The European Journal of Comparative Economics
Vol. 8, n. 2, pp. 235-263
ISSN 1824-2979

Supply and Demand Factors in Understanding the Educational Earnings Differentials: West Germany and the United States

Gulgun Bayaz Ozturk[1]

Abstract

This paper uses data from the March Current Population Survey and German Socio-Economic Panel to investigate the role of market forces and the institutional constraints in explaining the educational earnings differentials in the United States and West Germany. We make use of simple supply and demand framework to differentiate the effects of market forces from wage-setting institutions. Results indicate that differential growth in the relative employment of skilled workers is responsible for the differences in returns to skill in both countries over the period of analysis. In particular, rising educational attainment is the major factor underlying the changes in the employment of skilled workers in each country and it is followed by institutional factors. However, in addition to the differential growth in relative demand for skilled labor, differences in wage-setting institutions explain most of the cross-country differences in skill premia. We also provide evidence for polarization of jobs which is a recent phenomenon in both labor markets.

JEL classifications: J24, J30, J31

Keywords: earnings differentials, relative demand and supply of skills, skill premium, polarization.

1. Introduction

There is a vast literature that has documented the trends and differences in earnings inequality in the United States and the European countries. Widespread consensus indicates that the United States and the United Kingdom stood out from rest of the developed countries because of significant widening in their wage distributions during 1980s. There have been many studies that tried to explain the wage differentials across countries and some of those held institutional constraints responsible. They tried to show that those countries with slow growth in wage inequality were usually the ones with more centralized wage setting institutions.

In this paper, we try to explain the earnings differentials of two countries, the United States and West Germany during 1980s and 1990s, by focusing on educational earnings differentials. Since the evolution of wages and inequality are substantially different in West and East Germany, we restrict our analysis to West Germany (Gernandt and Pfeiffer, 2007). Our goal is to understand the importance of institutional factors and the market forces in explaining the earnings differentials across the two countries in the 1980s and how they have changed in the following decade. An advantage of this pair wise comparison is less compromise on data quality compared to studies that analyze many countries.

[1] School of Public Health, Hunter College, City University of New York; United States; correspondence address: gulgun.bayazozturk@hunter.cuny.edu

This study improves upon the existing literature by examining the trends in the 1990s and early 2000s which is a period shaped by major policy changes (i.e., trends towards decentralization in German labor markets). Further, it uses a different skill grouping to achieve better comparison between the two countries. Since the way skill groupings are formed might disguise the recent phenomenon of job polarization, we run an additional test to investigate whether our sample reproduces evidence that is consistent with the recent literature or not.

The paper is organized as follows. The next section reviews the literature. Section 3 analyzes the trends in earnings inequality in both countries. Section 4 uses data from the March CPS files and the German Socio-Economic Panel (GSOEP) along with Cross National Equivalent Files (CNEF) and implements the relative demand and supply framework to investigate the sources of earnings differentials between the two countries. Section 5 provides evidence for a recent phenomenon in the labor markets; i.e. polarization of work in both countries. And the last section concludes.

2. Literature Review

From the late 1960s to the beginning of 1980s, most of the OECD nations including the United States and West Germany experienced rapidly declining educational wage differentials. The primary reason underlying this common pattern among countries was the rapid increase in supply of college graduates despite the shifts in demand favoring highly educated workers. However, experience of the United States diverged from that of other OECD nations in the 1980s. Rapidly increasing educational attainment in most OECD countries muted changes in their wage structures. On the other hand, slower growth in the supply of highly educated workers in the United States, combined with shifts in relative demand favoring skilled workers, resulted in rising wage differentials by skill and, hence increasing overall inequality (Freeman and Katz, 1994). A survey by Levy and Murnane (1992) concluded that the shifts in demand and supply provide the major explanation for the wage dispersion between skill groups.

Most of the developed nations operate in similar economic environment. They adopt similar technologies in their production processes that lead to comparable industry and occupation mixes. That's why, shifts in relative demand for skilled workers will not radically differ among these countries. Most economists argue that relative demand shifts occurred due to *skill-biased technological change*. In other words, a change in the production process led to increasing marginal product of skilled workers relative to the unskilled workers, which resulted in increased relative employment of highly educated workers in most sectors of the economy (Katz and Murphy 1992). However, starting with the beginning of 1990s, the implied monotonic changes in skill demand were replaced with non-monotonic rises in skill demand. Research showed that this new pattern is due to the emergence of job polarization in the labor market and so required a *nuanced version of skill-biased technological change* (Autor, Katz and Kearney 2008, Spitz-Oener 2006, Dustmann, Ludsteck and Schönberg, 2007)

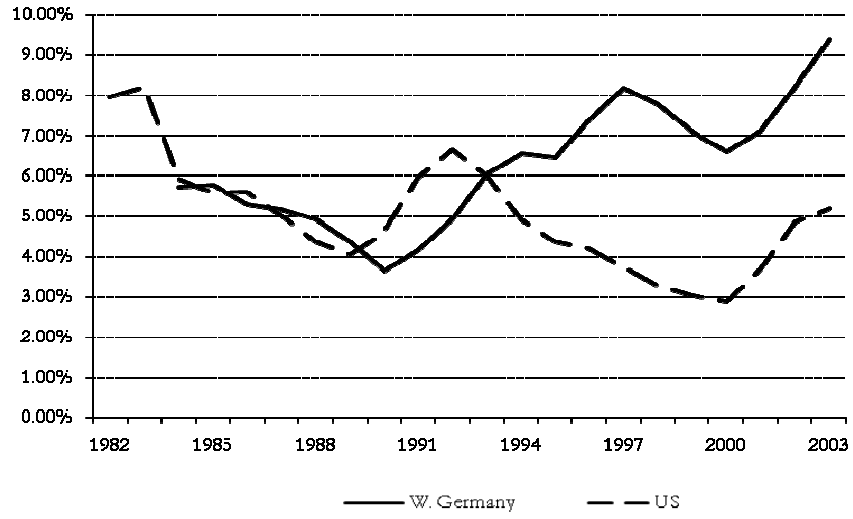
Given that developed nations faced similar relative demand shifts, economists have come up with two major answers to explain the cross-national wage differentials. The first one is a market-based explanation which emphasized the importance of market forces (in particular, rising relative skill supplies) underlying the small increases in overall

