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 (especially in the 1980s) 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'). An alternative view stresses the importance of differing supply changes across countries. However, empirical evidence on these questions is sparse. Furthermore, existing international comparisons often rely on strong assumptions or compromise on data quality. This paper uses large data sets from the U.S., Britain, and western Germany to test the Krugman hypothesis for the 1990s, when unemployment in Germany increased (unlike in the U.S. and Britain, where it fell). British and German evidence is further backed up with alternative data sets for these countries. 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 relative supply of skills and a relatively constant skill premium.

Keywords

wage, earnings, unemployment, non-employment, rigidity, identification

JEL Classification

E24, J21, J31, J64

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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; 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 countries 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).

[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. Almost all papers I have found relating to European wage rigidity in the face of relative demand shocks against the unskilled use data only up to the first half of the 1990s and thus do not fully describe the period when German and Anglo-Saxon unemployment rates strongly diverge (Acemoglu, 2003; is the only exception; *cf.* Manacorda and Manning, 2003; for Italy). Using data for time periods between 1970 to 1994 for 8 to 15 countries, Nickell and Bell (1995; 1996) point out and Manacorda and Petrongolo (1999) show that in several European countries high-skilled unemployment increased, too, not just low-skilled unemployment. On the other hand, Blau and Kahn (1996) argue that the differences in wage inequality between the U.S. and many European economies can only partly be explained by differences in the skill distributions between countries. These authors as well as Kahn (2000) further show that in a cross section of 15 countries, several collective bargaining indicators are correlated with medium-to-low-skill wage differentials as well as the relative employment-population rates between these two skill groups. Blanchard and Wolfers (2000) suggest that macroeconomic shocks in combination with institutions can explain unemployment changes in 20

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.

OECD countries from the mid 1960s to the mid 1990s very well. However, these authors also stress the lack of good time series data on institutions. Gottschalk and Joyce (1998), on the other hand, challenge the institutional explanation by providing evidence for 8 countries during the 1980s showing that changes in relative supply are a major factor explaining the differences in changes in earnings inequality. Another challenge to the view that continental European wage structure stability caused unemployment is provided by Card, Kramarz, and Lemieuz (1999) and Krueger and Pischke (1997). Comparing the U.S. with Canada, France, and Germany, these two studies show that their proxies for demand shocks are not correlated with employment changes in narrowly defined age-education cells in Canada, France, or Germany, although the wage structure in these countries was fairly constant.[3]

These puzzling differences in the results across studies may be related to the varying data sets and methodologies used by the authors.[4] Studies that analyse a wider spectrum of countries (*cf.* Blau and Kahn, 1996; Gottschalk and Joyce, 1998; Kahn, 2000; Acemoglu, 2003) often have to compromise on data quality.[5] By mainly exploiting cross-sectional variation across countries, the studies by Blau and Kahn (1996) and Kahn (2000) rely on the comparability of the skill variables they use plus the reliability of the collective bargaining indices. Freeman and Schettkat (2000) demonstrate on the basis of the OECD's adult literacy survey (IALS) that skill contents of

[3] Beissinger and Möller (1998) using the same methodology as these two papers, find that male wages showed some flexilibity in western Germany during the 1980s. Fehr, Götte, and Pfeiffer (2003), on the other hand, argue that centralised wage bargaining and nominal wage rigidities caused real wage rigidities in the form of 'wage sweep-ups' of the order of 4-8 percent in western Germany during the period 1975-1995. This result and the finding that wage rigidities are associated with lower sectoral employment growth rates are based on an econometric model with considerable structural assumptions.

[4] Another potential explanation for the apparently contradicting findings is offered by Acemoglu (1999; 2002; 2003), who argues that relative demand shocks against the unskilled have not occurred uniformly across the industrialised countries. Instead, he suggests a model in which wage compression in continental Europe may have caused firms to adopt technologies which raise the productivity of the unskilled more than in the U.S.

[5] 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

'similar-sounding' schooling types differ a lot between Germany and the U.S. Pupil test scores reported for the U.S., Britain, Switzerland, and Germany in Nickell and Bell (1996) suggest the same. Studies that compare a wide set of countries but do not pay tribute to national specificities in educational systems, have to be interpreted with a *caveat*. For these reasons, I will in the main part of the paper use more skill categories than just 'high' and 'low' skill and define them according to the conventions of the respective country.

Other methodological issues can be raised when considering the previous literature. The studies by Card, Kramarz, and Lemieuz (1999) and Krueger and Pischke (1997) assume that the wage at the beginning of the observation period (or computer usage) is a linear proxy for the demand shock experienced by any type of labour. Moreover, potential supply changes are not taken into account. I show in Section 2 that differences in the changes in the relative supply of skills are rather marked in the countries I investigate, even within the short period of a decade.

My microeconometric analysis is in concept most closely related to the empirical approach by Nickell and Bell (1995; 1996), which compares changes in relative wages and relative unemployment or non-employment across countries. As Gottschalk and Joyce (1998), I use unemployment and non-employment as measures of quantity rationing (*i.e.* the failure of the market to clear) potentially caused by wage rigidities. However, in contrast to these previous studies, I use a finer grid of skills and systematically compare regression-adjusted wage changes with regression-adjusted unemployment changes. I also check the sensitivity of my results using more than one data source for both Britain and western Germany. For each country, I have at least one data set with 150,000 workers or more in the labour force. Furthermore, it is in the middle and in the second half of the 1990s when German and Anglo-Saxon unemployment rates

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the International Social Survey Programme (ISSP) data, where in addition the sample size per country is rather

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.

I use both a 'macro' approach based on Katz and Murphy (1992) and a microeconometric test to provide evidence on the Krugman hypothesis. Both methodologies 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 not even an apprenticeship education. 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.

Section 2 describes the data sets used in this study. A 'macroeconomic' simulation of relative wage rigidity as well as relative demand and supply for skill changes is given in Section 3. Section 4 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, followed by the conclusions in Section 5.

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

small (about 1,000-2,000 observations).

German Socio-Economic Panel (GSOEP), the (large) German Labour Force Survey (*Mikrozensus*, GLFS), and a (large) German administrative data set (IABR).[6]

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.

[6] Table B1 gives the number of observations in these data sets for different subsamples I selected for wage, unemployment, and non-employment regressions, respectively.

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 and

simulations 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.[7]

Figure 2 and Figure 3 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. The assumption of no relative supply changes in the methodologies of Card, Kramarz, and Lemieux (1999) and Krueger and Pischke (1997) thus seems invalid. Figure 2 displays 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

[7] Table B1 in Appendix B gives the number of observations for each data set. Table B2 to Table B5 report sample unemployment and non-employment rates for different skill groups (using weights as suggested in the respective data sets). Although west German unemployment in my sample was not massively higher (if at all) in 1997 than in Britain, the displayed figures 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.

in the number of people between 16 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 Figure 3. Differences in the educational systems notwithstanding, it is clear from the figure 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) has decreased by about 10 percentage points in Britain within less than a decade. Although the diversity of educational qualifications within and across countries and the multidimensionality of skills make it difficult to provide a single measure for relative skill supply changes, the following section will nevertheless make an attempt at this.

3 Relative Demand and Supply of Skills and Wage Compression

To obtain a first descriptive picture of relative skill supplies, demands, and wage rigidities in the U.S., Britain, and western Germany in the 1990s, I adopt a constant elasticity of substitution (CES) production function framework similar to Katz and Murphy (1992), Autor, Katz and Krueger (1998), and Acemoglu (2003).[8] In this model, the production of output Y is undertaken

[8] Manacorda and Manning (2003) propose an alternative approach.

using high- (*H*) and low-skilled (*L*) labour as the two major inputs.[9] Technology is subsumed under the factor-augmenting terms A_h and A_l, respectively:

$$Y_t = \left[\left(A_{lt} L_t \right)^{\rho} + \left(A_{ht} H_t \right)^{\rho} \right]^{(1/\rho)}.$$

The relative demand index $\widehat{\ln\left(\frac{A_{ht}}{A_{lt}}\right)^{\sigma-1}} = \sigma \widehat{\ln\left(\frac{W_{ht}}{W_{lt}}\right)} + \widehat{\ln\left(\frac{N_{ht}}{N_{lt}}\right)}$ can be identified (and estimated, 'hats' indicating estimated values will henceforth be dropped) from this production function by noting that the implicit relative demand function is given by

$$\ln\left(\frac{W_{ht}}{W_{lt}}\right) = \left(\frac{1}{\sigma}\right)\left[\ln\left(\frac{A_{ht}}{A_{lt}}\right)^{\sigma-1} - \ln\left(\frac{N_{ht}}{N_{lt}}\right) \right] \qquad (1)$$

and by assuming the elasticity of substitution $\sigma = 1/(1-\rho)$ to be 1.4, which represents the consensus view in the literature that σ is between 1 and 2.[10]

N_h and N_l are demanded (employed) quantities of high- and low-skilled labour, respectively. As relative wages $\ln\left(\frac{W_{ht}}{W_{lt}}\right)$ and relative employment $\ln\left(\frac{N_{ht}}{N_{lt}}\right)$ are observed in the

[9] Alternatively, one may view *Y* as a labour composite which is part of another production function that also contains capital (*cf.* Heckman, Lochner, and Taber, 1998; p. 16). An elasticity of substitution of 1 between capital and this aggregate labour composite (*cf.* Heckman, Lochner, and Taber, 1998; p. 25f.) justifies ignoring capital and so I follow this procedure as Katz and Murphy (1992), Autor, Katz and Krueger (1998), and Acemoglu (2002) do.

[10] This range is derived in Freeman's (1986, p. 366) survey, but also more recent estimates by Katz and Murphy (1992, p. 72), Heckman, Lochner, and Taber (1998, p. 26) and Card and Lemieux (2001, p. 734) find elasticities of 1.4, 1.441, and of between 1.1 and 1.6, respectively. Consequently, Autor, Katz and Krueger (1998) and Acemoglu (2002) use the value of 1.4 for their simulations.

Although this evidence is mostly from the U.S., Angrist's (1995) estimates for the West Bank and the Gaza Strip imply an elasticity of substitution of a similar order, *viz.* 1.9 (derived as 1/(0.25+0.28) from Angrist's, 1995, p. 1080; estimates). The OECD estimate of 1.1 by Manacorda and Petrongolo (1999, p. 191) is based on different definitions of 'skilled' versus 'unskilled', as can be seen from the data appendix in their article ('skilled' here encloses qualifications significantly below college degree in Germany, for example). It is remarkable that despite different definitions, their estimate for a broad range of OECD countries is not too dissimilar from other estimates, either.

data, the implicit relative demand function with known elasticity of substitution identifies the relative demand index.

To create a benchmark for the simulation of relative wage rigidity that arose since my base year $t_0 = 1991$[11], I assume that relative supply is inelastic and changes in relative supply equal changes in the relative population of the two skill groups, $\ln\left(\frac{S_{ht}}{S_{lt}}\right)$.[12][13] Therefore, I define the 'market relative wage' as

$$\ln\left(\widetilde{\frac{W_{ht}}{W_{lt}}}\right) = \left(\frac{1}{\sigma}\right)\left[\ln\left(\frac{A_{ht}}{A_{lt}}\right)^{\sigma-1} - \ln\left(\frac{S_{ht}}{S_{lt}}\right)\right] + \left\{\ln\left(\frac{W_{ht_0}}{W_{lt_0}}\right) - \left(\frac{1}{\sigma}\right)\left[\ln\left(\frac{A_{ht_0}}{A_{lt_0}}\right)^{\sigma-1} - \ln\left(\frac{S_{ht_0}}{S_{lt_0}}\right)\right]\right\}. \quad (2)$$

The first term of the sum on the right hand side of equation (2) is the relative wage which creates equality of relative employment and relative supply. The second term {in curly brackets} enforces that the observed and the simulated relative wages are equal in the base year $t_0 = 1991$. For the years after 1991, equation (2) states the wage that equates *changes* in relative employment to *changes* in relative supply, which is why I refer to it as the 'market relative wage'.

In my case, the imposition of a common elasticity of 1.4 across the three countries may be subject to debate. However, as equation (4) below shows, the exact size of the elasticity of substitution cannot make a qualitative difference (in terms of the sign of the simulated relative wage rigidity term) to my simulations.

[11] Due to lack of wage data before 1993, the base year for the BLFS is 1993. Generally, the effects of alternative choices for the base year can easily be assessed from observing the results graphically in Figure 4 below. Section 4 will discuss formal tests using different base periods (1991-1993) in the footnotes.

[12] This adapts the framework in Katz and Murphy (1992), Autor, Katz and Krueger (1998), and Acemoglu, (2002), in order to simulate the extent of relative wage rigidity. Effectively, I impose that if the relative number of people with high skills increases by 10 percent in the population, the relative labour supply of high-skilled labour will also increase by 10 percent. In estimating relative employment and supply I use headcounts unadjusted by hours of work. This makes sense for my purpose, because the simulation of relative wage rigidity in equation (4) below is based on a comparison of changes in relative employment and relative working age population head counts. As there is no hours information available for the supply proxy (the working population head count), it is consistent to use only headcounts for the relative employment estimates, too.

[13] The German IABR data only samples the labour force (non-workers and non-receivers of benefits are not included). Hence, for this data set, I proxy relative supply changes by relative skill changes in the labour force

The difference between the observed relative wage and the simulated 'market relative wage', RWR_t, is a quantitative indicator for relative wage compression and hence relative wage rigidity:

$$RWR_t \equiv \ln\left(\frac{W_{ht}}{W_{lt}}\right) - \ln\left(\widetilde{\frac{W_{ht}}{W_{lt}}}\right). \tag{3}$$

Definition (2) guarantees that RWR_t is equal to zero in the base period $t_0 = 1991$. Straightforward algebraic reformulation reveals that the relative wage rigidity indicator is simply a function of the observed relative employment-population ratios of high- versus low-skilled labour plus the constant term in curly brackets (which sets *RWR* equal to zero in $t_0 = 1991$).[14]

$$RWR_t = \left(-\frac{1}{\sigma}\right)\left[\ln\left(\frac{N_{ht}}{S_{ht}}\right) - \ln\left(\frac{N_{lt}}{S_{lt}}\right)\right] + \left\{\left(\frac{1}{\sigma}\right)\left[\ln\left(\frac{N_{ht_0}}{N_{lt_0}}\right) - \ln\left(\frac{S_{ht_0}}{S_{lt_0}}\right)\right]\right\}. \tag{4}$$

If RWR_t is negative, a country has experienced 'wage compression' meaning that its skill premium has grown less than necessary to employ numbers of high- versus low-skilled workers corresponding to their relative supply changes. If the Krugman hypothesis holds for the 1990s, one would expect RWR_t growing negative in western Germany, but not in the Unites States nor in Britain.

Before presenting the empirical results, note that it is not trivial to form similar skill categories for all three countries investigated here. I define high-skilled workers in Britain and Germany as those with higher education, similar to U.S. college education. However, the

instead of in the working age population. Using this alternative proxy in the other data sets, too, does not change the qualitative results of the analysis in this section.

[14] Equation (4) is derived by substituting equation (2) into equation (3), replacing the relative demand index by its implicit definition $\ln\left(A_{ht}/A_{lt}\right)^{\sigma-1} = \sigma \ln\left(W_{ht}/W_{lt}\right) + \ln\left(N_{ht}/N_{lt}\right)$ from equation (1) and finally rearranging terms.

definition of the low-skilled groups is less straightforward. For example, the German apprenticeship system offers both classroom and on-the-job training for two to three years. It is unclear how one would relate a German apprenticeship training to an American high school degree. Here I define low-skilled workers in the United States as high school graduates (as common in the U.S. literature), whereas I define the low-skilled as O-level graduates in Britain and apprenticeship certificate holders in Germany. These choices for Britain and Germany are motivated by the fact that O-level graduates and apprenticeship certificate holders are the major low-skilled groups with formal certification in these countries.[15]

As in Autor, Katz, and Krueger (1998) and Acemoglu (2003), I form age-education-gender-region cells from the micro data sets described in the previous section. The number of cells varies by data set as I adjust the regional classification depending on data set and country size. Hence I obtain the following number of cells: 360 (U.S.-CPS), 150 (Britain-BLFS), 100 (Britain-BHPS), 50 (Germany – GSOEP), 150 (Germany – GLFS), and 150 (Germany – IABR). To obtain a wage series for a certain skill group, I take the weighted average of the median wages in each cell with that skill, where the weights are taken to be the average working age population share of a cell in the observation period (calculations based on cell mean wages make no difference to the results presented in this section).[16]

In order to aggregate all cells into labour supply equivalents of high- and low-skilled workers, I follow and adapt the approach by Autor, Katz, and Krueger (1998) and Acemoglu

[15] Unlike in the U.S., pupils with vocational interests in Britain and Germany are not expected to obtain a high school degree to accomplish 'proper' schooling. However, it should be noted that workers with only a British O-level certificate are likely to be less skilled on average than American high school graduates or German apprenticeship certificate holders. The reason is that they have less years of schooling than American high school graduates, but no German-style vocational education, either. German apprenticeship certificate holders, on the other hand, have some vocational education and work experience, which American high school graduates do not obtain.

