployment structure has become more unequal, whereas the one in the U.S. has not, it even has become more equal. This is exactly what the Krugman hypothesis states. The least educated in western Germany have also faced an increase in their non-employment likelihood, which is not the case for the least skilled in the U.S., who have experienced a decrease (*cf.* the discussion paper version, Puhani, 2003). However, albeit insufficiently flexible, the west German wage

structure has not been completely rigid according to the administrative IABR data set (*cf.* Figure 3a).

What about Britain? Figure 3b shows that, compared to the U.S. experience, the British educational wage structure was fairly stable during the observation period. The educational unemployment structure did not become much more unequal (*cf.* Figure 3b), which contrasts with the German experience, especially when the least skilled are considered. This result for the least educated is not robust when considering the non-employment structure in the BLFS, which has turned unfavourably against those *below O-level* education. Nevertheless, the broad picture that Britain was able to sustain a stable wage structure, without relative unemployment increases for the least educated as in western Germany, can be explained by the substantial relative supply changes as discussed in Section 3.

Are There Alternative Explanations?

Although the evidence presented here (especially when western Germany and the U.S. are compared) is consistent with the Krugman hypothesis, one may raise alternative explanations for these regression results. One argument could be based on the issue of sample selection in wage regressions (Heckman, 1979; Leung and Yu, 1996): In the face of relative demand shocks against the unskilled, one expects workers with the least *unobserved* skills to lose their jobs first. Hence, standard wage regressions as presented here might falsely conclude that the wage structure between *observed* skill categories has remained stable, whereas in fact the price of skills (taking into account observed and unobserved factors) has fallen. At the same time, one would probably measure an increase in the relative unemployment and non-employment of the least skilled workers, as they either leave the labour force or prefer to draw unemployment benefits instead of working for a lower wage. However, if this explanation is claimed to be the only factor

underlying my results, then one would expect an increase in the relative unemployment *or* relative non-employment for the low skilled not only in western Germany, but *also* in the U.S. Yet this did not happen to low education groups in the U.S. Therefore, the ‘sample selection interpretation’ cannot be the main factor driving the empirical observations of this paper.

Another alternative explanation could be that changes in the search intensities of low-skilled workers drive differences across countries in the changes in the relative unemployment and non-employment likelihoods. If this were the case, the Krugman hypothesis would not be the correct interpretation of the results presented here. Major reforms of the unemployment benefit and welfare systems in the United States and in Britain with their emphasis on mandatory job search assistance and the introduction of work requirements were, with the exception of the British New Deal of 1998, not explicitly targeted at young or less educated workers (*cf.* Monthly Labor Review, various issues; Blank and Haskins, 2001; and Weil, 2002; for the U.S.; Van Reenen, 2001; for Britain). However, the U.S. profiling system for unemployment insurance introduced since 1993 and significant welfare reform triggered by the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 can be expected to have taken effect mostly on these socio-economic groups (Blank, 2002). The same holds in Britain for the introduction of the Job Seekers’ Allowance in 1996 and the New Deal of 1998. However, also in Germany, welfare eligibility was made more stringent and work incentives were increased through the Welfare Reform Act of 1996. Moreover, there were no significant changes in the unemployment benefit regime in Germany during my observation period that could explain the increased relative unemployment of the young and the low skilled.¹¹ Furthermore, the time pattern of relative

¹¹ The only potential exception are increases in the minimum age for certain prolonged entitlement periods for unemployment benefits in 1997. These affected workers above 42 years of age. However, these changes, which for any given age group only altered the entitlement period by 2 months (*e.g.* from 14 to 12 months for 42 year olds),

unemployment and non-employment changes for young people in western Germany either suggests a rather smooth increase in relative unemployment of this group, or an increase which is mainly concentrated in the period 1991-1993 (*cf.* footnote 7). Hence, even if benefits became harder to collect over time in the U.S. thus potentially explaining the convergence in the U.S. unemployment structure, the changes in the German unemployment structure cannot have been caused by changes in the German unemployment benefit or welfare regime.