earnings inequality in the European countries. And the second one was the role of institutional constraints and its effects on wage determination. Studies showed that countries with centralized labor market institutions (Sweden, France, Germany, the Netherlands) experienced smaller increases in overall inequality, while the countries with decentralized labor markets experienced larger increases (United States, United Kingdom). This led to the hypothesis that institutional factors were responsible for the relatively small increases in the overall inequality in most of the European countries (Freeman and Katz 1994, Katz et al. 1995, Gottschalk and Joyce, 1998, Acemoglu 2003).

Krugman (1994) argues that "in a strong welfare state the increase in underlying pressures toward inequality may not be clearly visible in the actual distribution of earned wages, since those workers whose relative wages would have fallen the most are instead priced out of the labor market" (Krugman, 1994, p. 31) Hence, increasing inequality in the United States and rising structural unemployment rates in the European countries are the "*two sides of the same coin*" that occurred as a result of technological change favoring skilled workers (see Figure 1 for the evolution of unemployment rates in both countries).

Since then there have been several attempts both to understand the role of labor market institutions in explaining the international differences in wage inequality and to test the Krugman hypothesis. The empirical evidence is sparse. Some economists emphasized the importance of market forces without abandoning the impact of institutional constraints in determining wages (Gottschalk and Joyce 1998). Others suggested that wage-setting institutions were an important determinant of cross-national differences in wage distributions (Blau and Kahn 1996, Dinardo, Fortin and Lemiuex 1996, Dinardo and Lemieux 1997). However, despite recognizing the role of institutional constraints and their impact on wage structures, some economists showed that Krugman hypothesis did not hold (Card, Kramarz and Lemieux 1999 and Nickel and Layard 1999).

Figure 1 Evolution of Unemployment Rates



Source: OECD, unemployment rates of prime age males.

Most of the existing research studied the wage structures in the 1980s and before. And also, they focused on many countries with a few years of data points. Hence, in order to achieve comparability across countries, they had to compromise on data quality. In this study, we investigate the relative importance of market forces and institutional factors to explain the educational earnings differentials in the United States and West Germany during the 1980s and 1990s. We use the simple supply and demand framework described by Katz and Murphy (1992) and Acemoglu (2003) to differentiate the influence of institutional factors on the changes in relative wages of skilled workers.

3. Trends in Overall Inequality

Table 1 summarizes overall inequality in each country using three different measures. The first two panels for each country document the coefficient of variation and Gini coefficient of the distribution of earnings. We adjust earnings in the United States using CPI-UX1 inflation index. In West Germany, earnings are adjusted using CPI obtained from the CNEF.[2] Moreover both data sets are weighted to represent their respective populations.

For confidentiality purposes, earnings are top coded in the United States. However, there is no top coding in the German data set. To be able to compare the labor market outcomes across countries and time, we use the procedure that is proposed by Burkhauser, Couch, Houtenville and Rovba (2004). They impose the most restrictive top code on earnings in all years so that the same percentile of the distribution is affected in every year. [3]

[2] West German CPI is based on the "DESTATIS 2007, Preise. Verbraucherpreisindex und Index der Einzelhandelspreise.Lange Reiheab 1948 bis 2006.Basisjahr 2000."

[3] Another way of dealing with top coding is to replace top coded earnings by 1.5 times the value of top code in a given year. However, as Gottschalk and Joyce (1998) discuss, this might introduce significant measurement errors. We also reproduced the results with the alternative method, and observed that the trends in skill premia obtained through consistent top coding is similar to the trends obtained using this alternative method implemented by Autor, Katz and Kearney (2008).

Table 1a Coefficient of Variation, Gini and Percentile Points for Earnings Distribution

Year	West Germany				
	CV	**Gini**	**ln P 90/10**	**ln P 90/50**	**ln P 50/10**
1982	-	-	-	-	-
1983	-	-	-	-	-
1984	0.351	0.190	0.896	0.517	0.379
1985	0.358	0.193	0.897	0.537	0.360
1986	0.354	0.190	0.911	0.529	0.381
1987	0.360	0.192	0.912	0.561	0.351
1988	0.345	0.185	0.875	0.530	0.345
1989	0.350	0.188	0.887	0.531	0.355
1990	0.340	0.184	0.851	0.477	0.374
1991	0.340	0.186	0.845	0.474	0.371
1992	0.339	0.186	0.874	0.489	0.385
1993	0.350	0.189	0.906	0.557	0.350
1994	0.356	0.193	0.878	0.539	0.339
1995	0.362	0.195	0.917	0.545	0.372
1996	0.378	0.202	0.975	0.560	0.416
1997	0.375	0.205	0.952	0.543	0.409
1998	0.392	0.212	1.021	0.555	0.466
1999	0.401	0.214	1.016	0.584	0.432
2000	0.387	0.211	1.028	0.562	0.466
2001	0.378	0.208	1.030	0.548	0.482
2002	0.410	0.224	1.089	0.572	0.518
2003	0.419	0.228	1.090	0.568	0.522

Source: Author's own calculations.