[16] Where it occurs, I treat top and interval coding by using the midpoints of the given wage intervals and multiply top coded wages by 1.5 (*cf.* Autor, Katz, and Krueger, 1998; Acemoglu, 2002).

(2003): for the U.S., cells with some college are allocated equally to the high-skilled (*college graduates*) and low-skilled (*high school graduates*) group. *High school dropouts* are counted as entailing half the human capital of *high school graduates*. For Britain, persons with *higher (no degree)* education are counted as 0.6 times *degree* holders, whereas those with *high school* (*A-level*) are supposed to entail 0.2 times the human capital of *degree* holders. Analogously, these two education groups are assigned to *O-level* certificate holders with factors 0.4 and 0.8, respectively. Persons with education below *O-levels* are assumed to provide 0.5 times the human capital of *O-level* certificate holders to the market. The German high- and low-skilled equivalent supplies are calculated using the same human capital imputations as in Britain for the *higher no degree* in the *GLFS*, *Meister* in the GLFS, or *high school and apprenticeship* in the IABR, and *high school* (*Abitur*) educational levels. Similarly, persons with *below apprenticeship certificate* education are counted as 0.5 times *apprenticeship certificate* equivalents. Although the choices of the human capital equivalent factors are simply imposed, they are in the British and German cases a plausible adaptation of the factors used in the cited U.S. literature. While one might argue about the one or other factor, any changes within a plausible range do not make a qualitative difference to the simulation results of this section.[17]

Table 1 presents the relative wages, relative equivalent supplies, and the relative demand indices of high- versus low-skilled workers during the course of the 1990s. Note that the *levels* of the displayed series are not easy to compare due to the different educational systems across countries. For example, the fact that Britain (in the BLFS data) has the highest skill premium is likely to be a mere reflection of the fact that the low skilled in Britain (defined as O-level here) have less formal education than the low skilled in the U.S. (high school) or Germany

[17] The reason is that I am comparing the highest skill group with the major low-skill group. This is why the allocation of the other skill groups does not carry major weight.

(apprenticeship). Despite of the difficulty of comparability of the *levels* of the reported series across countries, the *changes* in the series reveal some interesting stylized facts. The upper panel of Table 1 shows an increasing skill premium in the U.S. and Britain between 1991(1993) and 1997(1999) (0.03 and 0.04 log points in the CPS and BLFS data, respectively), whereas there has been a decrease in western Germany (by between 0.02 and 0.06 log points). These different relative wage developments across countries are consistent with the Krugman hypothesis and qualitatively robust across alternative data sets used for western Germany and Britain. A second fact consistent with the hypothesis is the increase in the relative demand for skills in all three economies as displayed in the lower panel of Table 1.[18] Although there are differences in the quantitative changes in the relative demand for skills across countries, there are also marked differences in the quantitative (but not in the qualitative) relative supply changes, where Britain sticks out as the country with the largest relative supply and demand increases. One may adopt Acemoglu's (2002) interpretation that the differences in relative demand changes stem from different types of technology adoption across countries, but the lack of comparability of skills across countries also suggest a 'measurement interpretation' of these differential demand changes: As argued above, the low-skilled group in Britain is likely to entail less human capital than the low-skilled groups in the U.S. or Germany. Hence, it is quite likely to *measure* a larger relative demand change for Britain than for the other countries, even if technology changed in the same way.

The simulated relative wage rigidity indicator RWR_t, as defined in equation (4) above, is exhibited in Table 2 and Figure 4. The key question for the validity of the Krugman hypothesis is

[18] However, the increases in the relative supply of skills in all German data sets plus in the BHPS are larger than the relative demand index increases. This contrasts with the CPS and BLFS results, where the opposite is true. Hence, it seems from these simulations that a fall in the skill premium would have been justified by market forces in western Germany. However, it will turn out below that the actual fall in the skill premium was larger than justified.

whether the observed skill premium deviated from the simulated 'market skill premium' in western Germany, but not in the U.S. nor Britain in the 1990s. This is equivalent to RWR_t growing negative in western Germany, but not in the Anglo-Saxon economies. As can be seen from Table 2 and Figure 4, this is indeed the case: in all three German data sets, RWR_t turns negative. The size of the simulated increase in the relative wage rigidity depends on the data set and varies between 0.02 (IABR and GLFS) and 0.04 (GSOEP) log points for the period 1991 to 1997. By contrast, the two Anglo-Saxon economies have experienced wage decompression (of the order of 0.01 (CPS, United States) and 0.02 (BHPS and BLFS, Britain) log points), *i.e.* the relative wages of high- versus low-skilled workers increased by more than necessary to accommodate relative demand and supply shocks. Bootstrapped confidence intervals suggest that all these simulated relative wage rigidity indicator changes between 1991(3) and 1997(9) are significant at least at the 10 percent level (*cf.* Table 2). As can be seen from equation (4), alternative values for the elasticity of substitution, *e.g.* $\sigma = 2$, would simply alter the simulation results for the relative wage rigidity indicator RWR_t by a fixed factor, *e.g.* by *1.4/2* for $\sigma = 2$ instead of $\sigma = 1.4$. The conclusions regarding wage compression in western Germany on the one hand and decompression in the Anglo-Saxon economies on the other are therefore robust to the choice of σ within a commonly accepted range (*cf.* footnote 10).

Taken together, the simple macro simulations presented in this section provide evidence consistent with the Krugman hypothesis. This evidence is qualitatively robust across the used data sets. All three countries have experienced an increase in the relative demand for skilled versus unskilled workers. However, only western Germany exhibits 'wage compression', defined as a lower rise in the skill premium than required to accommodate changes in relative skill demands and supplies. A quantitative interpretation of the macro simulation results suggests a required

skill premium that exceeds the observed values by between 2 to 4 percent in order to equilibrate the relative supply and demand changes that occurred in western Germany between 1991 and 1997 (this finding is roughly of the order of Fitzenberger's, 1999; and Fitzenberger and Franz's, 2000; estimates for Germany, if one takes into account that these authors ask a different question). Roughly speaking, this means that the observed compression of the German skill premium by about 2 to 6 percent was not warranted by market forces, but a stable (or only slightly falling) skill premium would have been.

Although the evidence presented in this section gives a quick first overview of the labour market developments in the U.S., Britain, and western Germany in the 1990s, the applied methodology makes a lot of assumptions. Furthermore, only two skill groups (high and low) are distinguished. For these reasons, the following section implements a methodology to test the Krugman hypothesis that uses more detailed measures of skill and imposes less assumptions on the data.

4 Changes in 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 and wage rigidities. 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.

Standard log-linear wage and probit unemployment (or non-employment) regressions are estimated to test for *ceteris paribus* changes in the wage, unemployment and non-employment structures. The theoretical justification for and identifying assumptions of the empirical approach used are given in Appendix A. The cross-sectional regression models I estimate for each year *t* are:

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

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

with *W* denoting the hourly wage rate, *U* a binary unemployment or non-employment variable, **x** a vector of binary variables indicating different categories of *age*, *education*, *gender*, and *region*.[19] $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution. 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). The joint observation of changes in the wage and unemployment structures is used to identify skill characteristics that are increasing or decreasing in demand as well as those that are associated with a relative wage rigidity. A change in the wage structure means, for example, a *ceteris paribus* (regression adjusted) decrease in the wage for the low skilled in relation to some average wage. I define the 'average wage' as the estimated wage of the *1991 (base period) sample mean* of the labour force (the average unemployment or non-employment likelihood is defined analogously). It can be shown that due to the non-linearities of

the regression models used, a transformation of the $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ coefficients as in Haisken-DeNew and Schmidt (1997) is necessary in order to interpret differences across time in these coefficients as the contribution of the respective labour market characteristic to changes in wage or unemployment structures (*cf.* the methodological discussion in Appendix A). This transformation changes the reference category of any dummy variable group from an arbitrary base to the *1991 sample mean*. Therefore, the regression results reported below display transformed coefficients for *all* dummy variables in each category (for example, no education type is omitted as the base, as the base is the *1991 sample mean* of the education groups).

The classification of labour market characteristics x_k (*e.g.* young age, low level of education) depending on whether they are increasing or decreasing in demand (net of supply effects that are not separately identified (*cf.* Appendix A) but can be gauged in sign from Figure 2 and Figure 3), and on whether they are associated with relative wage rigidities is summarised in Table 3. By observing wage and unemployment (or non-employment) changes jointly in terms of the transformed (indicated by an asterisk) coefficients, $\left(\beta^*_{1991+\tau,k} - \beta^*_{1991,k}\right)$ and $\left(\gamma^*_{1991+\tau,k} - \gamma^*_{1991,k}\right)$, each labour market characteristic can be classified into one of nine different cases. The classifications (4) and (6) in Table 3 refer to flexible labour markets, where relative net demand shocks only cause relative price changes. On the other hand, classifications (1), (2), and (3) refer to labour markets where potential relative net demand shocks (not identified in case (1)) lead to quantity rationing in terms of higher relative unemployment (or non-employment). The following section presents the empirical results.

[19] If wages are top-coded (as in the CPS and IABR data) or given in intervals (as in the GLFS), I use tobit or interval (ordered probit with known boundaries) regression.

4.2 Relative Net Demand Shocks and Wage Rigidity

In order to focus the discussion on the test of the Krugman hypothesis, Table 4 to Table 7 present the classification results for the age and education variables as in Table 3. These 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. Depending on these tests each skill characteristic is classified into one of the nine fields as described in Table 3 (the estimation results for the age and education coefficients are displayed graphically for the major data sets in Figure 5 to Figure 10. The changes in the coefficients since the base year (1991, 1992 for the CPS, 1993 for the BLFS)[20] are reported together with their *t*-values in Table A1 to Table A8 in Appendix A[21]). 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 3. If the Krugman (1994) hypothesis were to hold, one would expect that low-skilled (young age, low education) categories in western Germany are classified as (1): 'strongly rigid', (2): 'weakly rigid in a decreasing market', or, if wages are somewhat but not sufficiently flexible, (3): 'weakly adjusting in a decreasing market'. In the 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

[20] 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 (see also Section 2; in Section 3, I still used 1991 as the base year in the CPS as the two education categories mainly affected by the definition change, high school graduates and high school dropouts, were aggregated into one category there). 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.

[21] I do not display the coefficients of the other control variables gender and region here, nor the results for the tests on the non-employment regressions, but they are available upon request; CPS and BLFS regressions also control for the month of interview.

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 4. 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))[22]. 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 as the measure for quantity rationing, more support for the Krugman hypothesis emerges (*cf.* Table 5): the U.S. evidence suggests no rigidity, the preferred British data set, the BLFS,

[22] 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.

classifies young workers mostly into the 'flexible' class (4), whereas class (3) dominates in the large German GLFS data set.[23]

At this stage, visual inspection of the regression coefficients over time is illustrative: the age coefficients are displayed for the major data sets of the three countries in Figure 5 to Figure 7 (CPS for the United States, BLFS for Britain, IABR for German wages, GLFS for German unemployment and non-employment). Turning to the U.S. first, Figure 5a shows that the *ceteris paribus* wage distribution by age has become slightly more unequal up until the mid 1990s, but clearly has turned more equal than in 1992 by the year 2001. The age unemployment structure (Figure 5b) also saw some swings, especially for young people whose relative unemployment likelihood temporarily increased up to 1998 but then fell back to roughly its 1991 level again. These developments explain why the classification results mentioned above can become somewhat erratic and sensitive to the choice of base year. On the whole, though, there is no compelling evidence against the view that the U.S. has a flexible labour market: Figure 5c shows that there were virtually no sizable changes in the U.S. non-employment structure in the 1990s. Taken together with the relative wage changes in Figure 5a, my results confirm that the U.S. labour market is dominated by price rather than quantity adjustments.

Is Britain similar to the U.S.? Not quite. Figure 6a shows the age wage structure as estimated from the large BLFS data set. The British age wage structure became more unequal

[23] 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 quantitiy 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) occurr in both the models with unemployment and non-employment when 1993 is chosen as the base year (note that there was no GLFS survey in 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 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.

during the 1990s and then stabilised. Unlike in the U.S., it did not become more equal at the end of the 1990s. Figure 6a suggests a clear fall in the relative wage of young workers. At the same time, this group experienced an increase in the relative unemployment likelihood as shown in Figure 6b. However, the regression results based on non-employment as a measure for quantity rationing exhibit no economically significant changes in the relative non-employment likelihood of young workers (Figure 6c). At least in this respect, the British age wage structure was flexibly adjusting to the negative net demand shock against unskilled workers (as reflected in most classification results in Table 5).

Germany is not much different from Britain in the sense that the age wage structure seems to have become more unequal, with relative wages of young workers falling. Yet this effect is less pronounced than in Britain, as a comparison between Figure 7a and Figure 6a demonstrates. At the same time, youth unemployment *and* non-employment increased *ceteris paribus* (Figure 7b/c). This contrasts with the British results, where youth non-employment did not increase significantly (see also the classification results in Table 5).

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 age wage and unemployment/non-employment structures, 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 6 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 classifications (1): 'strongly rigid' (GLFS data) and (3): 'weakly adjusting in a decreasing market' (IABR data).[24] 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 2, there was a massive decrease in the relative supply of the least educated group in Britain in the 1990s (*cf.* Figure 3) which has in all likelihood netted out the 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 2.[25]

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

[24] 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 6 show.

[25] 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 base, as well as the U.S. results if 1993 is chosen as the base period.

(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).

If I use non-employment as the measure for quantity rationing (*cf.* Table 7), the results are very similar except that in the British BLFS the lowest instead of the second lowest skill group displays relative wage rigidity.[26]

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 3c). Taken together, this evidence supports 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

[26] 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

as American high school graduates. The macro analysis of Section 3, which has been applied in similar contexts in other papers, lumps several low-skilled groups together and therefore blurs this interesting finding: a German-style apprenticeship education seems to convey skills that are of a rather different quality than the 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 and insufficiently flexible wages. 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 3c) leads to the conclusion that the negative relative *net* demand shock has been generated by a negative relative supply shock and an even more negative relative demand shock.

Apart from relying on the classification results based on statistical inference, a look at the point estimates presented graphically in Figure 8 to Figure 10 helps to illustrate the different experiences of the three countries. The U.S. education wage structure displayed in Figure 8a 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 8b/c). 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 8b and Figure 10b). The German unemployment structure has become more unequal (Figure 10b),

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).

whereas the one in the U.S. has not (it even become more equal, *cf.* Figure 8b). This is exactly what the Krugman hypothesis states. The least educated in western Germany have also faced an increase in their non-employment likelihood (*cf.* Figure 10c), which is not the case for the least skilled in the U.S., who have experienced a decrease (*cf.* Figure 8c). However, albeit insufficiently flexible, the west German wage structure has not been completely rigid according to the administrative IABR data set (*cf.* Figure 10a).

What about Britain? Figure 9a shows that, in contrast to the U.S. experience, the British educational wage structure was fairly stable during the observation period. Still, the educational unemployment structure did not become much more unequal (*cf.* Figure 9b), 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 to those with *below O-level* education. Nevertheless, the broad picture that Britain was able to sustain a stable wage structure, without such unfavourable relative unemployment increases for the least educated as in western Germany, can be explained by the substantial relative supply changes as discussed in Section 2 and in this Section above.

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 Unites 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.[27] Furthermore, the time pattern of relative 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 23). Hence, changes in the German unemployment benefit or welfare regime cannot serve as an alternative explanation to my interpretation of relative wage rigidity in western Germany.

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 5a to Figure 10c 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. 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 supports the

[27] 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), 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).

visual inspection of Figure 5a to Figure 10c 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 explaing 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 microeconometric 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 this hypothesis for the 1990s, the period when average unemployment decreased in the United States and Britain, but increased in western Germany.