A third critique to the interpretation of the results might argue that the three countries are observed at different stages of their business cycles and that changes in wage and unemployment structures are mere reflections of movements within different stages of the business cycle. This argument also does not stand up to scrutiny. First, the observation period covers between 6 and 9 years which is somewhat longer than an average ‘cycle’ (*cf.* Stock and Watson, 1999; the U.S. has experienced a prolonged high-growth period in the 1990s, but my data also includes the year 2001, when the growth rate has slowed down again, OECD, 2002). Second and more importantly, although there are some movements in the wage and unemployment/non-employment structures, visual inspection of these movements in Figure 3 (as well as the additional figures displayed in the discussion paper version) provides no support that they appear in a cyclical fashion for *any* of the investigated economies. Instead, most changes rather seem to have the character of a trend. This is also true for the unemployment structure in Germany, which became more unequal both in high and in low growth years of the 1990s. Third, robustness checks on the classifications (statistical tests) as discussed in the footnotes above give credence to the view that the reported main results are not sensitive to varying the base period between the years 1991 and 1993. This

were rather minor. A summary of social policy changes in Germany since the 1970s is provided in German on the web site http://www.arbeitnehmerkammer.de/sozialpolitik/seiten/1_politik_chronik_sopo.htm).

supports the visual inspection of Figure 3 but is a further argument against the business cycle interpretation of my results.

A fourth argument could be that efficiency wages rather than institutions (as claimed by the Krugman hypothesis) are responsible for wage rigidities. Efficiency wages seem to be a particularly unconvincing explanation for least-skilled unemployment. One reason is that the least skilled may be a cheap group to monitor as they mostly do routine tasks which may be easier to evaluate than more diversified tasks of qualified workers (*cf.* Milgrom and Roberts, 1992, Chapter 12). As monitoring costs are a major ingredient to the efficiency wage hypothesis (Shapiro and Stiglitz, 1984), this raises doubt about efficiency wages explaining the rise in relative unemployment for workers without apprenticeship in western Germany. More importantly, the efficiency wage hypothesis cannot explain why experiences should differ as they do between the investigated countries.

In sum, the microeconomic investigation of changes in wage, unemployment, and non-employment structures with respect to age and education has found some support for the Krugman hypothesis. This is especially true when comparing western Germany with the United States. The evidence on Britain and western Germany does not show drastic differences between the two countries: Both have seen an increase in the relative unemployment or non-employment rates of their least skilled groups, but the evidence is more pervasive in the German case.

5 Conclusions

Although it seems a consensus view among economists that rising European unemployment and rising inequality in the Anglo-Saxon countries are ‘two sides of the same coin’, namely a secular fall in the relative demand for the low skilled (‘Krugman hypothesis’), there are only few

empirical studies testing this hypothesis with individual data. This paper tests the Krugman hypothesis for the 1990s, the period when average unemployment decreased in the United States and Britain, but increased in western Germany. It is first shown that the assumption of no relative supply shocks made in some of the previous literature is unjustified. Subsequently, a methodology is applied which is agnostic about the nature of demand and supply shocks in its testing procedure. The approach developed in this paper also allows a more sophisticated distinction between different types of low-skilled workers than in the previous literature. This turns out to be important, especially when distinguishing between Germans with and without apprenticeship training.

Comparing the U.S. with western Germany renders support for the view that wage rigidities influenced unemployment (and non-employment) developments in Germany: Tests on changes in the wage, unemployment, and non-employment structures with respect to age and education reveal that the lack of sufficient wage flexibility impinged on young and least educated German workers in terms of higher relative unemployment risk. However, there is tentative evidence that persons with a German apprenticeship certificate were not affected by a negative relative (net) demand shock. This suggests that the German vocational education system provides many workers with skills shielding them from both relative wage and relative employment losses. By contrast, the relative wage position of American high-school graduates deteriorated.

On the other hand, the evidence on Britain demonstrates the importance of relative supply effects that helped to keep the educational wage structure constant.