Table 1b Coefficient of Variation, Gini and Percentile Points for Earnings Distribution

Year	United States				
	CV	**Gini**	**ln P 90/10**	**ln P 90/50**	**ln P 50/10**
1982	0.476	0.259	1.369	0.623	0.746
1983	0.488	0.266	1.347	0.595	0.752
1984	0.488	0.268	1.427	0.606	0.821
1985	0.499	0.273	1.409	0.588	0.821
1986	0.551	0.299	1.539	0.664	0.875
1987	0.500	0.274	1.427	0.634	0.793
1988	0.504	0.276	1.427	0.616	0.811
1989	0.514	0.280	1.450	0.637	0.813
1990	0.518	0.282	1.446	0.638	0.808
1991	0.517	0.281	1.474	0.640	0.834
1992	0.567	0.301	1.501	0.665	0.836
1993	0.571	0.304	1.492	0.693	0.799
1994	0.526	0.288	1.518	0.712	0.806
1995	0.544	0.294	1.526	0.700	0.827
1996	0.546	0.295	1.507	0.708	0.800
1997	0.530	0.284	1.540	0.722	0.818
1998	0.554	0.295	1.507	0.724	0.783
1999	0.558	0.298	1.543	0.720	0.823
2000	0.559	0.300	1.549	0.744	0.804
2001	0.555	0.298	1.528	0.732	0.796
2002	0.605	0.316	1.564	0.765	0.799
2003	0.594	0.314	1.592	0.793	0.799

Note: Source: Author's own calculations. Inequality measures CV and Gini are based on trimmed data (consistent top coding from above and 1% censoring from below), while the percentile points are based on untrimmed data. Sample includes males aged 25 to 55. Refer to Section 4.2 for a detailed information on the construction of wage sample.

We find that the most restrictive top code in the sample for the United States, which is composed of males aged 25 to 55, is 1.59%. We impose the same restriction on German data set. Moreover, to be consistent with other studies and to eliminate the

effects of outliers on the inequality measures, we trim the bottom 1% of earnings distribution in each country.[4] Coefficient of variation (CV) and Gini coefficients are based on trimmed data. Since another solution to top coding is to use inequality measures like percentile points, we also provide estimates for log deviations at different percentile points based on untrimmed data. These measures also allow us to observe trends in inequality across the earnings distribution. The last three panels for each country summarize log deviation between the 90th and 10th percentiles, and their deviations from median earnings.

Earnings inequality increased in both countries during the last two decades. Average annual growth of both CV and Gini was approximately 0.9% in Germany, while it was approximately 1% (CV) and 0.9% (Gini) for the United States over the whole period. Declining trend in overall inequality continued until 1992 in Germany. This trend was then replaced with a sharp rise in inequality at an annual growth rate of 1.64% between years 1994 and 2003 which are the trough years of 1990s business cycle roughly. On the other hand, earnings inequality increased in the 1980s business cycle in the US at a rate of 0.83% per year. However, its pace slowed down considerably in the 1990s and the annual growth rate was approximately 0.54% between the years 1991 and 2001.

Log deviations between percentile points allow us to see whether these increases arise from a decline at the bottom or an increase in earnings at the top of the distribution. Figure 2 shows the trends in these summary measures. Declining German wage inequality during the 1980s was due to more equally distributed wages both in the upper but especially in the bottom of the earnings distribution. On the other hand, greater deviation of log of earnings at the 10th percentile from the median earnings was the primary factor underlying the surge of overall German earnings inequality in the 1990s. As opposed to German experience, major source of rising US earnings inequality in the 1980s was the divergence of earnings in the bottom half of the earnings distribution. Log difference between the median earnings and the earnings at the 10th percentile increased from 0.746 in 1982 to 0.834 in 1991. This effect was further reinforced by the increasing inequality at the top of the distribution, where the difference between the log earnings at the 90th percentile and 50th percentile rose from 0.623 to 0.640.

[4] Year of the most restrictive top code is 1983.