A ‘macroeconomic’ simulation building on related approaches in Katz and Murphy (1992), Autor, Katz and Krueger (1998), and Acemoglu (2003) supports the view that there have been relative demand shocks against the low skilled in all investigated countries. I have further simulated the degree of relative wage rigidity arising in the 1990s. Confirming the Krugman hypothesis, the results show that there has been excessive wage compression between high- and low-skilled groups in western Germany, but not in Britain nor in the U.S.

Although the macro simulations based on a CES production function framework yield interesting quantitative results on relative wage rigidity, they rely on strong assumptions as discussed in the text. Therefore, I have also investigated relative wage rigidities with much weaker assumptions, which only allow qualitative statements, though. The evidence on Britain demonstrates the importance of relative supply effects that helped to keep the educational wage structure constant. Britain also does not fit perfectly into the Krugman hypothesis, because it experienced relative unemployment or non-employment increases for its lower skill groups. Comparing the U.S. with western Germany, though, renders support for the view that wage rigidities can influence unemployment or (non-employment) developments across countries. Tests

on changes in the wage, unemployment, and non-employment structures with respect to age and education reveal that 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 even affected by a negative relative (net) demand shock suggesting that the German vocational education system provides many workers with skills shielding them from both relative wage and relative employment losses, the former having been experienced by American high school graduates.

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Table 1: Relative Wages, Supply and Demand

Year	U.S.A.: CPS-MORG	Britain: BLFS	Britain: BHPS	Western Germany: GSOEP	Western Germany: GLFS	Western Germany: IABR
Log Relative Wages $\ln(W_h/W_l)$						
1991	0.56		0.59	0.46	0.53	0.63
1992	0.58		0.56	0.48		0.62
1993	0.59	0.61	0.59	0.50	0.49	0.63
1994	0.60	0.60	0.52	0.47		0.62
1995	0.60	0.60	0.57	0.42	0.50	0.65
1996	0.59	0.64	0.60	0.40	0.49	0.59
1997	0.60	0.64	0.60	0.40	0.48	0.61
1998	0.60	0.66	0.53	0.36		
1999	0.61	0.65	0.55	0.39		
2000	0.62	0.66	0.55	0.40		
2001	0.63					
1991(3)-1997(9)	*0.03*	*0.04*	*0.01*	*-0.06*	*-0.05*	*-0.02*
Log Relative Supply $\ln(S_h/S_l)$						
1991	-0.51		-1.29	-1.65	-1.47	-2.42
1992	-0.50		-1.22	-1.62		-2.39
1993	-0.47	-1.02	-1.18	-1.59	-1.42	-2.35
1994	-0.43	-1.01	-1.13	-1.56		-2.31
1995	-0.41	-0.98	-1.08	-1.51	-1.35	-2.27
1996	-0.39	-0.97	-1.05	-1.51	-1.32	-2.30
1997	-0.38	-0.96	-1.02	-1.52	-1.28	-2.28
1998	-0.35	-0.91	-0.97	-1.49		
1999	-0.32	-0.86	-0.94	-1.44		
2000	-0.31	-0.82	-0.89	-1.30		
2001	-0.29					
1991(3)-1997(9)	*0.13*	*0.17*	*0.27*	*0.13*	*0.20*	*0.15*
Log Relative Demand Index $\ln(A_h/A_l)^{\sigma-1}$						
1991	0.45		-0.31	-0.87	-0.57	-1.53
1992	0.48		-0.30	-0.78		-1.49
1993	0.52	-0.02	-0.20	-0.71	-0.55	-1.42
1994	0.57	-0.01	-0.27	-0.69		-1.40
1995	0.60	0.02	-0.14	-0.72	-0.46	-1.32
1996	0.60	0.08	-0.08	-0.77	-0.45	-1.43
1997	0.61	0.09	-0.07	-0.76	-0.42	-1.39
1998	0.63	0.15	-0.12	-0.80		
1999	0.67	0.18	-0.07	-0.68		
2000	0.70	0.24	-0.02	-0.57		
2001	0.73					
1991(3)-1997(9)	*0.16*	*0.20*	*0.25*	*0.11*	*0.16*	*0.14*

Note: These simulations assume $\sigma = 1.4$.

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

Table 2: Simulated Relative Wage Rigidity (RWR)

Year	U.S.A.: CPS-MORG	Britain: BLFS	Britain: BHPS	Western Germany: GSOEP	Western Germany: GLFS	Western Germany: IABR
Log Relative Wage Rigidity, RWR						
1991	0.00		0.00	0.00	0.00	0.00
1992	0.00		0.01	-0.02*		0.00*
1993	0.00	0.00	0.00	-0.03*	-0.01*	-0.01*
1994	0.00	0.00	0.01	-0.04*		-0.02*
1995	0.00	0.00*	0.01	-0.04*	-0.01*	-0.02*
1996	0.01*	0.01*	0.01	-0.03	-0.02*	-0.02*
1997	0.01*	0.01*	0.02*	-0.04*	-0.02*	-0.02*
1998	0.01*	0.02*	0.02*	-0.03		
1999	0.02*	0.02*	0.03*	-0.05*		
2000	0.02*	0.02*	0.03*	-0.02		
2001	0.02*					
1991(3)-1997(9)	*0.01**	*0.02**	*0.02**	*-0.04**	*-0.02**	*-0.02**

Note: Negative numbers indicate relative wage rigidity (wage compression of high-skilled versus low-skilled wages); these simulations assume σ = 1.4. Significance at the 10 percent level is indicated by an asterisk and based on bootstrap 90 percent confidence intervals for the estimated relative wage rigidity. The confidence intervals are based on 500 bootstrap replications.

Sources: CPS-MORG; BLFS; BHPS; GSOEP; GLFS; IABR; see also Table 1; own calculations.

Table 3: Relative Wage and Unemployment/Non-Employment Behaviour and Labour Market Classification

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

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 Appendix A). 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 the Appendix.

Table 4: 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 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 Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table 5: 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 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 Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table 6: 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 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 Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

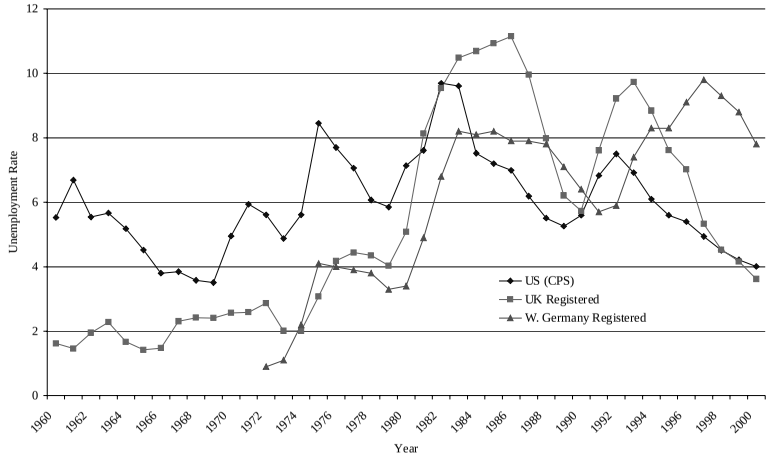
Table 7: Education Classification Summary (with Non-Employment Regressions)

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 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 Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Figure 1: Unemployment Rates 1960 - 2000



Note: The U.S. unemployment rate is base 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 Sample Means Working Age Population - U.S. (CPS)

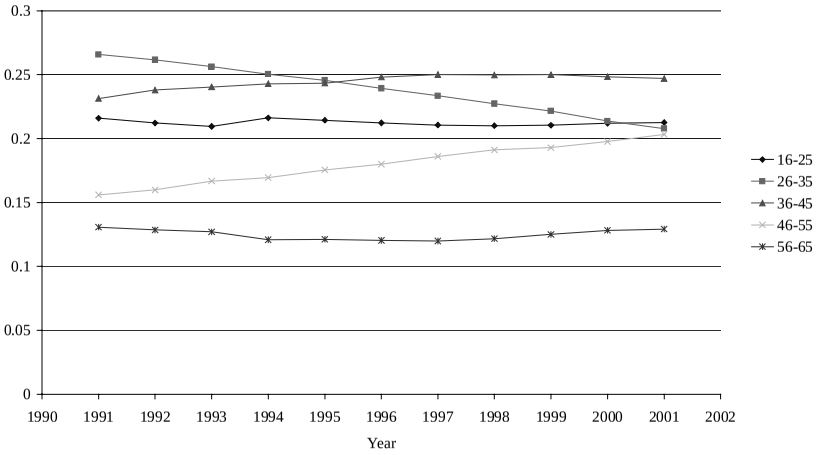


Figure 2b: Age Sample Means Working Age Population - Britain (BLFS)

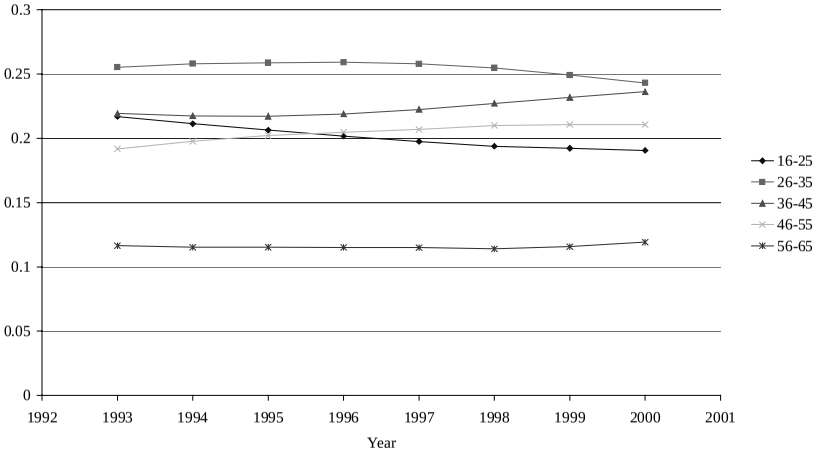


Figure 2c: Age Sample Means Working Age Population - Germany (GLFS)

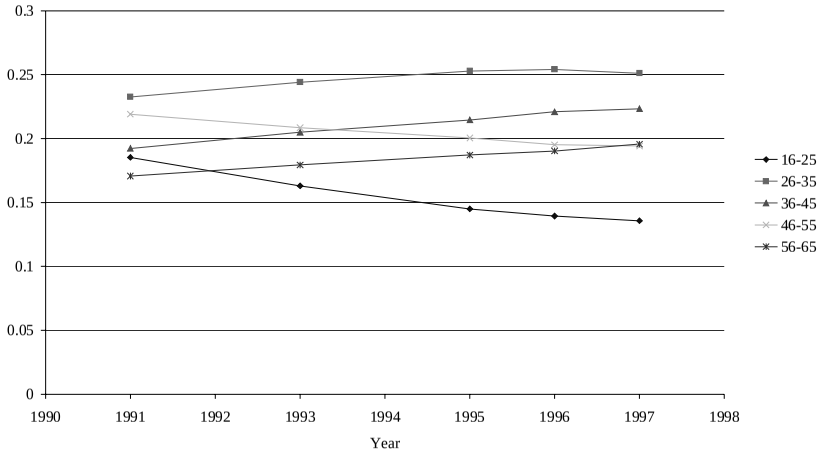
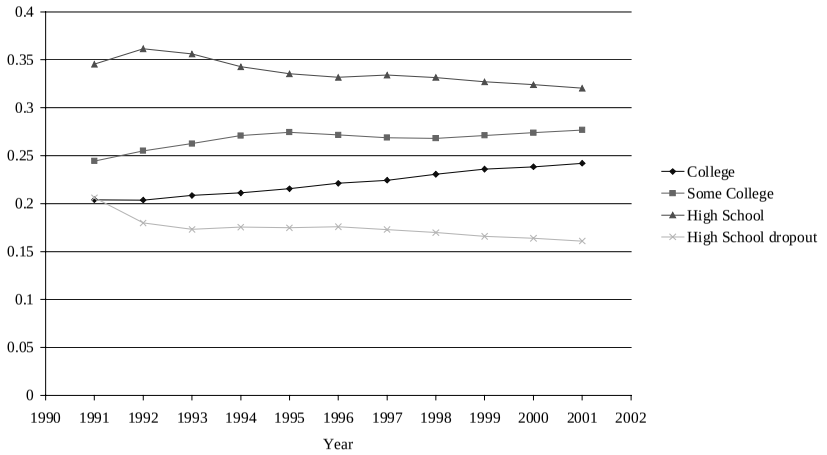


Figure 3a: Education Sample Means Working Age Population - U.S. (CPS)



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.

Figure 3b: Education Sample Means Working Age Population - Britain (BLFS)

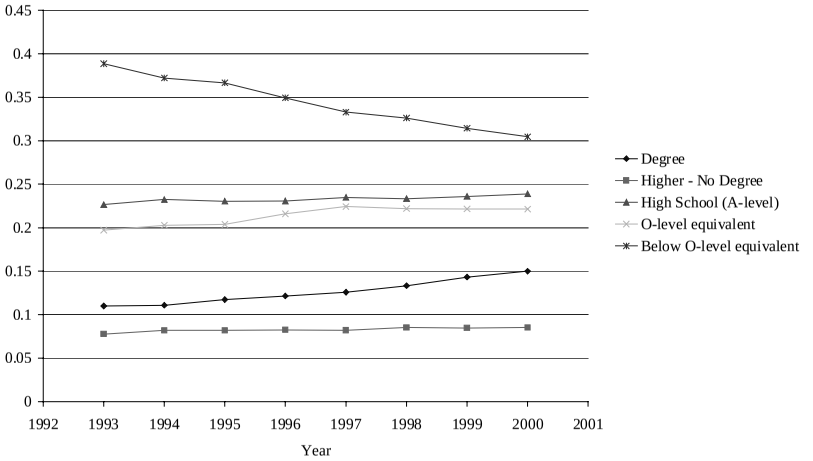


Figure 3c: Education Sample Means Working Age Population - Germany (GLFS)

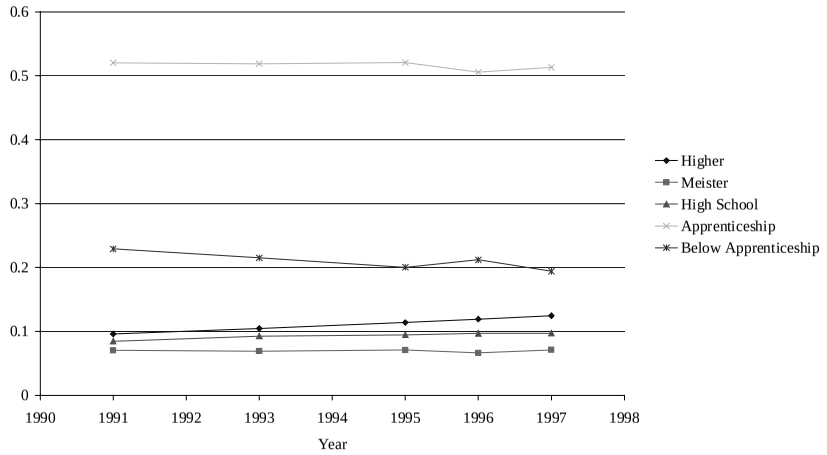
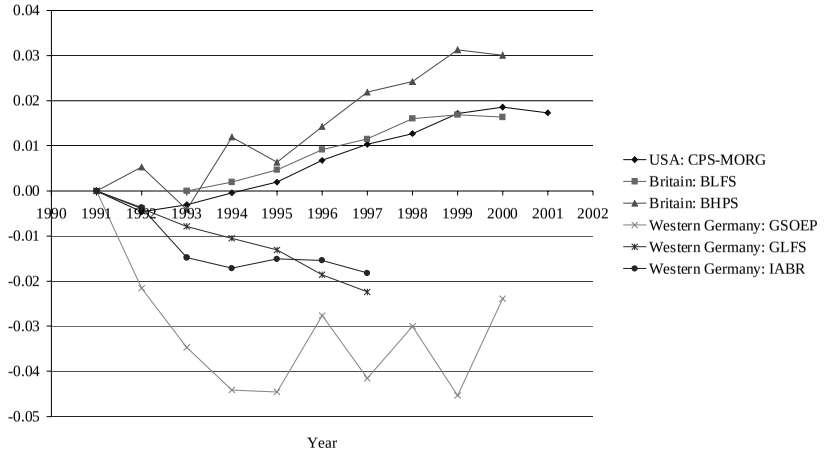


Figure 4: Simulated Relative Wage Rigidity (RWR)



Note: A negative number indicates relative wage rigidity (relative wage compression of high- versus low-skilled wages).