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Table 1: Relative Wage and Unemployment/Non-Employment Behaviour and Labour Market Classification

	Contributing to a relative unemployment decrease $(\gamma_{t+\tau,k}^* - \gamma_{t,k}^*) < 0$	Contributing to a constant relative unemployment $(\gamma_{t+\tau,k}^* - \gamma_{t,k}^*) = 0$	Contributing to a relative unemployment increase $(\gamma_{t+\tau,k}^* - \gamma_{t,k}^*) > 0$
Contributing to a relative wage increase $(\beta_{t+\tau,k}^* - \beta_{t,k}^*) > 0$	(7): $\xi^{l,r} < 0$ <i>weakly adjusting in increasing market relative to the reference market</i>	(6): $\xi^{l,r} < 0$ <i>strongly adjusting in increasing market relative to the reference market</i>	(1): $\xi^{l,r} = ?$ <i>strongly rigid (wage push) relative to the reference market</i>
Contributing to a constant relative wage $(\beta_{t+\tau,k}^* - \beta_{t,k}^*) = 0$	(8): $\xi^{l,r} < 0$ <i>weakly rigid in increasing market relative to the reference market</i>	(5): $\xi = 0$ <i>stable in stable market relative to the reference market</i>	(2): $\xi^{l,r} > 0$ <i>weakly rigid in decreasing market relative to the reference market</i>
Contributing to a relative wage decrease $(\beta_{t+\tau,k}^* - \beta_{t,k}^*) < 0$	(9): $\xi^{l,r} = ?$ <i>converging (wage pull) relative to the reference market</i>	(4): $\xi^{l,r} > 0$ <i>strongly adjusting in decreasing market relative to the reference market</i>	(3): $\xi^{l,r} > 0$ <i>weakly adjusting in decreasing market relative to the reference market</i>

Note: The terminology ‘increasing market’ refers to a positive relative net demand shock (which is the same as a negative relative net supply shock $\xi^{l,r} < 0$ for labour market l with respect to the reference market r as defined in Section 4). Increasing markets relative to the reference market are identified in cases (6), (7), and (8). Analogously, a ‘decreasing market’ is equivalent to a negative net demand shock. Decreasing markets relative to the reference market are identified in cases (2), (3), and (4). In cases (1) and (9), the sign of the net demand shock cannot be identified, $\xi^{l,r} = ?$. In case (5), there is no such shock. See also the theoretical discussion in Section 4.

Table 2: Age Classification Summary (with Unemployment Regressions)

Variable	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS; Base 1992)										
16-25		○	○	2	1	1	1	1	1	1
26-35		○	4	4	4	4	9	9	8	○
36-45		○	6	6	○	○	○	○	○	○
46-55		○	○	8	○	9	4	4	4	4
56-65		○	○	○	○	○	○	○	4	4
Britain (BLFS; Base 1993)										
16-25			4	4	4	3	3	3	3	
26-35			○	6	6	6	6	6	7	
36-45			○	2	○	○	○	○	○	
46-55			6	○	7	6	7	6	6	
56-65			○	○	○	○	8	8	7	
Britain (BHPS)										
16-25			4	4	4	4	3	4	3	
26-35			○	○	6	6	6	6	7	
36-45			○	○	2	○	○	○	○	
46-55			○	○	7	6	6	6	6	
56-65			○	○	○	○	○	○	○	
Germany (GSOEP)										
16-25	○	○	2	○	2	4	3	3	3	
26-35	○	○	○	○	○	○	○	○	○	
36-45	○	○	○	○	○	○	○	○	○	
46-55	○	○	○	○	○	○	○	○	○	
56-65	○	○	○	○	○	○	6	6	6	
Germany (GLFS)										
16-25		3		3	3	3				
26-35		6		9	8	8				
36-45		6		○	8	8				
46-55		7		6	6	6				
56-65		2		6	1	1				
Germany (IABR)										
16-25	1	1	1	1	1	3				
26-35	4	4	4	9	9	8				
36-45	4	9	9	4	4	4				
46-55	4	8	○	2	2	1				
56-65	8	○	8	○	7	7				

Note: The classifications are based on regression results controlling for age, education, gender, region, as well as the month of interview in the CPS and the BLFS. Columns with no entry signify that no data are available (to me) for these years.

The classification codes are as follows: (1): strongly rigid (rising relative wage and rising relative unemployment); (2): weakly rigid in a decreasing market (constant relative wage and rising relative unemployment); (3): weakly adjusting in a decreasing market (falling relative wage and rising relative unemployment); (4): strongly adjusting in a decreasing market (falling relative wage and constant relative unemployment); (○ = 5): stable in a stable market (constant relative wage and constant relative unemployment); (6): strongly adjusting in an increasing market (rising relative wage and constant relative unemployment); (7): weakly adjusting in an increasing market (rising relative wage and falling relative unemployment); (8): weakly rigid in an increasing market (constant relative wage and falling relative unemployment); (9): converging (falling relative wage and falling relative unemployment).