Figure 2a Male Earnings Inequality

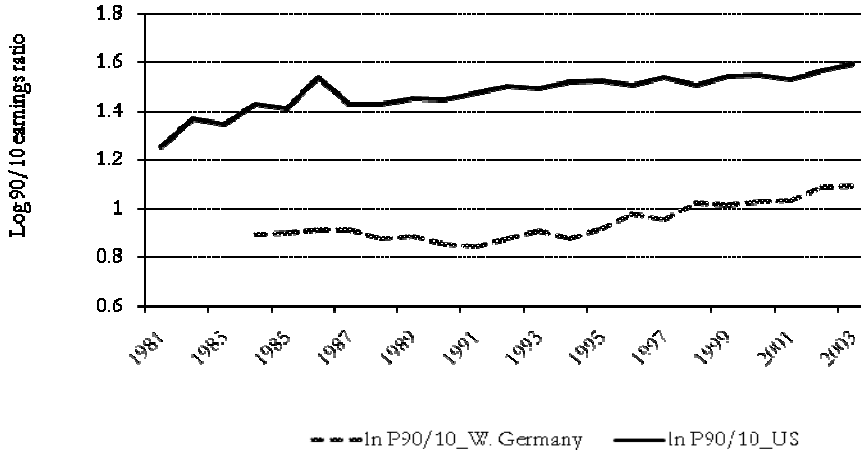


Figure 2b Log 90/50 Earnings

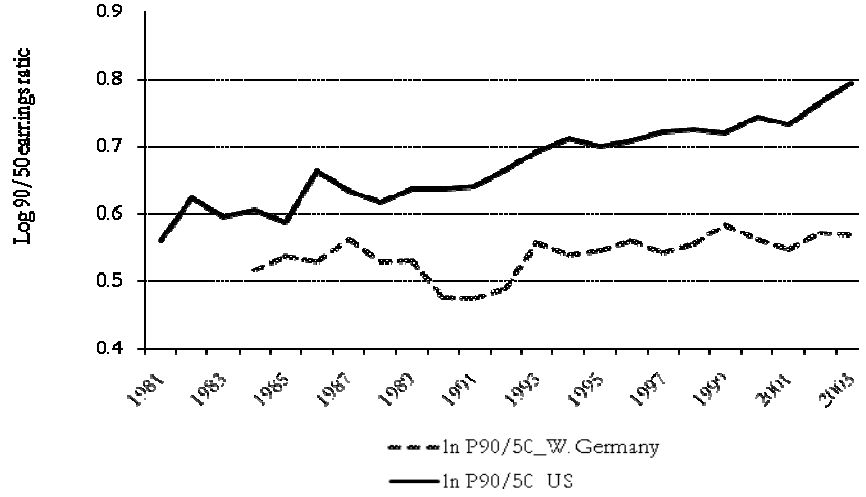
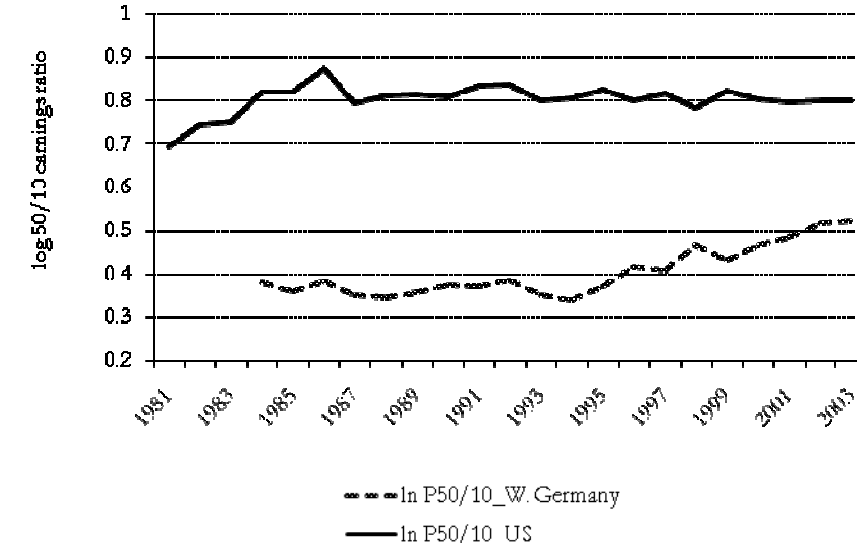


Figure 2c Log 50/10 earnings



Note: Sample includes males aged 25 to 55.

The trend in the 1980s was reversed during the following decade in the United States. In contrast to the experience of 1980s in the US and that of Germany in the 1990s, slower growth in male wage inequality was due to constant pattern of inequality at the bottom of the earnings distribution over the 1990s. These findings for two countries are also consistent with the previous studies, some of which use different data sets (Puhani 2003, Kohn 2006, Gernandt and Pfeiffer 2006, Autor et al. 2008).

4. Sources of Between Group Inequality

4.1 Theoretical Framework

Educational earnings differentials are one of the most important underlying sources of overall and between group earnings inequality in the United States. In this section, we develop the framework to investigate the causes of educational earnings differentials in the two countries by focusing on supply, demand and labor market institutional factors.

Prior evidence indicates the importance of secular shifts in relative demand for skilled workers based on the observation of increasing relative supplies and wages. Researchers used a simple demand and supply framework to assess the quantitative importance of both forces in explaining the relative wage changes in the United States (Katz and Murphy 1992, Autor, Katz and Krueger 1998, Acemoglu 2002a). Their findings show that the US wage inequality increased because the relative demand for skilled workers rose faster than the relative supply. They attribute the increasing skill demand to skill-biased technological change. However, although West Germany was subject to similar skill-biased technological shock, it did not experience such dramatic increase in wage inequality. There are three possible explanations for that. First, relative supply of skills increased faster in Germany. Second, labor market institutions prevented higher wage inequality. In contrary to these traditional arguments, Acemoglu (2003) proposes a third explanation which investigates the possibility of delays in the adoption of new technologies in European countries.

By using the following supply and demand framework, we investigate whether these explanations can provide a satisfactory explanation for the behavior of skill premia in West Germany and the US. The model is based on two types of workers; high-skilled and low-skilled and the following is the aggregate production function that takes the form of constant elasticity of substitution

$$Y_t(t) = \left(\alpha_t \left[A_h(t)H(t)\right]^{\rho} + \left(1-\alpha_t\right)\left[A_l(t)L(t)\right]^{\rho}\right)^{1/\rho} \tag{1}$$

where $L(t)$ and $H(t)$ denote the quantities employed of low-skilled and high-skilled workers in period t respectively (Acemoglu 2002a). A_l and A_h are the factor-augmenting technology terms for low and high skilled workers respectively. Skill-neutral technological change raise the technology terms by the same proportion, while skill-

biased technological change leads to an increase in $\left(\frac{A_h(t)}{A_l(t)}\right)$. α_t captures the share of work activities allocated to high-skilled labor.[5]

The elasticity of substitution between high and low-skilled workers is $\sigma = 1/(1-\rho)$. Assuming that workers are paid their marginal products, we will obtain the following relationship between relative wages $w(t) \equiv \frac{w_H(t)}{w_L(t)}$ and the relative supplies $\left(\frac{H(t)}{L(t)}\right)$;

$$\ln w(t) = \ln\left(\frac{\alpha(t)}{1-\alpha(t)}\right) + \frac{\sigma-1}{\sigma}\ln\left[\frac{A_H(t)}{A_L(t)}\right] - \frac{1}{\sigma}\ln\left[\frac{H(t)}{L(t)}\right] \tag{2}$$

and rearranging it will give us

$$\ln w(t) = \frac{1}{\sigma}\left[D(t) - \ln\left(\frac{H(t)}{L(t)}\right)\right] \tag{3}$$

where $D(t) = \sigma \ln\left(\frac{\alpha(t)}{1-\alpha(t)}\right) + (\sigma-1)\ln\left(\frac{A_h(t)}{A_l(t)}\right)$. $D(t)$ is in log quantity units and it captures relative demand shifts favoring high-skilled workers where changes in it arise from non-neutral changes in the relative prices and quantities. Changes in $D(t)$ can also arise from international trade. However, Feenstra and Hanson (1998) and Freeman (2003) argue that international trade has a minor role in labor markets. There exists substantial evidence which suggests the skill-biased technological change as the primary factor contributing to increasing relative demand for skills (Acemoglu 2003, Goldin and Katz 2007, Autor et al. 2008). This equation allows us to examine the changes in relative wages of two skill groups; high and low-skilled workers in relation to the relative supply for equivalents of these skill classes.