Figure 5a: U.S. Wage Regression: Age Coefficients - (CPS)

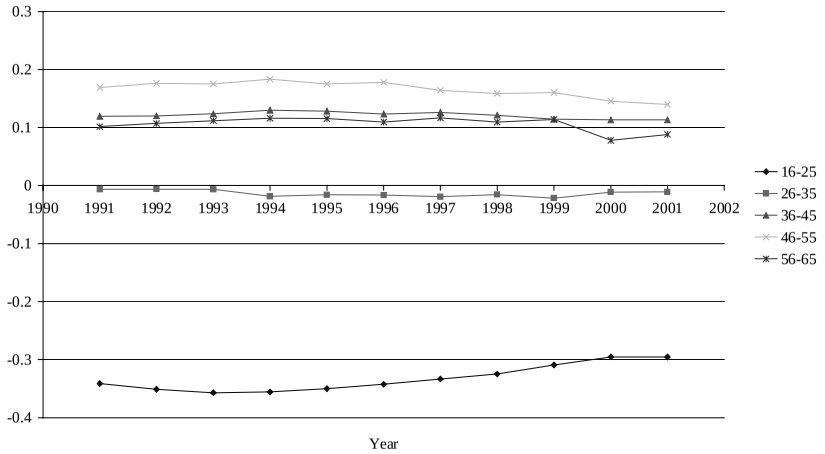


Figure 5b: U.S. Unemployment Regression: Age Coefficients - (CPS)

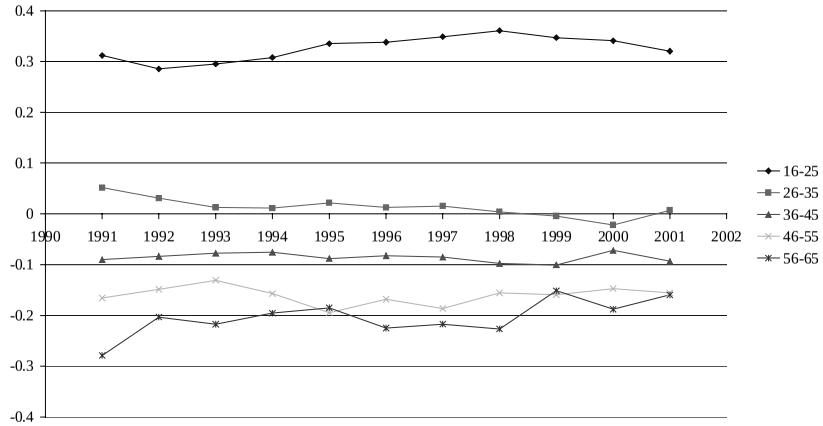


Figure 5c: U.S. Non-Employment Regression: Age Coefficients - (CPS)

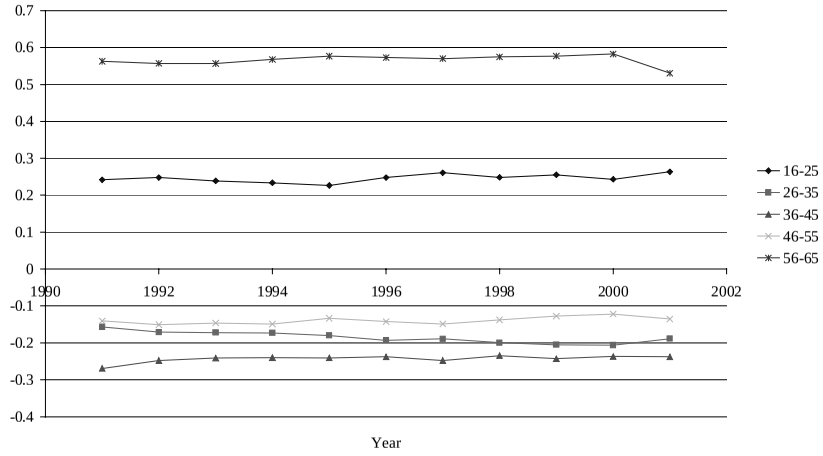


Figure 6a: British Wage Regression: Age Coefficients - (BLFS)

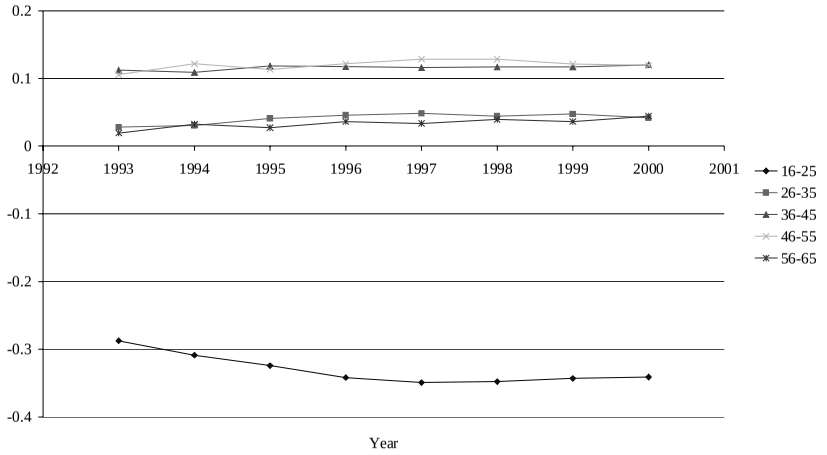


Figure 6b: British Unemployment Regression: Age Coefficients - (BLFS)

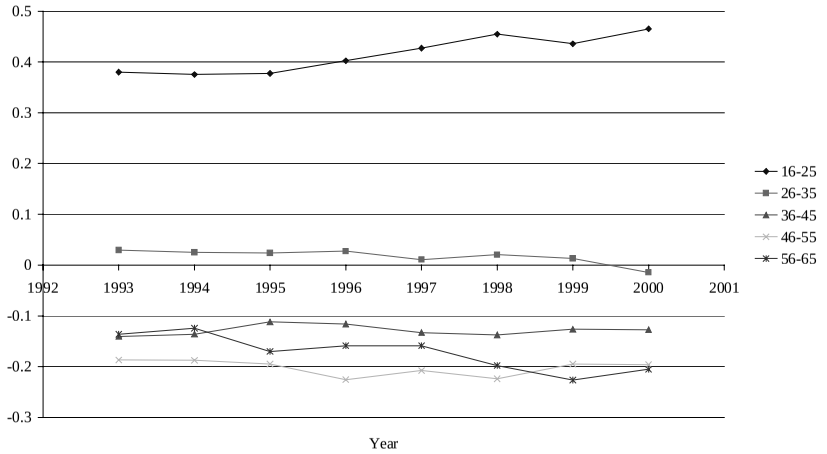


Figure 6c: British Non-Employment Regression: Age Coefficients - (BLFS)

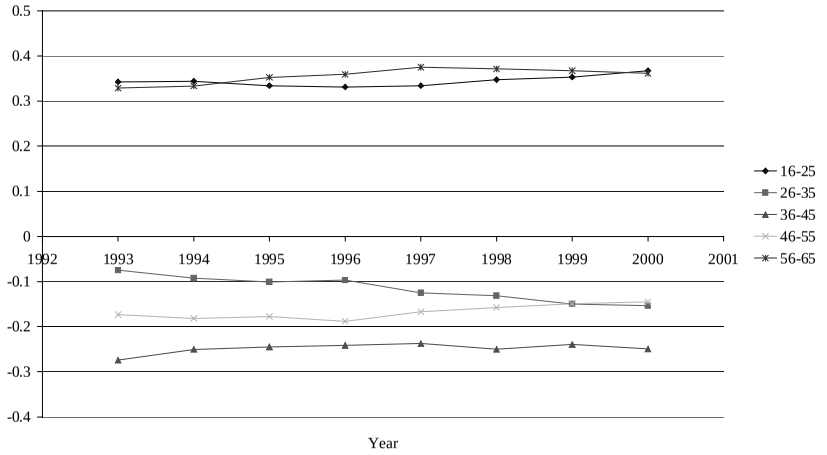


Figure 7a: German Wage Regression: Age Coefficients - (IABR)

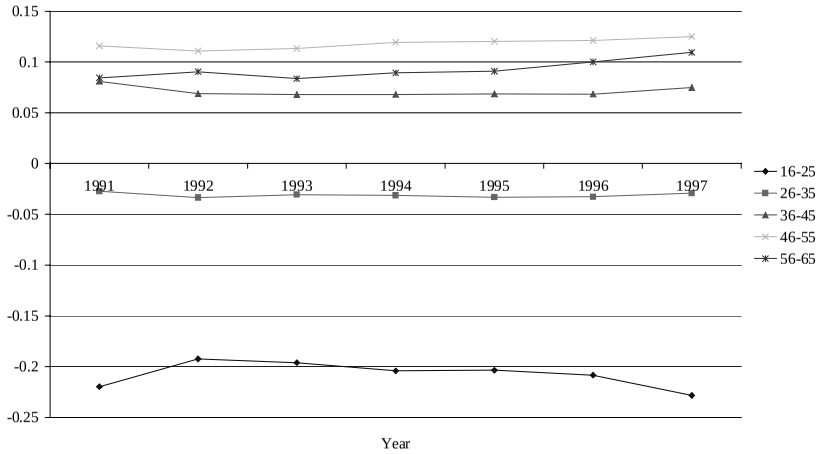


Figure 7b: Unemployment Regression: Age Coefficients - (GLFS)

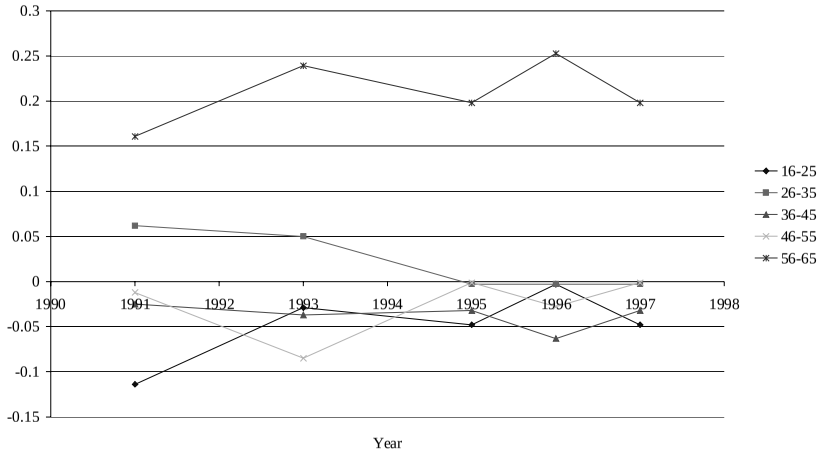


Figure 7c: German Non-Employment Regression: Age Coefficients - (GLFS)

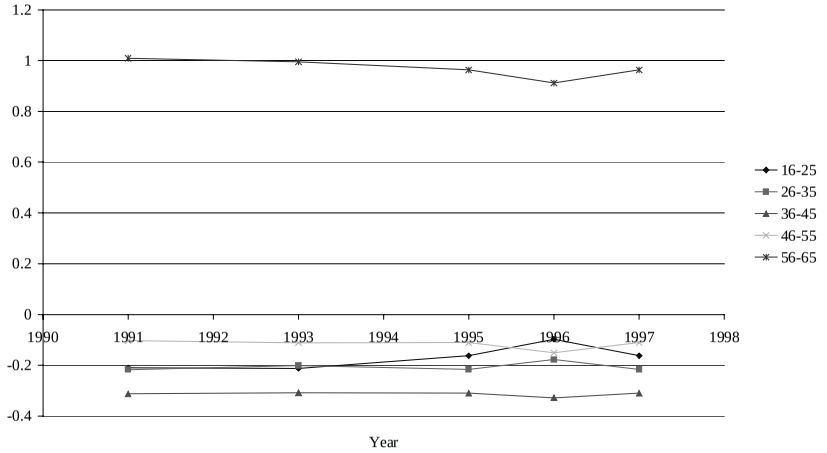


Figure 8a: U.S. Wage Regression: Education Coefficients - (CPS)

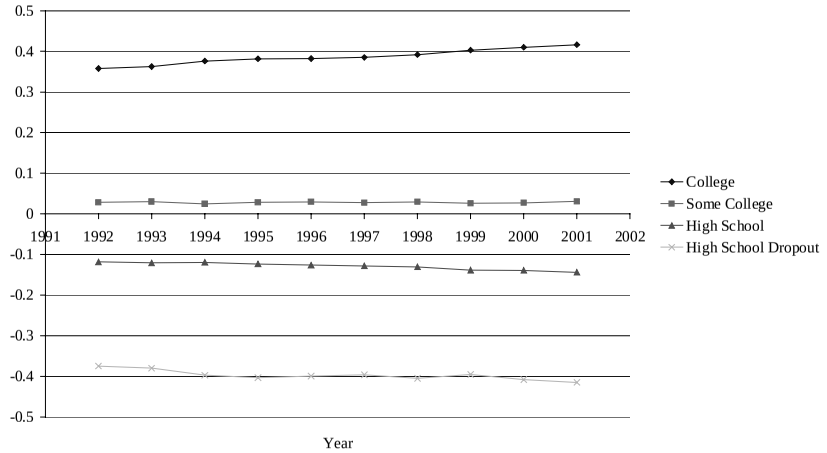


Figure 8b: U.S. Unemployment Regression: Education Coefficients - (CPS)

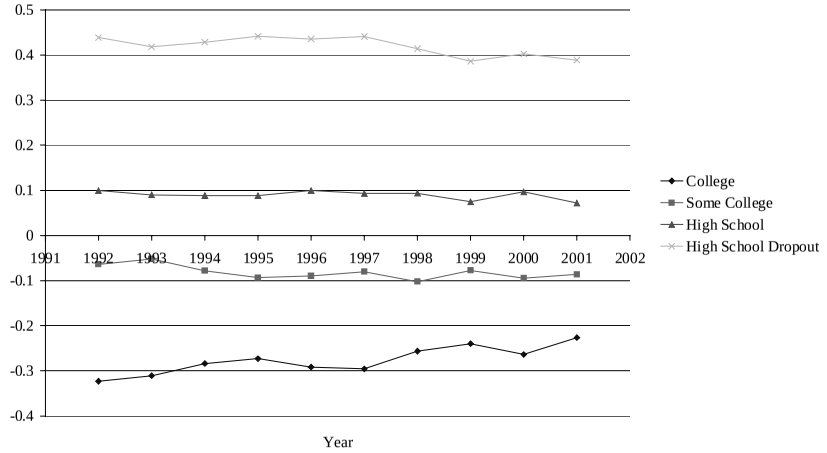


Figure 8c: U.S. Non-Employment Regression: Education Coefficients - (CPS)

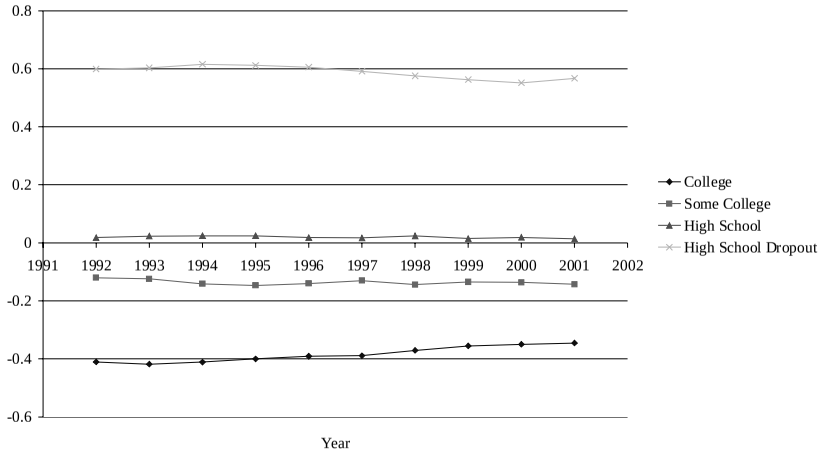


Figure 9a: British Wage Regression: Education Coefficients - (BLFS)