Sources: Current Population Survey – Merged Outgoing Rotation Group Files (CPS); British Labour Force Survey (BLFS); British Household Panel Survey (BHPS); German Socio-Economic Panel (GSOEP); German Labour Force Survey – *Mikrozensus* (GLFS); German Administrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table 3: Age Classification Summary (with Non-Employment Regressions)

Variable	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS; Base 1992)										
16-25		○	○	8	6	6	6	6	6	6
26-35		○	4	4	9	9	9	9	8	8
36-45		○	6	6	○	○	○	4	○	○
46-55		○	○	○	○	4	4	3	3	4
56-65		○	○	○	○	○	○	○	3	9
Britain (BLFS; Base 1993)										
16-25			4	4	4	4	4	4	3	
26-35			8	7	7	7	7	7	7	
36-45			2	2	2	2	2	2	2	
46-55			6	○	6	6	6	1	1	
56-65			○	○	2	2	2	2	1	
Britain (BHPS)										
16-25	2	2	○	2	3	3	4	○	○	
26-35	○	8	8	8	8	8	8	8	8	
36-45	○	2	○	○	○	○	○	○	○	
46-55	○	8	○	○	○	○	○	○	○	
56-65	○	○	○	○	○	○	○	2	○	
Germany (GSOEP)										
16-25	○	○	2	○	○	4	4	4	4	
26-35	○	○	○	○	○	○	○	○	○	
36-45	○	8	○	○	○	○	○	8	○	
46-55	○	2	2	○	2	○	○	○	○	
56-65	○	8	8	8	○	○	6	6	6	
Germany (GLFS)										
16-25		4		3	3	3				
26-35		1		4	3	2				
36-45		6		○	○	○				
46-55		6		6	7	7				
56-65		○		7	7	7				
Germany (IABR)										
No Data										

Note: The classifications are based on regression results controlling for age, education, gender, region, as well as the month of interview in the CPS and the BLFS.

The classification codes are as follows: (1): strongly rigid (rising relative wage and rising relative non-employment); (2): weakly rigid in a decreasing market (constant relative wage and rising relative non-employment); (3): weakly adjusting in a decreasing market (falling relative wage and rising relative non-employment); (4): strongly adjusting in a decreasing market (falling relative wage and constant relative non-employment); (○ = 5): stable in a stable market (constant relative wage and constant relative non-employment); (6): strongly adjusting in an increasing market (rising relative wage and constant relative non-employment); (7): weakly adjusting in an increasing market (rising relative wage and falling relative non-employment); (8): weakly rigid in an increasing market (constant relative wage and falling relative non-employment); (9): converging (falling relative wage and falling relative non-employment).

Sources: Current Population Survey – Merged Outgoing Rotation Group Files (CPS); British Labour Force Survey (BLFS); British Household Panel Survey (BHPS); German Socio-Economic Panel (GSOEP); German Labour Force Survey – *Mikrozensus* (GLFS); German Administrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table 4: Education Classification Summary (with Unemployment Regressions)