The second term on the right hand side of equation (3) is the employment of high-skilled relative to the low-skilled workers. Nickell and Layard (1999) propose an alternative way of writing equation (3) to explain the labor market experiences of

[5] Katz and Autor 1998 define the ratio of factor augmenting technology term and the time varying technology parameter α_t as the "*intensive* and *extensive* skill-biased technological change" respectively. Intensive skill-biased technological occurs when the productivity of the factors change, while extensive skill-biased technological change leads to task shifts from low-skilled workers to high-skilled ones.

European countries. They use the fact that relative employment of high-skilled and low-skilled workers is composed of relative supplies of skills in the population and relative non-employment rates. More formally;

$$\ln\left(\frac{H(t)}{L(t)}\right) = \ln\left(\frac{s}{1-s}\right) + \ln\left(\frac{1-u_h(t)}{1-u_l(t)}\right) \tag{4}$$

where s is the share of high-skilled workers in the labor force and u_h and u_l are the non-employment rates of them at time t. Incorporating this relationship into equation (3) will give us the following equation that differentiates between two sources of variation in the relative employment of skilled workers;

$$\ln w(t) = \frac{1}{\sigma}\left[D(t) - \ln\left(\frac{s}{1-s}\right) - \ln\left(\frac{1-u_h^t}{1-u_l^t}\right)\right] \tag{5}$$

Within this framework, besides relative demand and supply changes, it is also possible to examine the effects of wage-setting institutions on the relative wages of skilled workers.

4.2 Data and the Sample

For the analysis, we draw data from the March Current Population Survey (CPS), German Socio-Economic Panel (GSOEP) and Cross-National Equivalent Files (CNEF). GSOEP is representative for the whole population of Germany and the information on labor force complies with the International Labor Office definition. We use the March CPS files from 1983 to 2004 (covering earnings from 1982 to 2003) and GSOEP, CNEF from 1985 to 2004 (covering the period from 1984 to 2003) which provide retrospective information on earnings, weeks and hours worked. This also allows us to compare our findings with previous studies that focused on West Germany (Puhani 2003, Dustmann, Ludsteck and Schönberg, 2007).

Some of the previous studies (Gottschalk and Joyce 1998, Acemoglu 2003) used Luxembourg Income Study (LIS) for cross-national comparisons of earnings inequality. However, LIS is restricted because it involves income information only for the head of households. Hence, another advantage of using GSOEP is that we can use income information for every member of the household.

For both data sets, we construct two samples, a 'wage' and an 'employment' sample. Wage sample is used to compute relative wages of high skilled workers aged 25 to 55, who have strong labor market attachment (i.e., working at least 39 weeks per year and 30 hours per week). And employment sample is composed of all wage and salary workers between the ages of 25 to 55 (i.e. workers who worked full-time or part-time). Employment sample is used to compute relative skill supplies of college graduate employment to the employment of all other workers and it is adjusted for annual hours of work.

Following the procedure described above, we first use equation (3) to impute implied relative demand shifts conditional on the assumed values of σ and using data on relative skill premium and skill supplies. According to the large empirical literature on the subject, estimates of elasticity of substitution between high and low-skilled labor vary between 1 and 2.5 (Goldin and Katz, 2007). Although there is no precise estimate of σ, there is a general consensus that it is greater than 1 (Hammermesh 1993). Some studies found that its value is around 1.4 or possibly as large as 2 (Acemoglu 2003). That's why, we calculate demand shifts based on the assumed values of $\sigma = 1.4$ and $\sigma = 2$.

In line with Acemoglu (2003), we divide the workforce into two groups; college graduates (high-skilled labor) and non-college graduates (low-skilled labor). This allows us to examine the changes in relative wages of two skill groups; i.e. college and non-college graduates in relation to the relative supply for "equivalents" of these skill classes.

In order to be consistent with other studies, wage sample consists of full-time and full year, male workers. We exclude the earnings of self-employed workers in order not to measure potential returns to capital. Also, there is no direct measure of number of weeks worked in GSOEP, so we use the annual earnings to construct skill premia. Since the wage sample consists of full-time and full-year workers, we expect that the changes in real annual earnings reflect changes in wages rather than changes in hours worked.

We use the standard log-wage regressions to obtain the skill premia in both countries. The regressions contain education dummies, potential experience, quartic in experience, race/ethnicity, age dummies (persons aged 25 to 34 and 45 to 55 years old), marital status and migration variable when applicable.[6] We define three skill categories based on the level of education. Skill premium is obtained from the log wage regression and it is the coefficient on workers with a college degree or more relative to medium skilled workers.

Since the education systems in the US and West Germany differ a lot, it is difficult to establish perfectly comparable skill categorization. We define three skill categories for both countries based on the interpretation of West German education system by Krueger and Pischke (1995).The first skill category is the low skilled which includes those with less than high school degree in the United States. And it is the individuals without apprenticeship and vocational degrees in West Germany (e.g., those with lower or intermediate secondary school and no education). For Germany, the category of medium skilled workers are composed of those with upper-secondary school degree giving access to university studies (*Abitur*), certificate for specialized short-course higher education (*Fachhochschhulreife*), apprenticeship (*Lehre*) and specialized vocational school (*Berufsfachschule*).[7] Students who study at *Gymnasium* are eligible to take the the *Abitur*. Krueger and Pischke (1995) argue that the last two years of Gymnasium is "roughly comparable" to the first years of college education in the US. Moreover, vocational

[6] We control for the effects of internal migration in West Germany after the German reunification. Results from standard log-wage regression are not shown here for the sake of brevity. They are available upon request.