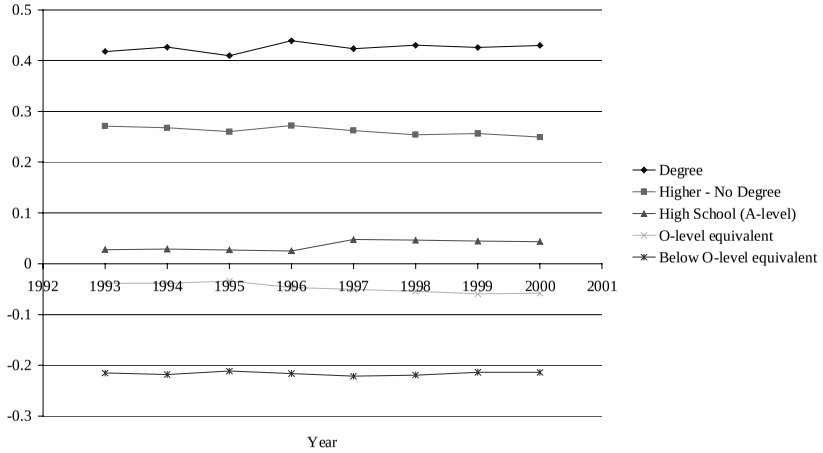


Figure 9b: British Unemployment Regression: Education Coefficients - (BLFS)

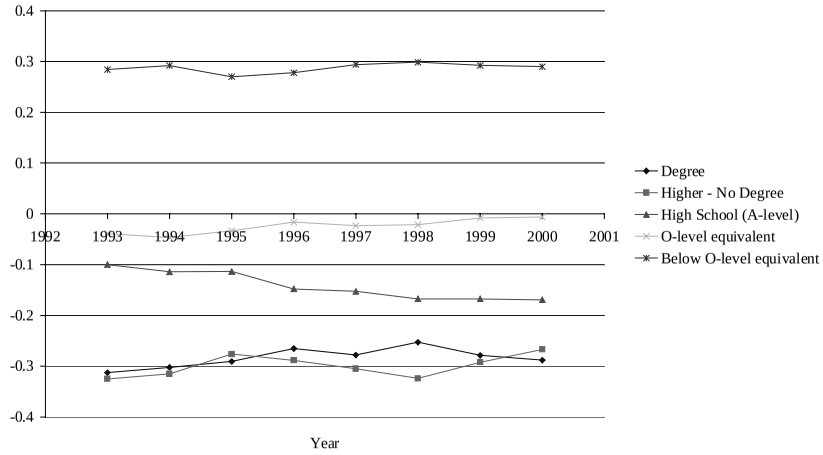


Figure 9c: British Non-Employment Regression: Education Coefficients - (BLFS)

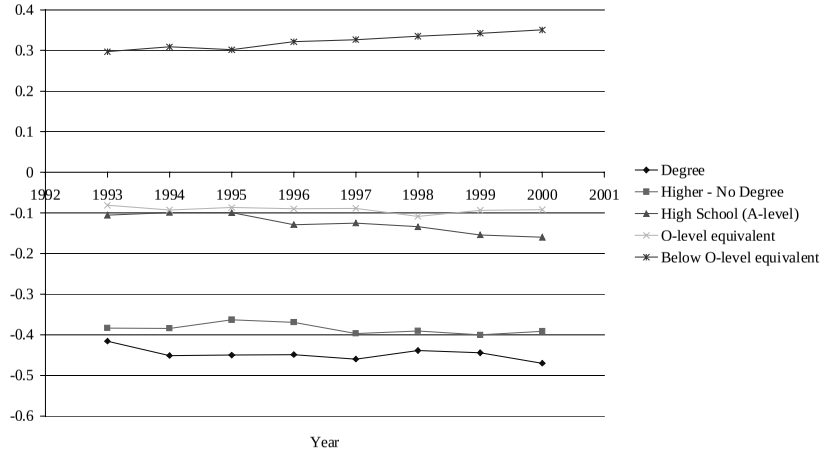


Figure 10a: German Wage Regression: Education Coefficients - (IABR)

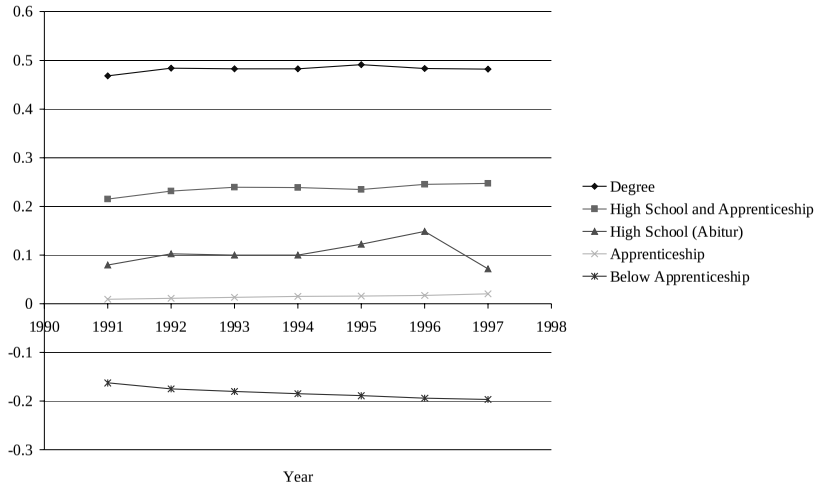
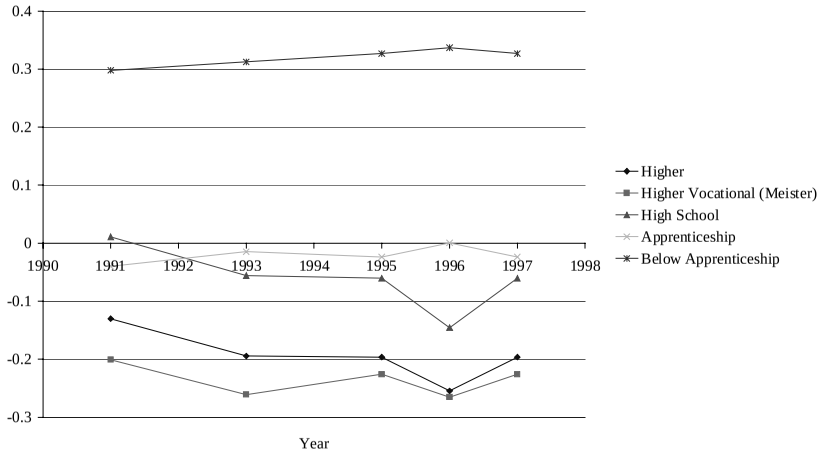
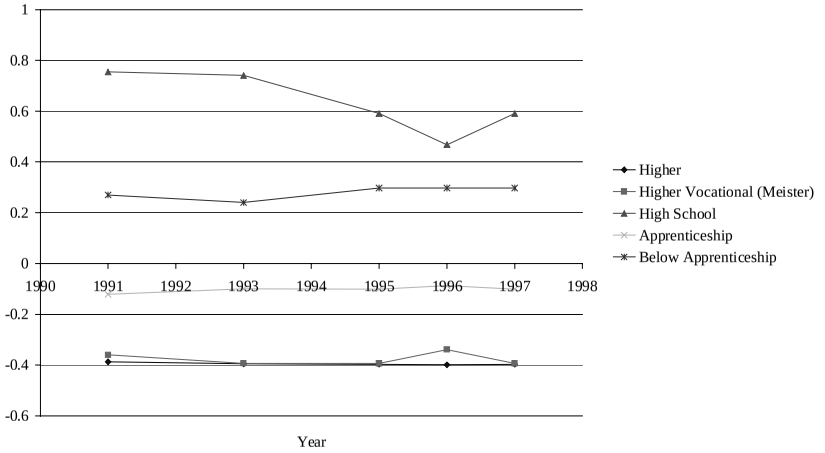


Figure 10b: German Unemployment Regression: Education Coefficients - (GLFS)



Note: The jumps in the coefficients in 1996 seem to be specific to the GLFS data in that particular year (they mostly affect the 'Higher Education' and 'High School' groups, which each make up only about 10 percent of the labour force). Comparing the GLFS coefficient changes between 1995 and 1997 with those in the IBAR data confirms that 1996 represents the outlier. Data providing agencies in Germany could not explain this phenomenon. The slight coding change of the labour force state cannot serve as an explanation, because, first, the jumps in 1996 are robust to different treatments of the change (here I present results with harmonised definitions across years). Second, trends between 1995 and 1997 are similar in the IABR data as mentioned, and 1997 has the same design as 1996 as far as the relevant variables are concerned.

Figure 10c: German Non-Employment Regression: Education Coefficients - (GLFS)



Appendix A

Theoretical Justification for the Empirical Approach in Section 4

In order to identify relative net demand shocks, I adapt Katz and Autor's (1999) supply-demand-institutions framework. The framework rests on a neoclassical model of the labour market:

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

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

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 and $\mathcal{Z}_t$ is a vector of demand and/or supply 'shift factors', which subsumes a wide range of aspects such as the size of the labour force, technological change, foreign demand, or the preference structure of the population.

In the face of a negative net relative demand shock (formally defined below), a real wage rigidity will cause quantity rationing (*i.e.* the failure of the market to clear) in the form of unemployment (or non-employment). This is the same conceptual set up as in the studies by Nickell and Bell (1996) and Gottschalk and Joyce (1997). Formally, unemployment due to rigid wages can be expressed as a function of the vector of wage rates and supply/demand shift factors as

$$\mathcal{U}_{rigid,t} = \frac{\left(S_t - D_t\right)}{S_t} = 1 - \frac{D_t\left(\mathcal{W}_t, \mathcal{Z}_t\right)}{S_t\left(\mathcal{W}_t, \mathcal{Z}_t\right)} = \mathcal{U}_{rigid,t}\left(\mathcal{W}_t, \mathcal{Z}_t\right) \qquad \text{(A1)}$$

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

Because transaction costs or incomplete information may induce market frictions, the observed unemployment rate may be higher than the unemployment rate component due to rigid wages. This issue has not been addressed in related papers by Card, Kramarz, and Lemieux (1999) or Krueger and Pischke (1997), probably because an empirically tractable model of unemployment with wage rigidities in a search context has not been developed yet. Here, I will at least state the condition for the frictional unemployment component to be ignorable. Formally, one can write the observed unemployment rate as

$$\mathcal{U}_{observed,t} = \varphi_t\left(\mathcal{U}_{rigid,t}, \delta_t\right) \tag{A2}$$

($L\times 1$ vector of observed unemployment rates)

where δ_t is the frictional component of unemployment, which may be affected by changes in the unemployment benefit regime. This frictional component can be ignored for the analysis of this paper if between any two points in time t and $t+\tau$

$$\operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^l_{observed}\right) = \operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^l_{rigid}\right) \quad \forall l$$

holds, which means that the frictional component is not exogenously changing the observed unemployment rate. Imposing this restriction and using a Taylor expansion one obtains

$$\operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^l_{observed}\right) \approx \operatorname{sgn}\left(\underbrace{\underbrace{\mathcal{U}^{l,l}_{\mathcal{W}} \cdot \Delta_t^{t+\tau}\mathcal{W}^l}_{\text{own wage effect}} + \underbrace{\sum_{j\neq l}\mathcal{U}^{l,j}_{\mathcal{W}} \cdot \Delta_t^{t+\tau}\mathcal{W}^j}_{\text{cross wage effects}} + \underbrace{\sum_{j}\mathcal{U}^{l,j}_{\mathcal{Z}} \cdot \Delta_t^{t+\tau}\mathcal{Z}^j}_{\text{pure net supply shift effects}}}_{\text{net supply shift effects}} \right) \tag{A3}$$

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 $\mathcal{U}_{rigid}$ 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, $\mathcal{U}_{\mathcal{Z}}^{l,j}$, as these variables subsume a wide range of unspecified factors. Note that – unlike in the macro approach of Section 3 – 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 (A3), 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)

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

in 7 out of 9 cases (distinguished by the sign of wage and unemployment changes, similarly as in Table 3 in the text) (*cf.* Puhani, 2001). Note that a negative net demand shock is equivalent to a positive net supply shock, *i.e.* $\xi > 0$. I argue that such a qualitative empirical approach with comparatively few assumptions provides a valuable and robust tool for gaining insights into the existence of wage rigidities.

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: $\Delta_t^{t+\tau}\mathcal{W}^l - \Delta_t^{t+\tau}\mathcal{W}^r$ and $\Delta_t^{t+\tau}\mathcal{U}^l_{observed} - \Delta_t^{t+\tau}\mathcal{U}^r_{observed}$.

In order to identify relative negative net demand shocks note that

$$\Delta_t^{t+\tau}\mathcal{U}^l_{observed} - \Delta_t^{t+\tau}\mathcal{U}^r_{observed} =$$
$$\varphi^l_{t+\tau}\left(\mathcal{U}^l_{rigid,t+\tau}, \delta^l_{t+\tau}\right) - \varphi^l_t\left(\mathcal{U}^l_{rigid,t}, \delta^l_t\right) - \varphi^r_{t+\tau}\left(\mathcal{U}^r_{rigid,t+\tau}, \delta^r_{t+\tau}\right) + \varphi^r_t\left(\mathcal{U}^r_{rigid,t}, \delta^r_t\right)$$

where *r* denotes the reference market with respect to which the wage and unemployment structure is defined. For the frictional components δ of unemployment to be ignorable for identification, it has to be the case that

$$\operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^l_{observed} - \Delta_t^{t+\tau}\mathcal{U}^r_{observed}\right) = \operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^l_{rigid} - \Delta_t^{t+\tau}\mathcal{U}^r_{rigid}\right).$$

Take the following example to gain some intuition for this condition: let the function $\varphi(\bullet)$ be additive for all labour markets at all time periods. Then the change in the observed unemployment structure can be written as

$$\Delta_t^{t+\tau}\mathcal{U}^l_{observed} - \Delta_t^{t+\tau}\mathcal{U}^r_{observed} = \Delta_t^{t+\tau}\mathcal{U}^r_{rigid} - \Delta_t^{t+\tau}\mathcal{U}^r_{rigid} + \Delta_t^{t+\tau}\delta^l - \Delta_t^{t+\tau}\delta^r .$$

The condition for frictional unemployment to be ignorable then becomes

$$\operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^r_{rigid} - \Delta_t^{t+\tau}\mathcal{U}^r_{rigid} + \Delta_t^{t+\tau}\delta^l - \Delta_t^{t+\tau}\delta^r\right) = \operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^l_{rigid} - \Delta_t^{t+\tau}\mathcal{U}^r_{rigid}\right).$$

In words, this means that relative changes in the frictional components of unemployment must not dominate relative changes in unemployment due to wage rigidities. Fulfilment of this condition is plausible if there are no institutional or technological shocks to the labour market which have a major impact on the search process of unemployed people or firms trying to fill vacancies. I argue in the text of the paper that the inspection of the unemployment benefit and welfare reforms across countries makes it implausible that the main results of Section 4.2 can be explained purely by changes in frictional unemployment.

Note also that the condition for the identification of absolute net demand shocks, $\operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^l_{observed}\right) = \operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^l_{rigid}\right)$, and the one for the identification of relative net demand shocks $\operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^l_{observed} - \Delta_t^{t+\tau}\mathcal{U}^r_{observed}\right) = \operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}^l_{rigid} - \Delta_t^{t+\tau}\mathcal{U}^r_{rigid}\right)$, are not nested. The identification of relative net demand shocks also requires an additional assumption, namely $\mathcal{U}^{l,l}_{\mathcal{W}} \approx \mathcal{U}^{r,r}_{\mathcal{W}}$. Using a Taylor approximation as for the derivation of (A3) one can write:

$$\Delta_t^{t+\tau}\mathcal{U}_{rigid}^{l} - \Delta_t^{t+\tau}\mathcal{U}_{rigid}^{r} \approx$$
$$\mathcal{U}_{\mathcal{W}}^{l,l} \cdot \Delta_t^{t+\tau}\mathcal{W}^{l} - \mathcal{U}_{\mathcal{W}}^{r,r} \cdot \Delta_t^{t+\tau}\mathcal{W}^{r} + \sum_{j\neq l}\mathcal{U}_{\mathcal{W}}^{l,j} \cdot \Delta_t^{t+\tau}\mathcal{W}^{j} - \sum_{j\neq r}\mathcal{U}_{\mathcal{W}}^{r,j} \cdot \Delta_t^{t+\tau}\mathcal{W}^{j} +$$
$$\sum_{j}\mathcal{U}_{\mathcal{Z}}^{l,j} \cdot \Delta_t^{t+\tau}\mathcal{Z}^{j} - \sum_{j}\mathcal{U}_{\mathcal{Z}}^{r,j} \cdot \Delta_t^{t+\tau}\mathcal{Z}^{j} \quad . \qquad \text{(A4)}$$

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:

$$\operatorname{sgn}\left(\Delta_t^{t+\tau}\mathcal{U}_{observed}^{l} - \Delta_t^{t+\tau}\mathcal{U}_{observed}^{r}\right) = \operatorname{sgn}\begin{pmatrix} \mathcal{U}_{\mathcal{W}}^{l,l}\left[\Delta_t^{t+\tau}\mathcal{W}^{l} - \Delta_t^{t+\tau}\mathcal{W}^{r}\right] + \\ \sum_{j\neq l}\mathcal{U}_{\mathcal{W}}^{l,j} \cdot \Delta_t^{t+\tau}\mathcal{W}^{j} - \sum_{j\neq r}\mathcal{U}_{\mathcal{W}}^{r,j} \cdot \Delta_t^{t+\tau}\mathcal{W}^{j} + \\ \sum_{j}\mathcal{U}_{\mathcal{Z}}^{l,j} \cdot \Delta_t^{t+\tau}\mathcal{Z}^{j} - \sum_{j}\mathcal{U}_{\mathcal{Z}}^{r,j} \cdot \Delta_t^{t+\tau}\mathcal{Z}^{j} \end{pmatrix}. \qquad \text{(A5)}$$

Hence, by observing relative wage and unemployment changes, $\Delta_t^{t+\tau}\mathcal{W}^{l} - \Delta_t^{t+\tau}\mathcal{W}^{r}$ and $\Delta_t^{t+\tau}\mathcal{U}_{observed}^{l} - \Delta_t^{t+\tau}\mathcal{U}_{observed}^{r}$, and noting that equation (A5) holds, the sign of the relative net supply shock

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

(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 3.