Variable	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS; Base 1992)										
College Degree		○	1	1	1	6	1	1	1	1
Some College		○	○	8	8	○	8	○	8	○
High School		○	○	○	4	4	4	9	4	9
High School Dropout		○	4	4	4	4	4	9	9	9
Britain (BLFS; Base 1993)										
Degree			○	○	1	○	2	○	○	
Higher - No Degree			○	○	○	○	○	○	4	
High School (A-level)			○	○	8	7	7	7	7	
O-level equivalent			○	○	○	○	4	3	3	
Below O-level equivalent			○	○	○	○	○	○	○	
Britain (BHPS)										
Degree	○	6	○	2	2	2	○	○	○	
Higher - No Degree	4	○	○	○	4	○	2	4	○	
High School (A-level)	○	○	○	○	○	4	4	○	4	
O-level equivalent	○	○	○	○	○	○	○	○	○	
Below O-level equivalent	○	○	○	○	○	○	○	○	○	
Germany (GSOEP)										
Degree	○	○	○	○	○	4	4	○	○	
Higher - No Degree	8	8	○	8	○	○	8	8	8	
High School - Abitur	○	○	○	6	○	○	○	○	○	
Apprenticeship	2	2	2	6	6	○	6	6	6	
Below Apprenticeship	○	4	○	4	4	○	○	○	4	
Germany (GLFS)										
Higher		9		9	9	9				
Meister		○		○	9	9				
High School		8		7	7	7				
Apprenticeship		1		2	2	2				
Below Apprenticeship		4		6	1	1				
Germany (IABR)										
Degree	6	7	7	7	7	8				
High School and Apprenticeship	7	7	7	7	7	7				
High School (Abitur)	○	○	○	6	6	○				
Apprenticeship	6	6	6	6	7	7				
Below Apprenticeship	4	3	3	3	3	3				

Note: The classifications are based on regression results controlling for age, education, gender, region, as well as the month of interview in the CPS and the BLFS.

The classification codes are as follows: (1): strongly rigid (rising relative wage and rising relative unemployment); (2): weakly rigid in a decreasing market (constant relative wage and rising relative unemployment); (3): weakly adjusting in a decreasing market (falling relative wage and rising relative unemployment); (4): strongly adjusting in a decreasing market (falling relative wage and constant relative unemployment); (○ = 5): stable in a stable market (constant relative wage and constant relative unemployment); (6): strongly adjusting in an increasing market (rising relative wage and constant relative unemployment); (7): weakly adjusting in an increasing market (rising relative wage and falling relative unemployment); (8): weakly rigid in an increasing market (constant relative wage and falling relative unemployment); (9): converging (falling relative wage and falling relative unemployment).

Sources: Current Population Survey – Merged Outgoing Rotation Group Files (CPS); British Labour Force Survey (BLFS); British Household Panel Survey (BHPS); German Socio-Economic Panel (GSOEP); German Labour Force Survey – *Mikrozensus* (GLFS); German Administrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table 5: Education Classification Summary (with Non-Employment Regressions)

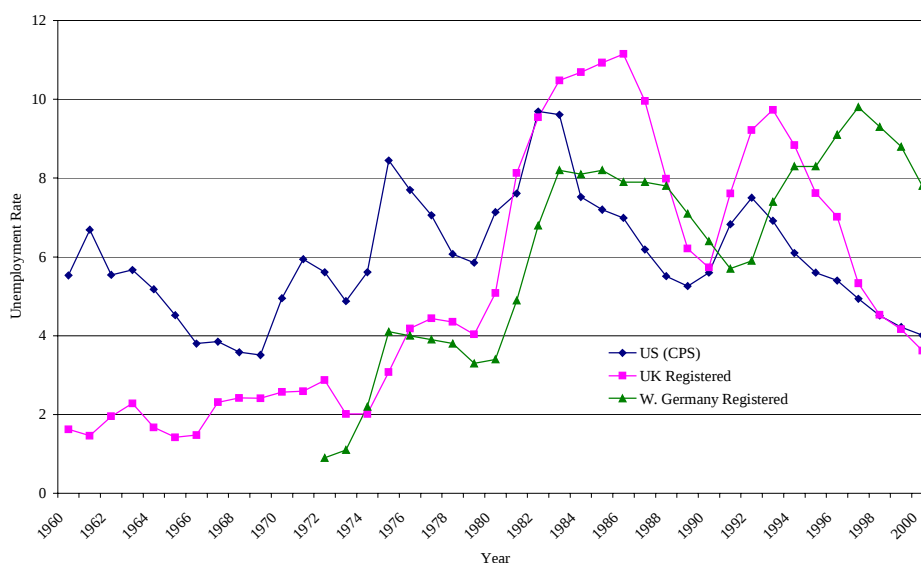
Variable	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS; Base 1992)										
College Degree		○	6	6	1	1	1	1	1	1
Some College		○	8	8	8	○	8	○	8	8
High School		○	○	○	4	4	4	4	4	4
High School Dropout		○	4	4	4	4	9	9	9	9
Britain (BLFS; Base 1993)										
Degree			8	8	7	8	○	○	8	
Higher - No Degree			○	○	○	○	○	○	4	
High School (A-level)			○	○	8	6	7	7	7	
O-level equivalent			○	○	○	5	9	4	4	
Below O-level equivalent			2	○	2	2	2	2	2	
Britain (BHPS)										
Degree	○	6	○	○	○	○	○	○	○	
Higher - No Degree	4	○	○	○	4	○	○	4	○	
High School (A-level)	○	○	○	○	○	4	9	8	9	
O-level equivalent	○	○	○	○	○	○	○	○	○	
Below O-level equivalent	○	○	○	8	○	○	○	○	○	
Germany (GSOEP)										
Degree	○	○	○	○	○	4	4	○	○	
Higher - No Degree	○	○	○	○	○	○	○	○	○	
High School - Abitur	○	○	8	7	8	8	8	○	8	
Apprenticeship	○	○	○	6	6	○	6	6	6	
Below Apprenticeship	○	4	○	4	4	○	○	○	4	
Germany (GLFS)										
Higher		4		4	4	4				
Meister		○		8	4	4				
High School		○		7	7	7				
Apprenticeship		1		2	3	3				
Below Apprenticeship		9		1	1	1				
Germany (IABR)										
No Data										