[7] We use variables from CNEF when constructing skill categories in Germany.

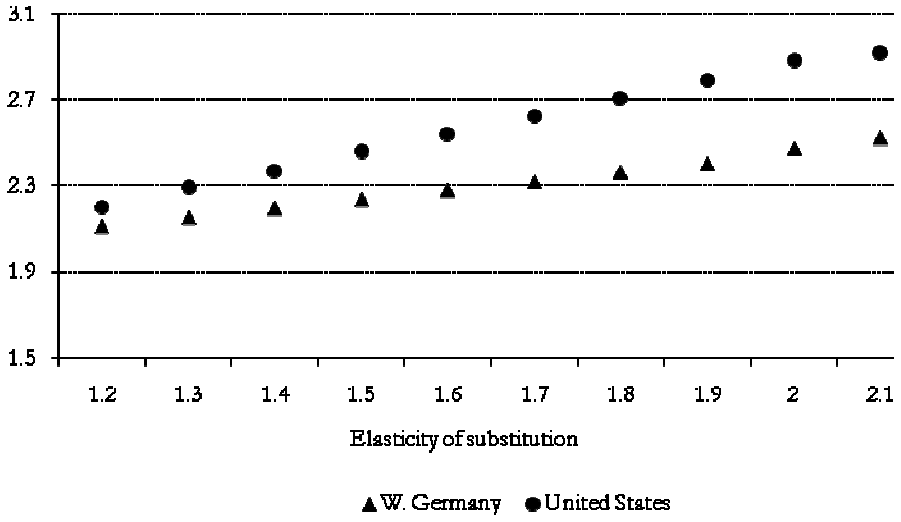
training is composed of an apprenticeship and part-time schooling where *Berufsschule* provides the theoretical background for the profession as well as liberal arts education. In order to make the skill levels more comparable across countries, we include those people with some college in the medium skilled category in the United States. Second category includes high school graduates and workers with some college (i.e., workers with 13 to 15 years of education include those who hold associate degree, which is a vocational type of degree) in the United States.

The last skill category is the high-skilled workers. This category corresponds to college graduates and those with post-graduate degrees in the United States. Employees with university and technical college degrees (*Fachhochschule* or *TechnischeUniversität*) make up the high-skilled category in West Germany. Krueger and Pischke note that *Fachhochschule* is "roughly comparable" to the professional colleges in the US.

4.3 Empirical Results

Table 2 shows how the skill premium (obtained through the log wage regressions) and the relative skill supplies have changed over the years in both countries. We also report the standard errors for skill premia and relative employment of skilled labor. Table 3 shows the decomposition of relative employment of skilled labor into relative skill supplies in the labor force and the ratio of employment rate of high skilled workers to the employment rate of low skilled ones using equation (4).

Figure 3 Changes in Relative Demand and Elasticity of Substitution



Notes: Relative demand shifts are calculated using equation (3) and are shown in vertical axis.

To investigate whether the relative demand shifts are not radically different across countries given plausible values of elasticity of substitution, we plot the relationship between σ and relative demand changes for both countries in Figure 3. We observe similar demand shifts for different values of elasticity of substitution especially at the lower values of elasticity of substitution. For higher values of σ, greater demand shifts are required to explain a given change in relative wages especially in periods with large relative wage changes. Since results indicate a greater change in relative wages in the US

(with an average annual change of 0.84%) than in Germany (0.42% per year) over the whole period (Table 4, rows 6 and 10), a higher value for elasticity of substitution would imply greater shifts in relative demand for high-skilled workers in the US than in West Germany. That's why, we present results both for $\sigma = 1.4$ (which provides similar relative demand shifts across countries over the whole period) and $\sigma = 2$.

Table 2 Estimated Skill Premia and Relative Skill Supplies of Male Workers

Year	West Germany				United States			
	Skill Premia	Std. error	Relative Supply	Std. error	Skill Premia	Std. error	Relative Supply	Std. error
1982	-	-	-	-	0.262	0.009	0.365	0.00013
1983	-	-	-	-	0.293	0.008	0.378	0.00014
1984	0.229	0.016	0.292	0.00022	0.310	0.009	0.377	0.00015
1985	0.209	0.017	0.285	0.00020	0.327	0.009	0.376	0.00014
1986	0.198	0.016	0.291	0.00019	0.362	0.007	0.364	0.00014
1987	0.210	0.017	0.279	0.00020	0.333	0.008	0.394	0.00013
1988	0.212	0.016	0.302	0.00020	0.343	0.009	0.401	0.00014
1989	0.208	0.016	0.290	0.00019	0.347	0.008	0.394	0.00013
1990	0.199	0.016	0.305	0.00019	0.331	0.008	0.396	0.00013
1991	0.250	0.018	0.300	0.00020	0.382	0.010	0.385	0.00021
1992	0.234	0.017	0.314	0.00019	0.407	0.009	0.397	0.00013
1993	0.204	0.018	0.320	0.00014	0.415	0.009	0.410	0.00014
1994	0.257	0.018	0.338	0.00020	0.362	0.008	0.423	0.00015
1995	0.236	0.018	0.341	0.00020	0.393	0.009	0.427	0.00014
1996	0.266	0.019	0.348	0.00021	0.362	0.010	0.416	0.00013
1997	0.225	0.021	0.357	0.00020	0.375	0.012	0.424	0.00014
1998	0.298	0.020	0.338	0.00021	0.393	0.009	0.445	0.00015
1999	0.347	0.018	0.370	0.00021	0.410	0.009	0.455	0.00015
2000	0.312	0.015	0.379	0.00022	0.410	0.011	0.448	0.00016
2001	0.309	0.017	0.374	0.00026	0.430	0.007	0.463	0.00015
2002	0.307	0.016	0.410	0.00024	0.436	0.008	0.472	0.00024
2003	0.318	0.018	0.402	0.00017	0.419	0.008	0.474	0.00017

Note: Estimates for Germany are based on GSOEP and estimates for the US are based on March CPS files. Skill premium is obtained from the regression of log real annual gross earnings on education dummies, potential experience, quartic in experience, race/ethnicity, age dummies (persons aged 25 to 34 and 45 to 55 years old), marital status and migration variable when applicable. Relative employment of skilled workers is the ratio of college to non-college employment. All estimates are weighted by appropriate sample weights.