Empirical Implementation

In order to apply the above concepts to individual data, I define a labour market *l* by its characteristics $\mathbf{x}_l$ (see Section 2 for a variable description; the subscript *l* shall be dropped

henceforth), and denote the reference labour market *r* by $\bar{\mathbf{x}}$. $\mathcal{W}$ and $\mathcal{U}$ are defined as expected values of the wage rate *W* and the unemployment/non-employment indicator $U = 1(\textit{unemployed} / \textit{non}-\textit{employed})$, respectively. $1(\bullet)$ is the indicator function which takes on value *1* if the argument is true and *0* otherwise. Hence I define

$$\left[\Delta_t^{t+\tau}\mathcal{W}^l - \Delta_t^{t+\tau}\mathcal{W}^r\right] \equiv E\left[W_{t+\tau} - W_t \middle| \mathbf{x}\right] - E\left[W_{t+\tau} - W_t \middle| \bar{\mathbf{x}}\right]$$

$$\left[\Delta_t^{t+\tau}\mathcal{U}^l_{observed} - \Delta_t^{t+\tau}\mathcal{U}^r_{observed}\right] \equiv E\left[U_{t+\tau} - U_t \middle| \mathbf{x}\right] - E\left[U_{t+\tau} - U_t \middle| \bar{\mathbf{x}}\right].$$

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

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

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

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.* 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: $\left(\beta^*_{t+\tau,k} - \beta^*_{t,k}\right)$ and $\left(\gamma^*_{t+\tau,k} - \gamma^*_{t,k}\right)$, respectively. The transformed coefficients (as well as their standard errors) are calculated as in Haisken-De New and Schmidt (1997): $\boldsymbol{\beta}^*_t = (\mathbf{I} - \mathbf{W})\boldsymbol{\beta}_t$, $\boldsymbol{\gamma}^*_t = (\mathbf{I} - \mathbf{W})\boldsymbol{\gamma}_t$, where **I** is the identity matrix and **W** is a matrix containing weights, which in my case are the *base period* (*1991 in most cases) 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 (*cf.* Puhani, 2001). 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 3, depending on whether it contributed to a rising, constant, or falling relative wage or unemployment likelihood. This is the approach taken in Section 4 of the paper.

Table A1: U.S. and British Wage Regressions (Changes in Transformed Age Coefficients with Respect to 1991 – Corresponding t-values in Parentheses)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS, Base 1992)										
16-25		-0.01	0.00	0.00	0.01	0.02	0.03	0.04	0.06	0.06
		-(1.8)	-(1.2)	(0.3)	(2.1)	(4.5)	(6.5)	(10.0)	(13.7)	(13.3)
26-35		0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	0.00	0.00
		-(0.1)	-(4.0)	-(3.0)	-(3.1)	-(4.0)	-(2.8)	-(4.6)	-(1.3)	-(1.2)
36-45		0.00	0.01	0.01	0.00	0.01	0.00	-0.01	-0.01	-0.01
		(1.3)	(2.9)	(2.3)	(0.9)	(1.7)	(0.4)	-(1.6)	-(1.8)	-(1.7)
46-55		0.00	0.01	0.00	0.00	-0.01	-0.02	-0.02	-0.03	-0.04
		-(0.2)	(1.5)	-(0.4)	(0.4)	-(2.6)	-(3.7)	-(3.4)	-(6.5)	-(7.5)
56-65		0.00	0.01	0.01	0.00	0.01	0.00	0.01	-0.03	-0.02
		(0.7)	(1.2)	(1.1)	(0.3)	(1.2)	(0.3)	(0.9)	-(3.6)	-(2.3)
Britain (BLFS; Base 1993)										
16-25			-0.02	-0.04	-0.05	-0.06	-0.06	-0.06	-0.05	
			-(2.5)	-(4.3)	-(6.2)	-(7.8)	-(7.7)	-(7.1)	-(6.8)	
26-35			0.00	0.01	0.02	0.02	0.02	0.02	0.01	
			(0.4)	(2.1)	(2.8)	(3.6)	(3.0)	(3.5)	(2.4)	
36-45			0.00	0.01	0.01	0.00	0.00	0.00	0.01	
			-(0.5)	(0.9)	(0.8)	(0.6)	(0.8)	(0.8)	(1.3)	
46-55			0.02	0.01	0.02	0.02	0.02	0.02	0.01	
			(2.1)	(1.1)	(2.2)	(3.4)	(3.5)	(2.4)	(2.1)	
56-65			0.01	0.01	0.02	0.01	0.02	0.02	0.03	
			(0.9)	(0.6)	(1.2)	(1.1)	(1.6)	(1.4)	(2.0)	
Britain (BHPS)										
16-25	0.02	0.00	-0.02	0.00	-0.05	-0.05	-0.04	-0.02	-0.02	
	(1.0)	(0.0)	-(1.0)	-(0.1)	-(2.3)	-(2.1)	-(2.0)	-(0.9)	-(0.8)	
26-35	0.00	0.00	0.01	0.00	0.00	0.01	0.00	-0.01	0.00	
	-(0.3)	-(0.3)	(1.0)	(0.3)	-(0.1)	(0.5)	-(0.2)	-(0.5)	(0.1)	
36-45	-0.02	-0.01	-0.01	0.01	0.01	0.03	0.02	0.03	0.02	
	-(1.6)	-(0.8)	-(0.6)	(0.5)	(0.9)	(1.5)	(1.5)	(1.7)	(1.4)	
46-55	0.01	0.01	0.00	-0.02	0.04	0.01	0.01	0.01	0.02	
	(0.6)	(0.8)	-(0.2)	-(0.8)	(1.9)	(0.7)	(0.5)	(0.7)	(0.8)	
56-65	0.00	0.01	0.03	0.00	0.00	-0.01	0.01	-0.04	-0.07	
	(0.1)	(0.4)	(0.8)	(0.0)	(0.0)	-(0.4)	(0.3)	-(1.1)	-(1.8)	

Note: *t*-values are based on standard errors allowing for clustering wherever applicable. Estimates use sampling weights wherever applicable.

Sources: Current Population Survey – Merged Outgoing Rotation Group Files (CPS); British Labour Force Survey (BLFS); British Household Panel Survey (BHPS); own calculations.

Table A2: German Wage Regressions (Changes in Transformed Age Coefficients with Respect to 1991 – Corresponding t-values in Parentheses)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Germany (GSOEP)									
16-25	(0.0)	(1.3)	-(0.8)	-(1.3)	-(1.2)	-(2.7)	-(4.0)	-(3.0)	-(2.5)
	-0.01	-0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.00
26-35	-(0.4)	-(1.4)	(0.6)	(0.6)	(0.8)	(1.2)	(0.8)	(0.8)	-(0.2)
	0.00	0.00	0.01	0.02	0.01	0.01	0.03	0.00	0.01
36-45	(0.1)	-(0.3)	(0.7)	(1.3)	(0.3)	(0.5)	(1.8)	(0.0)	(0.6)
	-0.01	0.01	-0.01	-0.02	0.00	0.00	-0.01	0.00	0.00
46-55	-(0.7)	(0.3)	-(0.8)	-(0.9)	-(0.1)	(0.1)	-(0.5)	(0.1)	-(0.1)
	0.04	0.01	0.01	0.03	0.04	0.04	0.10	0.10	0.08
56-65	(1.2)	(0.4)	(0.2)	(0.6)	(1.0)	(0.8)	(2.1)	(2.3)	(2.2)
	0.00	0.01	-0.02	-0.06	-0.05	-0.10	-0.12	-0.06	-0.07
Germany (GLFS)									
16-25		-0.04		-0.01	-0.04	-0.05			
		-(14.0)		-(3.9)	-(9.4)	-(13.1)			
26-35		0.02		-0.01	0.00	0.00			
		(6.9)		-(4.7)	-(1.5)	-(0.3)			
36-45		0.01		0.00	0.00	0.00			
		(3.1)		(1.4)	(0.8)	(0.6)			
46-55		0.01		0.01	0.02	0.02			
		(3.9)		(5.6)	(6.2)	(8.6)			
56-65		0.00		0.01	0.03	0.04			
		(0.1)		(2.7)	(6.8)	(7.8)			
Germany (IABR)									
16-25	0.03	0.02	0.02	0.02	0.01	-0.01			
	(11.8)	(8.8)	(5.2)	(5.2)	(3.4)	-(2.1)			
26-35	-0.01	0.00	0.00	-0.01	-0.01	0.00			
	-(4.2)	-(2.0)	-(2.3)	-(3.3)	-(2.5)	-(0.6)			
36-45	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01			
	-(7.8)	-(7.1)	-(6.2)	-(5.6)	-(5.3)	-(2.5)			
46-55	-0.01	0.00	0.00	0.00	0.01	0.01			
	-(3.4)	-(1.4)	(1.6)	(1.9)	(1.9)	(2.9)			
56-65	0.01	0.00	0.00	0.01	0.02	0.02			
	(1.3)	-(0.2)	(0.9)	(1.2)	(2.6)	(4.2)			

Note: *t*-values are based on standard errors allowing for clustering wherever applicable. Estimates use sampling weights wherever applicable.

Sources: German Socio-Economic Panel (GSOEP); German Labour Force Survey – *Mikrozensus* (GLFS); German Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table A3: U.S. and British Unemployment Regressions (Changes in Transformed Age Coefficients with Respect to 1991 – Corresponding t-values in Parentheses)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS, Base 1992)										
16-25		0.01	0.02	0.05	0.05	0.06	0.08	0.06	0.06	0.04
		(0.8)	(1.7)	(3.7)	(3.8)	(4.6)	(5.3)	(4.3)	(3.8)	(2.5)
26-35		-0.02	-0.02	-0.01	-0.02	-0.01	-0.03	-0.03	-0.05	-0.02
		-(1.7)	-(1.7)	-(0.7)	-(1.5)	-(1.2)	-(2.1)	-(2.7)	-(4.0)	-(1.9)
36-45		0.01	0.01	0.00	0.00	0.00	-0.01	-0.02	0.01	-0.01
		(0.5)	(0.6)	-(0.3)	(0.1)	-(0.1)	-(1.0)	-(1.2)	(0.9)	-(0.7)
46-55		0.02	-0.01	-0.05	-0.02	-0.04	-0.01	-0.01	0.00	-0.01
		(1.2)	-(0.5)	-(2.6)	-(1.1)	-(2.1)	-(0.4)	-(0.6)	(0.1)	-(0.4)
56-65		-0.01	0.01	0.02	-0.02	-0.01	-0.02	0.05	0.02	0.04
		-(0.6)	(0.3)	(0.7)	-(0.8)	-(0.5)	-(0.8)	(1.9)	(0.5)	(1.7)
Britain (BLFS; 1993 Base)										
16-25			0.00	0.00	0.02	0.05	0.07	0.06	0.09	
			-(0.4)	-(0.2)	(1.7)	(3.5)	(5.4)	(4.0)	(5.9)	
26-35			0.00	-0.01	0.00	-0.02	-0.01	-0.02	-0.04	
			-(0.4)	-(0.5)	-(0.2)	-(1.5)	-(0.7)	-(1.2)	-(3.2)	
36-45			0.00	0.03	0.02	0.01	0.00	0.01	0.01	
			(0.4)	(2.1)	(1.8)	(0.5)	(0.2)	(1.0)	(0.9)	
46-55			0.00	-0.01	-0.04	-0.02	-0.04	-0.01	-0.01	
			(0.0)	-(0.5)	-(2.4)	-(1.3)	-(2.2)	-(0.5)	-(0.5)	
56-65			0.01	-0.03	-0.02	-0.02	-0.06	-0.09	-0.07	
			(0.6)	-(1.4)	-(0.9)	-(0.9)	-(2.3)	-(3.4)	-(2.6)	
Britain (BHPS)										
16-25	0.02	0.03	-0.05	-0.05	-0.05	0.04	0.07	0.03	0.01	
	(0.3)	(0.5)	-(0.7)	-(0.8)	-(0.7)	(0.5)	(0.9)	(0.4)	(0.1)	
26-35	0.02	-0.07	-0.07	-0.05	-0.04	-0.05	0.01	0.03	0.04	
	(0.5)	-(1.1)	-(1.2)	-(0.7)	-(0.6)	-(0.7)	(0.1)	(0.4)	(0.5)	
36-45	0.05	0.15	0.13	0.09	0.08	0.06	0.04	0.00	0.01	
	(1.0)	(2.4)	(1.9)	(1.3)	(1.1)	(0.9)	(0.4)	(0.0)	(0.2)	
46-55	-0.02	-0.02	-0.01	0.02	0.01	-0.03	-0.15	0.01	0.00	
	-(0.3)	-(0.3)	-(0.1)	(0.3)	(0.1)	-(0.4)	-(1.6)	(0.2)	(0.0)	
56-65	-0.19	-0.22	-0.03	-0.04	-0.01	-0.05	0.02	-0.16	-0.16	
	-(2.2)	-(2.2)	-(0.2)	-(0.4)	-(0.1)	-(0.4)	(0.2)	-(1.2)	-(1.2)	

Note: *t*-values are based on standard errors allowing for clustering wherever applicable. Estimates use sampling weights wherever applicable.

Sources: Current Population Survey – Merged Outgoing Rotation Group Files (CPS); British Labour Force Survey (BLFS); British Household Panel Survey (BHPS); own calculations.

Table A4: German Unemployment Regressions (Changes in Transformed Age Coefficients with Respect to 1991 – Corresponding t-values in Parentheses)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Germany (GSOEP)									
16-25	-0.13	0.19	0.30	0.19	0.29	0.18	0.23	0.27	0.26
	-(1.2)	(1.9)	(2.8)	(1.7)	(2.5)	(1.4)	(2.0)	(2.3)	(2.5)
26-35	0.03	0.06	-0.08	0.03	-0.14	-0.07	-0.15	-0.06	-0.08
	(0.4)	(0.8)	-(0.9)	(0.3)	-(1.5)	-(0.8)	-(1.6)	-(0.6)	-(1.0)
36-45	-0.02	-0.18	-0.12	-0.12	-0.10	-0.04	0.09	-0.03	-0.10
	-(0.2)	-(1.9)	-(1.2)	-(1.2)	-(1.0)	-(0.4)	(0.8)	-(0.3)	-(1.1)
46-55	0.07	0.03	0.13	0.07	0.10	0.00	-0.03	-0.08	0.00
	(0.7)	(0.2)	(1.1)	(0.6)	(0.9)	(0.0)	-(0.3)	-(0.7)	(0.0)
56-65	0.01	-0.09	-0.25	-0.25	-0.06	0.00	-0.13	-0.02	0.03
	(0.1)	-(0.4)	-(1.2)	-(1.2)	-(0.3)	(0.0)	-(0.7)	-(0.1)	(0.2)
Germany (GLFS)									
16-25		0.09		0.07	0.11	0.12			
		(4.7)		(3.6)	(6.1)	(6.6)			
26-35		-0.01		-0.06	-0.06	-0.07			
		-(0.9)		-(4.8)	-(4.8)	-(5.6)			
36-45		-0.01		-0.01	-0.04	-0.03			
		-(0.8)		-(0.5)	-(2.5)	-(2.0)			
46-55		-0.07		0.01	-0.02	-0.02			
		-(4.8)		(0.7)	-(1.1)	-(1.1)			
56-65		0.08		0.04	0.09	0.08			
		(3.4)		(1.7)	(4.2)	(3.5)			
Germany (IABR)									
16-25	0.05	0.06	0.08	0.04	0.06	0.05			
	(3.7)	(4.4)	(5.5)	(2.4)	(3.6)	(2.9)			
26-35	-0.01	0.00	-0.02	-0.05	-0.04	-0.04			
	-(1.2)	(0.4)	-(1.6)	-(4.6)	-(4.0)	-(3.5)			
36-45	-0.02	-0.03	-0.04	-0.01	-0.01	0.02			
	-(1.8)	-(2.9)	-(3.2)	-(1.1)	-(0.7)	(1.8)			
46-55	0.00	-0.02	0.01	0.04	0.03	0.03			
	-(0.1)	-(2.1)	(0.4)	(3.3)	(2.4)	(2.7)			
56-65	-0.03	-0.01	-0.06	0.00	-0.06	-0.17			
	-(2.4)	-(0.9)	-(3.8)	(0.1)	-(3.7)	-(10.2)			

Note: *t*-values are based on standard errors allowing for clustering wherever applicable. Estimates use sampling weights wherever applicable.