Note: The classifications are based on regression results controlling for age, education, gender, region, as well as the month of interview in the CPS and the BLFS.

The classification codes are as follows: (1): strongly rigid (rising relative wage and rising relative non-employment); (2): weakly rigid in a decreasing market (constant relative wage and rising relative non-employment); (3): weakly adjusting in a decreasing market (falling relative wage and rising relative non-employment); (4): strongly adjusting in a decreasing market (falling relative wage and constant relative non-employment); (○ = 5): stable in a stable market (constant relative wage and constant relative non-employment); (6): strongly adjusting in an increasing market (rising relative wage and constant relative non-employment); (7): weakly adjusting in an increasing market (rising relative wage and falling relative non-employment); (8): weakly rigid in an increasing market (constant relative wage and falling relative non-employment); (9): converging (falling relative wage and falling relative non-employment).

Sources: Current Population Survey – Merged Outgoing Rotation Group Files (CPS); British Labour Force Survey (BLFS); British Household Panel Survey (BHPS); German Socio-Economic Panel (GSOEP); German Labour Force Survey – *Mikrozensus* (GLFS); German Administrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Figure 1: Unemployment Rates 1960 - 2000



Note: The U.S. unemployment rate is based on the CPS, which uses a definition of unemployment equivalent to the ILO definition. For Western Germany, OECD figures only provide the registered unemployment rate for a longer time period. Comparing the registered with the OECD standardized unemployment rate for United Germany suggests about a 1.5 percent difference between the two, so that the standardised unemployment rate for Western Germany would also be lower than depicted in the graph. For the UK, however, the standardised unemployment rate is about 1 percentage point higher than the registered one shown in the graph. It is, however, not available for such a long time period.

Source: OECD.

Figure 2a: Age and Education Sample Means Working Age Population - U.S. (CPS)

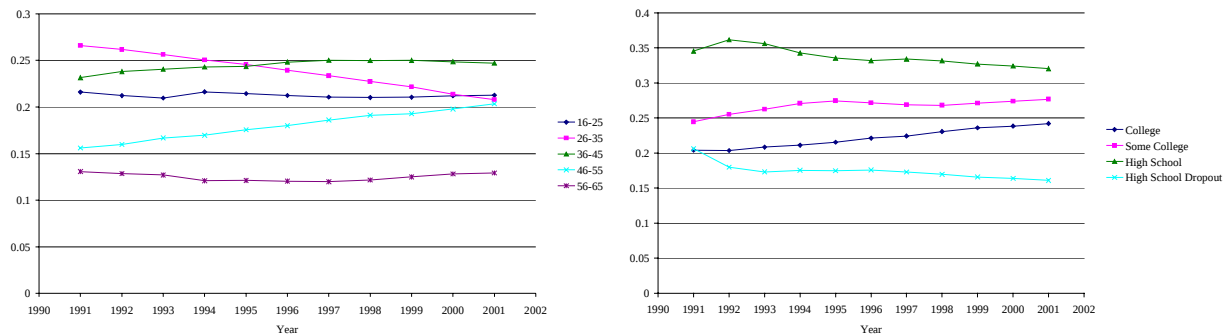


Figure 2b: Age and Education Sample Means Working Age Population - Britain (BLFS)