Table 4 presents results from the application of supply and demand framework. The table shows how changing skill supply and demand affected the changes in skill premium in both countries. The values represent annual log changes and they are calculated using the information from Tables 2 and 3. We obtain relative demand shifts using equation (3) by assuming plausible values for σ. In order to eliminate the effects of business cycles, changes in relative wages, relative supply and demand for skilled workers are reported both for the whole period and across troughs of business cycles for each country.[8] Forth and the fifth columns decompose the overall change in relative employment of skilled labor.

Table 3 Relative skill supplies in the Labor Force and Relative Employment rates

Year	West Germany		United States	
	Relative Supply of Skills in the Labor Force	Relative Employment Rate	Relative Supply of Skills in the Labor Force	Relative Employment Rate
1982	-	-	0.351	1.039
1983	-	-	0.363	1.042
1984	0.283	1.029	0.370	1.020
1985	0.276	1.032	0.367	1.025
1986	0.268	1.040	0.299	1.027
1987	0.283	1.026	0.278	1.023
1988	0.293	1.031	0.393	1.020
1989	0.283	1.025	0.387	1.017
1990	0.289	1.054	0.381	1.021
1991	0.286	1.045	0.375	1.027
1992	0.306	1.025	0.386	1.029
1993	0.309	1.033	0.399	1.028
1994	0.317	1.070	0.412	1.026
1995	0.305	1.037	0.416	1.026
1996	0.327	1.065	0.407	1.022
1997	0.312	1.032	0.417	1.017
1998	0.323	1.047	0.439	1.014
1999	0.360	1.028	0.449	1.013
2000	0.361	1.020	0.443	1.012
2001	0.357	1.049	0.456	1.017
2002	0.394	1.039	0.462	1.022
2003	0.368	1.092	0.464	1.022

Note: Estimates for Germany are based on GSOEP and estimates for the US are based on March CPS files. All estimates are weighted by appropriate sample weights.

[8] Trough years in the US are 1982, 1991 and 2001, and 1982, 1994 and 2003 in Germany. Since the earliest year that we are using is in German data set starts from 1984, we will be using 1984 as the starting year in the analysis of 1980s. This will underestimate the change in relative wages.

Forth column shows the role of changes in relative skill supplies in the labor force and the fifth column quantifies the annual changes in relative employment rate of skilled workers (calculated using equation 4). One advantage of this decomposition is to understand the role of labor market institutions in both countries' response to rising relative demand for skilled workers.

We observe that faster increase in the relative employment of skilled groups in West Germany (1.61% in Germany as opposed to 1.20% in the US) was responsible for the slower rise (0.44% per year) in the relative wages of skilled workers over the whole period. 19% of this increase in skilled employment in West Germany reflected the effects of wage-setting institutions (row 6 and column 5), while the rest of the rise occurred due to increasing educational attainment. In the United States, we actually observe that increasing supply of skills in the labor force more than explained the rise in the employment of skilled workers (row 10 and column 4). And also employment rate of low-skilled group increased faster compared to the employment rate of high-skilled one which led to a decline in the relative employment rate of high-skilled group. Another important finding is that the root cause of all the differential growth in relative employment of skilled labor in both countries was actually due to differences in institutional factors rather than differences in educational attainment.

4.3.1 Sub-Period Analysis I: 1980s

First period analysis focuses on changes between 1982 and 1991 in the US and 1984 and 1994 in West Germany, which were the trough years. These periods roughly correspond to the decade of 1980s. Results in Table 4 indicate a faster increase in college wage premium in the US i.e. college wage premium increased by 1.2% a year on average, while German earnings were more stable and grew only 0.26% a year. Although we observe similar relative demand changes over the whole period, in the first period, relative demand growth was lower in West Germany. According to our findings, annual log change in the relative demand for skilled workers was 1.7% in West Germany as opposed to 2.2% in the United States given that the elasticity of substitution is assumed to be equal to 1.4. This provides some support for an explanation that is recently proposed by Acemoglu (2003). He claims that earnings inequality differentials can be explained by differences in the speed of technology adoption across countries.

Relative employment of skilled labor increased 1.3% per year in West Germany, while it was 0.53% in the United States. 26% of the increase in the overall relative supply was because of rising relative employment rate of high-skilled workers in West Germany. On the other hand, relative employment rate of skilled workers declined over the 1980s in the US. In this period, we observe declining unemployment rates for both skill types in the US. However, the rise in the employment rate of low-skilled workers was greater than that of high-skilled workers which resulted in relatively lower employment rate for skilled group in 1991 than in 1982. This may be partly due to declining value of real minimum wage during the 1980s. The nominal Federal Minimum Wage was fixed at $3.35 per hour from 1981 to 1990. Moreover, this period was shaped by declining unionization rates, too.

Table 4 Changes in the College Earnings Premium and in the Supply of and Demand for College-Educated Workers (Annual log change × 100)

Period	Change in Relative Earnings	Change in Relative Employment			Change in Relative Demand	Change in Relative Demand
		Overall	Supply	Emp. Rate	$\sigma = 1.4$	$\sigma = 2$
West Germany						
1984-1994	0.259	1.333	0.991	0.342	1.695	1.851
1994-2003	0.606	1.750	1.520	0.230	2.598	2.961
1984-2003	0.435	1.608	1.305	0.303	2.217	2.479
United States						
1982-1991	1.201	0.533	0.654	-0.121	2.215	2.936
1991-2001	0.437	1.691	1.778	-0.087	2.303	2.565
1982-2001	0.841	1.197	1.305	-0.110	2.374	2.879

Notes: Calculations are based on the information in Tables (2) and (3). Changes in relative employment of high skilled workers is decomposed into two parts using equation (4) and their annual log changes are listed in columns 4 and 5.