Sources: German Socio-Economic Panel (GSOEP); German Labour Force Survey – *Mikrozensus* (GLFS); German Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table A5: U.S. and British Wage Regressions (Changes in Transformed Education Coefficients with Respect to 1991 – Corresponding t-values in Parentheses)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS, Base 1992)										
College		0.00	0.02	0.02	0.02	0.03	0.03	0.05	0.05	0.06
		(1.4)	(4.7)	(6.1)	(5.9)	(6.8)	(8.5)	(11.4)	(12.9)	(14.1)
Some College		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		(0.7)	-(1.1)	(0.0)	(0.5)	-(0.2)	(0.4)	-(0.6)	-(0.3)	(0.8)
High School		0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.03
		-(1.1)	-(0.4)	-(1.9)	-(2.9)	-(3.5)	-(4.4)	-(7.2)	-(7.4)	-(8.8)
High School Dropout		-0.01	-0.02	-0.03	-0.02	-0.02	-0.03	-0.02	-0.03	-0.04
		-(1.2)	-(4.0)	-(4.9)	-(4.3)	-(3.9)	-(5.4)	-(3.8)	-(6.0)	-(7.0)
Britain (BLFS; Base 1993)										
Degree			0.01	-0.01	0.02	0.01	0.01	0.01	0.01	
			(0.9)	-(0.9)	(2.2)	(0.6)	(1.4)	(0.9)	(1.4)	
Higher - No Degree			0.00	-0.01	0.00	-0.01	-0.02	-0.01	-0.02	
			-(0.3)	-(1.0)	(0.1)	-(0.9)	-(1.7)	-(1.5)	-(2.2)	
High School (A-level)			0.00	0.00	0.00	0.02	0.02	0.02	0.02	
			(0.1)	-(0.1)	-(0.4)	(3.0)	(2.8)	(2.5)	(2.4)	
O-level equivalent			0.00	0.00	-0.01	-0.01	-0.02	-0.02	-0.02	
			(0.0)	(0.6)	-(1.1)	-(1.7)	-(2.2)	-(3.0)	-(2.8)	
Below O-level equivalent			0.00	0.00	0.00	-0.01	0.00	0.00	0.00	
			-(0.5)	(0.7)	-(0.2)	-(1.2)	-(0.8)	(0.3)	(0.3)	
Britain (BHPS)										
Degree	0.04	0.06	0.01	0.01	0.04	0.03	0.01	0.03	0.03	
	(1.8)	(2.6)	(0.5)	(0.5)	(1.4)	(1.2)	(0.5)	(1.2)	(1.3)	
Higher - No Degree	-0.05	0.00	-0.05	-0.04	-0.07	-0.06	-0.05	-0.09	-0.04	
	-(2.0)	(0.1)	-(1.5)	-(1.2)	-(2.3)	-(1.8)	-(1.7)	-(2.5)	-(1.1)	
High School (A-level)	0.00	0.00	0.00	-0.02	-0.01	-0.03	-0.03	-0.03	-0.03	
	(0.2)	(0.2)	-(0.1)	-(1.3)	-(1.0)	-(2.0)	-(2.0)	-(1.8)	-(2.0)	
O-level equivalent	0.01	-0.01	0.02	0.01	0.03	0.01	0.01	0.02	-0.01	
	(0.5)	-(0.5)	(1.3)	(1.0)	(1.7)	(0.4)	(0.7)	(1.5)	-(0.6)	
Below O-level equivalent	-0.01	-0.01	-0.01	0.01	0.00	0.02	0.02	0.01	0.03	
	-(0.7)	-(1.2)	-(0.5)	(0.6)	-(0.2)	(1.4)	(1.5)	(0.8)	(1.9)	

Note: *t*-values are based on standard errors allowing for clustering wherever applicable. Estimates use sampling weights wherever applicable.

Sources: Current Population Survey – Merged Outgoing Rotation Group Files (CPS); British Labour Force Survey (BLFS); British Household Panel Survey (BHPS); own calculations.

Table A6: German Wage Regressions (Changes in Transformed Education Coefficients with Respect to 1991 – Corresponding t-values in Parentheses)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Germany (GSOEP)									
Degree	0.00	0.01	-0.02	-0.06	-0.05	-0.10	-0.12	-0.06	-0.07
	-(0.1)	(0.2)	-(0.7)	-(1.6)	-(1.6)	-(3.4)	-(3.3)	-(1.4)	-(1.5)
Higher - No Degree	-0.01	0.04	-0.02	0.03	-0.04	-0.03	-0.03	-0.03	0.06
	-(0.4)	(1.2)	-(0.4)	(0.7)	-(0.9)	-(0.6)	-(0.8)	-(0.6)	(1.6)
High School - Abitur	0.04	0.07	0.10	0.14	0.03	0.06	0.00	-0.02	-0.01
	(0.6)	(1.3)	(1.6)	(2.5)	(0.4)	(0.8)	(0.0)	-(0.2)	-(0.2)
Apprenticeship	0.00	0.01	0.00	0.02	0.03	0.01	0.03	0.03	0.04
	-(0.7)	(1.0)	(0.0)	(2.1)	(3.6)	(1.6)	(2.9)	(2.8)	(3.5)
Below Apprenticeship	0.01	-0.05	0.00	-0.05	-0.05	0.02	-0.01	-0.04	-0.08
	(0.8)	-(2.4)	(0.2)	-(2.0)	-(2.4)	(0.8)	-(0.3)	-(1.4)	-(2.8)
Germany (GLFS)									
Higher		-0.04		-0.02	-0.04	-0.05			
		-(9.9)		-(6.5)	-(9.3)	-(12.3)			
Meister		0.00		-0.01	-0.02	-0.03			
		(0.4)		-(1.5)	-(4.1)	-(5.1)			
High School		-0.01		0.02	0.04	0.04			
		-(1.6)		(4.1)	(6.7)	(6.7)			
Apprenticeship		0.02		0.00	0.00	0.00			
		(13.6)		-(0.5)	-(0.3)	(0.0)			
Below Apprenticeship		-0.03		0.01	0.02	0.03			
		-(7.7)		(3.9)	(6.0)	(8.1)			
Germany (IABR)									
Degree	0.02	0.01	0.01	0.02	0.02	0.01			
	(3.8)	(3.7)	(3.5)	(5.6)	(2.6)	(1.5)			
High School and Apprenticeship	0.02	0.02	0.02	0.02	0.03	0.03			
	(3.1)	(4.2)	(3.7)	(3.1)	(4.2)	(4.3)			
High School (Abitur)	0.02	0.02	0.02	0.04	0.07	-0.01			
	(1.4)	(1.1)	(0.9)	(2.3)	(3.4)	-(0.4)			
Apprenticeship	0.00	0.00	0.01	0.01	0.01	0.01			
	(3.0)	(4.9)	(6.6)	(7.3)	(8.6)	(10.7)			
Below Apprenticeship	-0.01	-0.02	-0.02	-0.03	-0.03	-0.03			
	-(6.8)	-(8.8)	-(10.4)	-(12.4)	-(13.1)	-(13.2)			

Note: *t*-values are based on standard errors allowing for clustering wherever applicable. Estimates use sampling weights wherever applicable.

Sources: German Socio-Economic Panel (GSOEP); German Labour Force Survey – *Mikrozensus* (GLFS); German Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table A7: U.S. and British Unemployment Regressions (Changes in Transformed Education Coefficients with Respect to 1991 – Corresponding t-values in Parentheses)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS, Base 1992)										
College Degree		0.01	0.04	0.05	0.03	0.03	0.07	0.08	0.06	0.10
		(0.9)	(2.6)	(3.2)	(2.0)	(1.7)	(4.1)	(5.1)	(3.5)	(6.2)
Some College		0.01	-0.01	-0.03	-0.03	-0.02	-0.04	-0.01	-0.03	-0.02
		(1.1)	-(1.2)	-(2.4)	-(2.0)	-(1.3)	-(2.9)	-(1.0)	-(2.2)	-(1.8)
High School		-0.01	-0.01	-0.01	0.00	-0.01	-0.01	-0.02	0.00	-0.03
		-(1.1)	-(1.2)	-(1.2)	(0.0)	-(0.7)	-(0.6)	-(2.4)	-(0.3)	-(2.8)
High School Dropout		-0.02	-0.01	0.00	0.00	0.00	-0.02	-0.05	-0.04	-0.05
		-(1.4)	-(0.6)	(0.2)	-(0.2)	(0.1)	-(1.5)	-(3.0)	-(2.1)	-(3.0)
Britain (BLFS; 1993 Base)										
Degree			0.01	0.02	0.05	0.03	0.06	0.03	0.02	
			(0.5)	(1.0)	(2.2)	(1.6)	(2.7)	(1.5)	(1.1)	
Higher - No Degree			0.01	0.05	0.04	0.02	0.00	0.03	0.06	
			(0.4)	(1.7)	(1.3)	(0.7)	(0.0)	(1.1)	(1.9)	
High School (A-level)			-0.01	-0.01	-0.05	-0.05	-0.07	-0.07	-0.07	
			-(1.2)	-(1.0)	-(3.5)	-(3.8)	-(4.7)	-(4.7)	-(4.7)	
O-level equivalent			-0.01	0.01	0.02	0.02	0.02	0.03	0.03	
			-(0.6)	(0.4)	(1.6)	(1.1)	(1.2)	(2.1)	(2.1)	
Below O-level equivalent			0.01	-0.01	-0.01	0.01	0.01	0.01	0.01	
			(0.9)	-(1.4)	-(0.6)	(0.9)	(1.3)	(0.8)	(0.5)	
Britain (BHPS)										
Degree	0.11	0.06	0.14	0.29	0.24	0.33	0.16	0.19	-0.01	
	(1.0)	(0.5)	(1.1)	(2.4)	(2.0)	(2.7)	(1.2)	(1.4)	-(0.1)	
Higher - No Degree	-0.07	0.11	0.07	0.11	-0.33	0.13	0.37	-0.03	0.21	
	-(0.4)	(0.7)	(0.4)	(0.6)	-(1.7)	(0.7)	(2.0)	-(0.1)	(1.2)	
High School (A-level)	-0.05	-0.10	0.03	-0.09	0.00	-0.01	-0.04	-0.04	-0.02	
	-(0.8)	-(1.6)	(0.5)	-(1.3)	(0.0)	-(0.1)	-(0.6)	-(0.6)	-(0.3)	
O-level equivalent	-0.04	-0.02	-0.10	0.05	0.03	-0.05	-0.07	-0.01	-0.08	
	-(0.7)	-(0.4)	-(1.6)	(0.8)	(0.4)	-(0.8)	-(0.9)	-(0.1)	-(1.0)	
Below O-level equivalent	0.04	0.05	0.00	-0.07	-0.02	-0.07	-0.04	-0.01	0.03	
	(1.1)	(1.1)	-(0.1)	-(1.4)	-(0.4)	-(1.4)	-(0.6)	-(0.2)	(0.5)	

Note: *t*-values are based on standard errors allowing for clustering wherever applicable. Estimates use sampling weights wherever applicable.

Sources: Current Population Survey – Merged Outgoing Rotation Group Files (CPS); British Labour Force Survey (BLFS); British Household Panel Survey (BHPS); own calculations.

Table A8: German Unemployment Regressions (Changes in Transformed Education Coefficients with Respect to 1991 – Corresponding t-values in Parentheses)

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Germany (GSOEP)									
Degree	-0.24	-0.24	-0.07	-0.08	0.10	-0.34	-0.08	-0.29	-0.09
	-(1.2)	-(1.4)	-(0.4)	-(0.5)	(0.6)	-(2.0)	-(0.5)	-(1.6)	-(0.6)
Higher - No Degree	-0.52	-0.70	-0.39	-0.47	-0.19	-0.04	-0.46	-0.52	-0.16
	-(2.3)	-(3.4)	-(1.9)	-(2.3)	-(0.8)	-(0.2)	-(2.2)	-(2.5)	-(0.9)
High School - Abitur	0.17	0.11	-0.22	0.18	0.08	-0.05	0.08	0.10	0.09
	(0.9)	(0.5)	-(0.8)	(0.7)	(0.3)	-(0.2)	(0.3)	(0.4)	(0.4)
Apprenticeship	0.11	0.14	0.12	0.07	0.02	0.10	0.07	0.07	-0.01
	(2.4)	(3.1)	(2.7)	(1.6)	(0.4)	(2.0)	(1.4)	(1.5)	-(0.1)
Below Apprenticeship	-0.03	-0.04	-0.14	-0.03	-0.05	-0.06	-0.02	0.10	0.09
	-(0.3)	-(0.5)	-(1.5)	-(0.3)	-(0.5)	-(0.6)	-(0.2)	(1.0)	(1.1)
Germany (GLFS)									
Higher		-0.06		-0.07	-0.12	-0.16			
		-(2.6)		-(2.8)	-(5.2)	-(6.8)			
Meister		-0.06		-0.03	-0.06	-0.09			
		-(1.9)		-(0.8)	-(2.1)	-(2.8)			
High School		-0.07		-0.07	-0.16	-0.13			
		-(2.1)		-(2.3)	-(5.0)	-(4.2)			
Apprenticeship		0.03		0.02	0.04	0.05			
		(3.4)		(2.3)	(5.6)	(6.7)			
Below Apprenticeship		0.01		0.03	0.04	0.04			
		(0.9)		(1.8)	(2.5)	(2.8)			
Germany (IABR)									
Degree	-0.04	-0.13	-0.12	-0.11	-0.08	-0.11			
	-(1.4)	-(4.9)	-(4.6)	-(4.1)	-(3.1)	-(4.1)			
High School and Apprenticeship	-0.09	-0.13	-0.13	-0.18	-0.17	-0.18			
	-(2.2)	-(3.1)	-(3.2)	-(4.2)	-(4.1)	-(4.3)			
High School (Abitur)	-0.01	0.00	-0.02	-0.09	-0.07	-0.08			
	-(0.2)	(0.0)	-(0.3)	-(1.5)	-(1.1)	-(1.4)			
Apprenticeship	0.00	0.00	-0.01	-0.01	-0.01	-0.01			
	(0.5)	(0.7)	-(1.7)	-(1.3)	-(2.4)	-(2.5)			
Below Apprenticeship	0.01	0.04	0.06	0.06	0.07	0.08			
	(1.4)	(3.9)	(6.4)	(6.5)	(6.8)	(7.8)			

Note: *t*-values are based on standard errors allowing for clustering wherever applicable. Estimates use sampling weights wherever applicable.