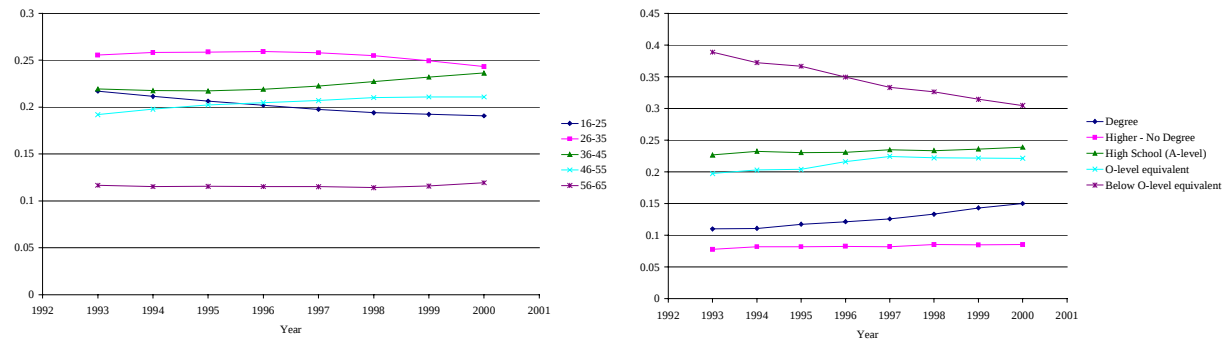
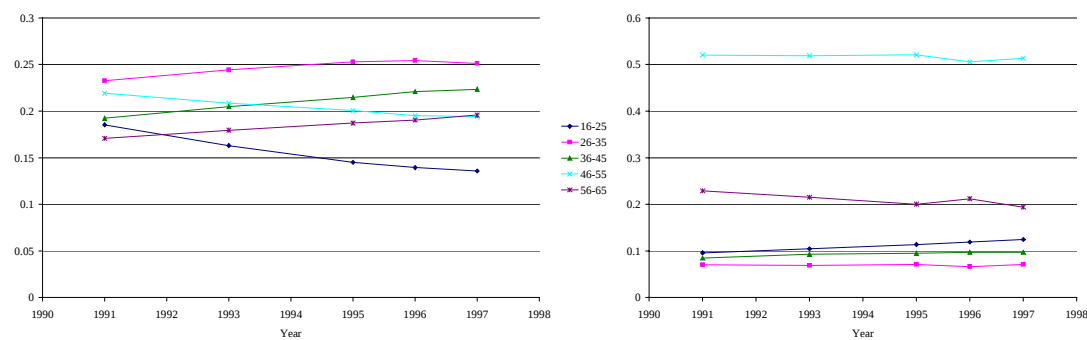


Figure 2c: Age and Education Sample Means Working Age Population - Germany (GLFS)



Note: Between 1991 and 1992 the coding of the education variable changed in the CPS, which explains changes in the shares of especially *high school graduates* and *high school dropouts* between those years. I therefore use 1992 as the base year for the reported classifications.

Sources: Current Population Survey – Merged Outgoing Rotation Group Files (CPS); British Labour Force Survey (BLFS); German Labour Force Survey – *Mikrozensus* (GLFS); own calculations.

Figure 3a: U.S. Wage and Unemployment Regression: Education Coefficients - (CPS)

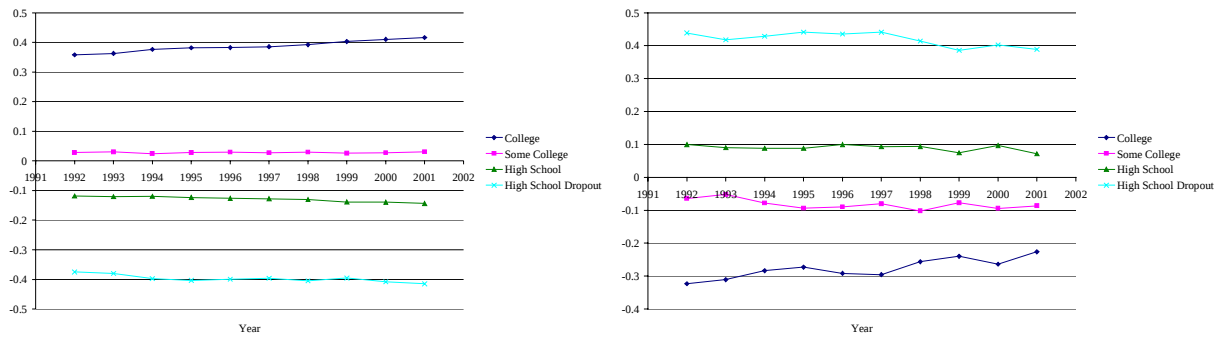


Figure 3b: British Wage and Unemployment Regression: Education Coefficients - (BLFS)

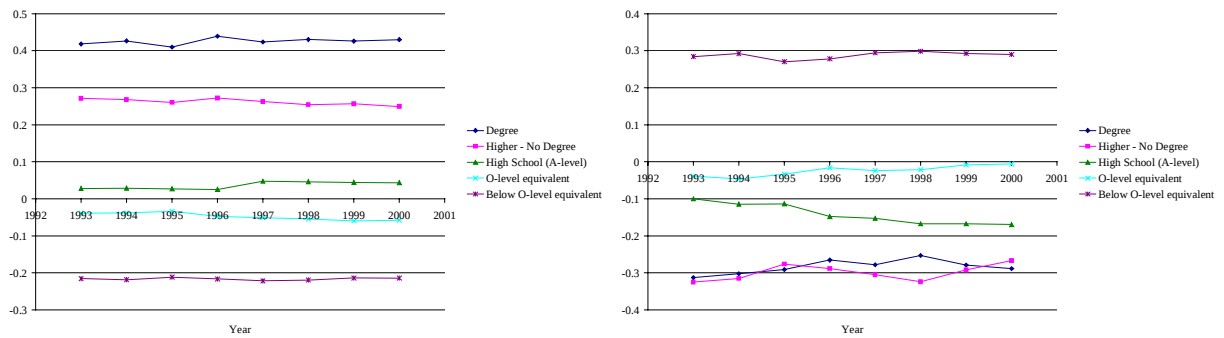
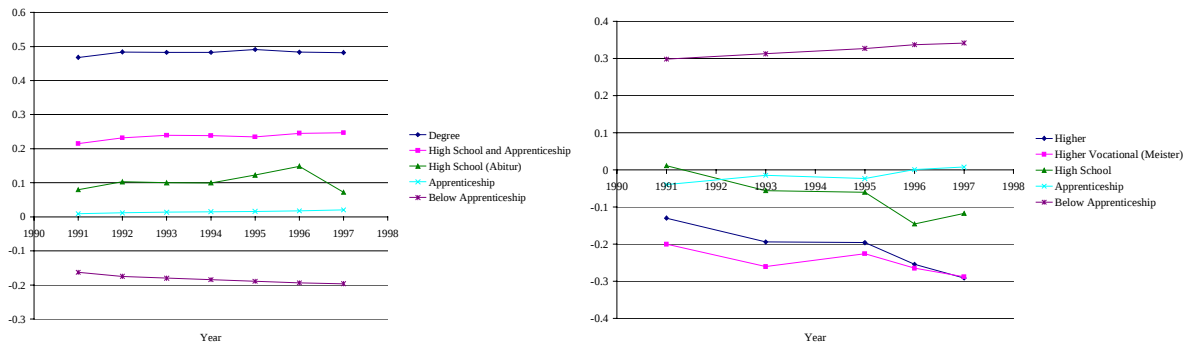


Figure 3c: German Wage and Unemployment Regression: Education Coefficients - (Wages: IABR; Unemployment: GLFS)



Note: The left and right panels exhibit the transformed wage and unemployment regression coefficients $\beta_{i,k}^*$ and $\gamma_{i,k}^*$, respectively.

Sources: Current Population Survey – Merged Outgoing Rotation Group Files (CPS); British Labour Force Survey (BLFS); German Labour Force Survey – *Mikrozensus* (GLFS); own calculations.