Sources: German Socio-Economic Panel (GSOEP); German Labour Force Survey – *Mikrozensus* (GLFS); German Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Appendix B

Table B1: Numbers of Observations

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS)											
Wage Regression	166,640	164,571	161,685	147,040	134,019	105,589	107,365	106,798	103,098	101,048	105,440
Unempl. Regression	214,970	212,232	208,411	202,498	200,246	177,983	180,462	181,377	182,691	183,530	196,172
Non-Empl. Regression	283,576	278,606	274,198	266,401	263,147	232,780	235,372	235,549	237,754	238,950	255,548
Britain (BLFS)											
Wage Regression			33,441	33,924	35,809	35,485	63,367	69,952	67,058	64,366	
Unempl. Regression			283,381	279,782	282,896	274,108	260,728	262,232	258,136	253,360	
Non-Empl. Regression			362,679	357,707	362,278	350,368	332,907	334,519	327,482	321,094	
Britain (BHPS)											
Wage Regression	4,355	4,085	3,922	3,971	3,975	4,132	4,254	4,230	4,140	3,974	
Unempl. Regression	6,184	5,714	5,458	5,455	5,296	5,506	5,520	5,408	5,309	5,076	
Non-Empl. Regression	8,056	7,598	7,269	7,225	7,036	7,314	7,289	7,005	6,866	6,553	
Germany (GSOEP)											
Wage Regression	3,969	3,852	3,877	3,747	4,007	3,898	3,789	3,949	4,100	7,258	
Unempl. Regression	5,527	5,360	5,378	5,119	5,423	5,311	5,159	5,588	5,560	10,156	
Non-Empl. Regression	7,567	7,462	7,393	7,215	7,633	7,335	7,126	7,723	7,559	14,013	
Germany (GLFS)											
Wage Regression	131,886		125,004		132,817	131,079	131,566				
Unempl. Regression	170,067		169,734		176,098	171,658	174,587				
Non-Empl. Regression	239,101		235,371		244,291	240,106	242,695				
Germany (IABR)											
Wage Regression	156,049	157,493	154,606	148,811	147,495	143,780	140,906				
Unempl. Regression	205,424	209,560	210,288	207,097	205,829	203,028	200,607				

Note: Changes between 1995 and 1996 in the CPS are explained by the changes in the imputation flags (*cf.* Hirsch and Schumacher, 2002). The large increase in the number of wage observations in the BLFS between 1996 and 1997 is explained by the fact that respondents were asked about their wage only in the 1st quarter of interview up to 1996, but also in the 5th quarter since 1997.

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 Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table B2: Unemployment Rates by Age

Variable	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS)											
Whole sample	6.8	7.5	7.0	6.1	5.6	5.3	4.9	4.5	4.1	3.9	4.6
16-25	12.6	13.3	12.8	11.6	11.3	11.1	10.6	9.9	9.1	8.6	9.6
26-35	6.7	7.3	6.7	5.7	5.2	4.9	4.5	4.0	3.7	3.3	4.3
36-45	4.9	5.6	5.4	4.6	4.0	4.0	3.6	3.2	3.0	3.0	3.5
46-55	4.6	5.3	5.1	4.0	3.3	3.3	2.9	2.7	2.5	2.4	2.9
56-65	4.0	5.3	4.7	4.1	3.7	3.3	3.0	2.5	2.8	2.4	3.1
Britain (BLFS)											
Whole sample			10.4	9.6	8.7	8.1	7.0	6.3	6.0	5.5	
16-25			17.9	16.6	15.4	15.0	13.7	13.0	12.3	11.9	
26-35			10.0	9.2	8.4	7.9	6.5	5.9	5.6	4.8	
36-45			7.6	7.0	6.7	6.2	5.0	4.4	4.4	3.9	
46-55			7.5	6.9	6.1	5.3	4.6	4.0	4.0	3.6	
56-65			9.2	8.6	7.0	6.6	5.7	4.6	4.2	3.9	
Britain (BHPS)											
Whole sample	8.7	9.4	9.0	8.5	6.4	6.5	5.3	4.6	4.2	4.6	
16-25	16.1	17.7	17.8	16.0	12.8	13.2	12.1	11.2	10.0	10.6	
26-35	7.2	8.4	6.9	6.6	5.1	5.2	4.3	4.0	4.0	4.3	
36-45	4.8	6.1	7.1	6.6	4.4	4.2	3.3	2.5	2.2	2.6	
46-55	7.1	7.4	7.0	6.9	5.3	5.1	3.7	2.4	3.3	3.8	
56-65	10.8	8.8	8.1	10.5	7.5	8.2	6.0	6.0	3.8	4.5	
Germany (GSOEP)											
Whole sample	3.6	3.7	5.1	5.4	5.9	5.6	6.7	6.8	5.4	4.5	
16-25	5.1	4.3	9.6	12.0	11.1	12.8	13.2	14.2	13.3	11.6	
26-35	4.1	4.6	6.4	5.3	7.0	5.1	7.1	6.0	5.3	4.4	
36-45	3.5	3.6	3.2	4.1	4.5	4.7	6.2	7.9	4.7	3.5	
46-55	2.3	3.0	3.7	4.9	4.6	4.8	4.7	4.6	3.3	2.9	
56-65	2.0	2.2	2.5	1.8	2.1	3.0	4.1	3.3	3.1	2.6	
Germany (GLFS)											
Whole sample	3.2		5.3		5.8	6.4	7.1				
16-25	2.8		5.6		6.0	7.2	8.3				
26-35	3.4		5.4		5.4	5.9	6.5				
36-45	2.8		4.6		5.1	5.3	6.0				
46-55	3.1		4.4		5.7	5.9	6.6				
56-65	4.5		8.5		8.6	10.3	10.9				
Germany (IABR)											
Whole sample	4.7	5.3	7.2	8.6	8.5	9.4	9.7				
16-25	3.1	3.9	5.6	7.1	6.3	7.4	7.8				
26-35	4.6	5.0	6.9	8.0	7.2	8.1	8.6				
36-45	3.8	4.1	5.4	6.4	6.4	7.2	8.1				
46-55	4.0	4.4	5.8	7.4	7.4	8.1	8.6				
56-65	15.5	16.2	20.6	22.1	23.1	22.9	20.5				

Note: The comparatively high youth unemployment rates in the GSOEP (when compared to GLFS and IABR) are explained by the lack of an 'active search' question in the GSOEP up to 1995 (although desire to work again and readiness to start work immediately are asked for all through the years). Using the 'search' question in 1996, for example, reduces the youth unemployment rate in the GSOEP from 12.8 to 8.9 percent. However, in oder to obtain a consistent definition over time, I have not used this variable for the years 1996 onward. Sampling weights are used wherever applicable.

Sources: CPS-MORG; BLFS; BHPS; GSOEP; GLFS; IABR; see also Table B1; own calculations.

Table B3: Non-Employment Rates by Age

Variable	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS)											
Whole sample	29.4	29.6	29.3	28.5	28.1	27.7	27.1	26.6	26.5	26.5	27.3
16-25	40.7	41.2	40.8	40.2	39.8	40.4	40.3	39.0	39.2	38.4	40.4
26-35	22.0	22.1	22.0	21.4	20.6	20.0	19.5	18.8	18.5	18.3	19.5
36-45	18.6	19.5	19.5	19.0	18.7	18.6	17.9	18.0	17.6	17.7	18.3
46-55	24.0	24.1	23.7	22.6	22.5	21.6	20.8	20.5	20.5	20.5	20.9
56-65	50.9	51.2	50.7	50.0	49.6	48.8	47.6	47.0	46.6	46.5	45.4
Britain (BLFS)											
Whole sample			29.8	29.1	28.4	27.8	26.9	26.3	25.6	25.1	
16-25			41.0	40.1	39.1	38.1	37.2	36.9	36.5	36.5	
26-35			25.7	24.7	24.0	23.5	21.9	21.2	20.1	19.5	
36-45			20.8	21.0	20.6	20.3	19.6	18.8	18.5	17.8	
46-55			25.2	24.5	24.0	23.3	23.0	22.9	22.4	22.0	
56-65			42.7	42.2	41.9	41.7	41.3	40.5	39.7	38.6	
Britain (BHPS)											
Whole sample	30.3	32.0	32.1	31.8	30.2	30.5	29.2	27.3	27.3	27.3	
16-25	36.3	41.4	41.8	41.7	41.0	40.9	38.9	33.7	33.7	35.0	
26-35	23.9	24.3	23.9	22.5	21.3	21.9	19.5	18.8	18.1	17.3	
36-45	17.5	20.0	21.5	20.3	18.7	17.1	16.4	16.2	15.1	16.6	
46-55	23.5	24.1	22.6	23.9	23.8	24.4	24.2	21.9	22.1	23.0	
56-65	56.6	58.0	59.4	60.7	56.4	59.1	58.2	56.6	57.0	54.2	
Germany (GSOEP)											
Whole sample	30.6	31.7	31.8	34.2	33.9	32.3	32.5	33.0	31.0	30.7	
16-25	33.7	35.5	38.3	43.9	42.9	40.4	38.8	41.3	38.2	35.7	
26-35	21.8	23.8	24.5	24.9	24.6	23.3	24.6	25.7	23.0	23.0	
36-45	20.5	19.4	17.6	20.9	21.8	19.3	20.7	19.7	16.2	16.8	
46-55	21.0	24.4	26.7	29.0	27.4	26.5	24.0	23.6	22.7	20.0	
56-65	62.5	63.3	60.2	60.8	61.1	60.8	64.0	63.3	61.0	62.9	
Germany (GLFS)											
Whole sample	31.1		31.7		32.1	33.1	33.2				
16-25	29.1		29.8		31.3	33.8	34.3				
26-35	23.0		24.2		23.9	25.7	25.5				
36-45	19.0		19.4		19.8	20.4	20.6				
46-55	25.4		25.2		25.5	25.5	25.3				
56-65	65.1		65.1		65.0	64.9	64.4				

Note: The differerence in the non-employment rates for young people in the German GSOEP and GLFS data sets stems from the fact that certain groups like conscripts or mothers on maternity leave cannot be treated consistently over time in the same way across these two data sets. Sampling weights are used wherever applicable.

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 Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table B4: Unemployment Rates by Education

Variable	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS)											
Whole sample	6.8	7.5	7.0	6.1	5.6	5.3	4.9	4.5	4.1	3.9	4.6
College Degree	3.0	3.3	3.2	2.8	2.5	2.3	2.0	2.0	1.9	1.7	2.4
Some College	5.8	6.3	6.1	5.0	4.4	4.2	3.9	3.4	3.4	3.0	3.8
High School	6.9	8.2	7.7	6.6	6.0	5.9	5.4	5.0	4.5	4.4	5.1
High School Dropout	14.1	15.6	14.8	13.6	13.2	12.6	12.0	10.9	9.9	9.6	10.9
Britain (BLFS)											
Whole sample			10.4	9.6	8.7	8.1	7.0	6.3	6.0	5.5	
Degree			5.4	5.1	4.8	4.7	3.8	3.5	3.2	2.8	
Higher - No Degree			4.7	4.5	4.5	4.0	3.3	2.8	2.9	2.8	
High School (A-level)			9.1	8.2	7.5	6.5	5.5	4.8	4.6	4.2	
O-level equivalent			10.2	9.3	8.7	8.6	7.4	6.8	6.7	6.3	
Below O-level equivalent			14.7	13.9	12.4	11.9	10.7	9.8	9.4	8.7	
Britain (BHPS)											
Whole sample	8.7	9.4	9.0	8.5	6.4	6.5	5.3	4.6	4.2	4.6	
Degree	3.8	5.4	5.4	5.3	5.1	4.7	4.7	3.0	3.1	2.3	
Higher - No Degree	3.4	3.5	4.5	4.0	3.3	1.2	3.1	4.2	1.8	3.7	
High School (A-level)	6.4	6.9	6.0	7.1	4.1	4.8	4.1	3.4	3.0	3.4	
O-level equivalent	7.8	7.9	7.8	6.4	6.8	6.1	4.7	4.0	4.1	4.1	
Below O-level equivalent	13.5	15.0	14.9	13.9	10.0	11.0	8.4	8.2	7.9	9.5	
Germany (GSOEP)											
Whole sample	3.6	3.7	5.1	5.4	5.9	5.6	6.7	6.8	5.4	4.5	
Degree	3.3	2.1	2.7	4.2	4.6	5.9	3.0	5.5	2.5	3.4	
Higher - No Degree	4.5	1.5	1.3	2.7	2.7	4.5	7.3	3.3	2.1	3.8	
High School - Abitur	5.0	6.8	9.7	5.4	11.1	9.8	8.8	11.7	10.0	8.9	
Apprenticeship	2.6	3.5	4.9	5.3	5.1	4.2	6.2	6.0	4.3	3.1	
Below Apprenticeship	5.8	5.7	7.9	7.9	9.3	9.5	10.2	10.7	11.3	10.2	
Germany (GLFS)											
Whole sample	3.2		5.3		5.8	6.4	7.1				
Degree	2.2		3.3		3.8	3.7	3.9				
Meister	1.8		2.9		3.5	3.7	4.0				
High School	3.2		4.7		5.0	4.5	5.5				
Apprenticeship	2.8		4.9		5.4	6.2	7.1				
Below Apprenticeship	5.6		9.3		10.5	11.4	12.8				
Germany (IABR)											
Whole sample	4.7	5.3	7.2	8.6	8.5	9.4	9.7				
Degree	2.9	3.0	3.5	4.5	4.5	5.4	5.5				
High School and Apprenticeship	3.3	3.0	3.8	4.7	4.1	4.7	5.0				
High School (Abitur)	3.1	3.5	4.9	5.9	4.8	5.7	5.9				
Apprenticeship	4.0	4.5	6.3	7.5	7.5	8.2	8.5				
Below Apprenticeship	7.0	8.1	11.2	13.7	13.5	14.8	15.4				

Note: Sampling weights are used wherever applicable.

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 Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.

Table B5: Non-Employment Rates by Education

Variable	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
U.S. (CPS)											
Whole sample	29.4	29.6	29.3	28.5	28.1	27.7	27.1	26.6	26.5	26.5	27.3
College Degree	14.7	14.9	14.8	14.5	14.5	14.5	14.2	14.4	14.9	15.1	15.9
Some College	25.0	24.6	24.4	23.2	22.7	22.6	22.4	21.7	22.1	22.1	22.9
High School	27.6	29.4	29.4	28.7	28.3	27.6	27.0	27.0	26.8	27.0	27.7
High School Dropout	51.9	53.7	53.8	53.4	52.9	52.5	51.3	50.0	49.8	49.2	51.2
Britain (BLFS)											
Whole sample			29.8	29.1	28.4	27.8	26.9	26.3	25.6	25.1	
Degree			14.7	13.8	13.6	13.5	12.8	12.9	12.5	11.8	
Higher - No Degree			17.0	16.5	16.7	16.3	15.1	15.0	14.5	14.4	
High School (A-level)			24.9	24.6	24.1	22.9	22.3	21.8	21.1	20.7	
O-level equivalent			29.1	28.0	27.5	26.8	25.9	24.9	24.8	24.7	
Below O-level equivalent			39.9	39.9	39.1	39.3	38.9	38.7	38.6	38.5	
Britain (BHPS)											
Whole sample	30.3	32.0	32.1	31.8	30.2	30.5	29.2	27.3	27.3	27.3	
Degree	13.3	15.7	15.3	17.1	14.6	17.2	15.7	14.3	15.2	14.6	
Higher - No Degree	22.6	26.3	25.9	26.0	25.6	24.3	24.7	24.8	24.6	26.9	
High School (A-level)	21.7	24.4	24.7	25.2	24.2	23.8	22.1	19.0	19.3	19.9	
O-level equivalent	27.2	28.3	30.0	29.1	29.8	30.2	28.4	27.2	27.1	27.9	
Below O-level equivalent	41.9	44.2	44.5	44.2	42.1	43.2	43.6	43.8	44.1	44.8	
Germany (GSOEP)											
Whole sample	30.6	31.7	31.8	34.2	33.9	32.3	32.5	33.0	31.0	30.7	
Degree	16.0	14.6	14.8	15.4	15.0	15.0	13.3	15.1	11.9	14.7	
Higher - No Degree	22.4	23.4	19.0	23.5	24.8	24.2	24.9	25.0	20.4	22.4	
High School - Abitur	49.5	48.5	49.5	45.6	43.8	43.2	39.3	45.6	43.7	45.2	
Apprenticeship	26.9	27.5	28.4	30.2	30.4	29.1	30.6	30.7	28.8	29.5	
Below Apprenticeship	43.0	46.5	46.2	51.2	50.4	48.6	46.7	47.2	46.7	45.8	
Germany (GLFS)											
Whole sample	31.1		31.7		32.1	33.1	33.2				
Degree	15.0		15.3		15.8	16.5	16.8				
Meister	16.0		16.1		16.9	18.7	19.3				
High School	49.6		50.0		46.0	44.1	42.6				
Apprenticeship	26.0		27.4		28.6	29.8	30.9				
No Prof Training	47.0		47.1		49.3	49.6	50.1				

Note: Sampling weights are used wherever applicable.

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 Adminsitrative Data – *Institut für Arbeitsmarkt und Berufsforschung Regionalstichprobe* (IABR); own calculations.