The rest of the change in relative employment of skilled workers was explained by increasing relative skill supplies in the labor force in both countries. Relative skill supplies grew much faster in Germany (0.99% per year) than in the US (0.65% per year). Comparison of the results across countries shows that both institutional factors and rising educational attainment were important in explaining the differential growth in relative employment of skilled labor in the United States and West Germany. In particular, institutional factors explained 58% and the changes in educational attainment explained 42% of the differences.

These results are in line with the hypothesis of Krugman (1994) to some extent. He argues that skill-biased technological change lead to rising inequality in the US and increasing unemployment in European countries, which are actually the two sides of the same coin. That is, in the US we observe a combination of low wages for low-skilled workers (hence increasing wage inequality) and lower unemployment rate, while in West Germany we observe higher unemployment rate among low-skilled workers along with higher wages due to the existence of rigid labor market institutions. Figure 4 presents the employment rates of college graduates and non-college graduates in both countries. There was a declining trend in the employment rate of non-college graduates in Germany from the beginning of 1990s up to year 1995. This trend was slightly reversed until the year 2002 which then was followed with a sharp decrease in the employment rate of non-college graduates in 2003. On the other hand, employment rates of college graduates and non-college graduates showed a rising trend in both decades in the United States.

4.3.2 Sub-Period Analysis II: 1990s

Second sub-period analysis is based on trough years of the 1990s business cycle (1991-2001) in the US and, it is the 1994-2003 business cycle in West Germany. In the US, relative wages increased much slower at an average rate of 0.44% annually as opposed to sharp increases in the previous period.[9] An interesting finding is the greater annual growth of German earnings at an average of 0.61%.[10] In this period, supply forces were less important since we observe similar growth in the relative employment of skilled labor in both countries. Hence, the difference in skill premia can be attributed to a somewhat faster growth in relative demand for skilled labor in West Germany.

Rising educational attainment continued to be the primary factor affecting the overall change in relative supplies, leaving a secondary role to wage-setting institutions in both countries. Relative employment rate of high-skilled workers in Germany explains the 13% (as opposed to 26% in the previous period) of the increase in relative employment of skilled workers. This might be a result of recent developments in labor market institutions in West Germany like falling collective bargaining coverage and shortening of entitlement period to unemployment insurance. The weaker the role of institutions in wage determination, the greater will be the effect of shifts in supply and demand on relative wages and, so the smaller will be their effect on relative employment (Freeman 1994). In the 1990s, there has been a trend towards more flexibility in the collective bargaining agreements. At the beginning of 1990s, share of workers covered by union agreements was around 90% and Germany ranked number 5 among OECD nations. By year 2000, collective bargaining coverage declined to 68% for unified Germany and 76% in West Germany and its ranking was 13 (see Table 5). "*Opt-out clauses*" that allow negotiations to set wages below the wage floor determined at the sectoral-level agreements or *employment pacts* where job guarantee was obtained through pay cuts are some examples of the recent changes in labor market institutions. At the beginning of both decades, collective bargaining coverage was much lower in the US. It is 18% (and ranked number 20) at the beginning of 1990s and 14% (ranked number 24) by year 2000. (OECD, Employment Outlook, 2004).

Launov et al. (2004) investigate the impact of entitlement period to unemployment insurance using years 1986 and 1995 from GSOEP data set. They find that the generous entitlement periods in the 1980s increased the unemployment rate of unskilled workers from 10.3% in 1986 to 15.1% in 1995. However, recent reforms (in 1997 and 2003) shortened the entitlement period which might have lowered the unemployment rate of low-skilled workers in Germany. According to our findings, the unemployment rate of those workers that fall into skill category one declined from 14% in 1995 to 13% in 2003.

[9] These findings are similar to the findings of Goldin and Katz (2006).

[10] This finding proves the close correspondence between the trends in skill premium and the overall earnings inequality.

Figure 4a Evolution of Employment rates by skill groups_ West Germany

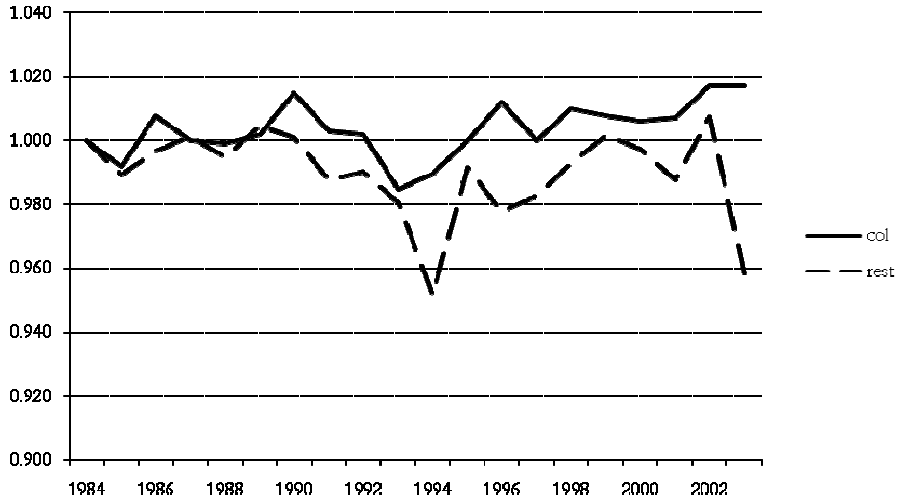
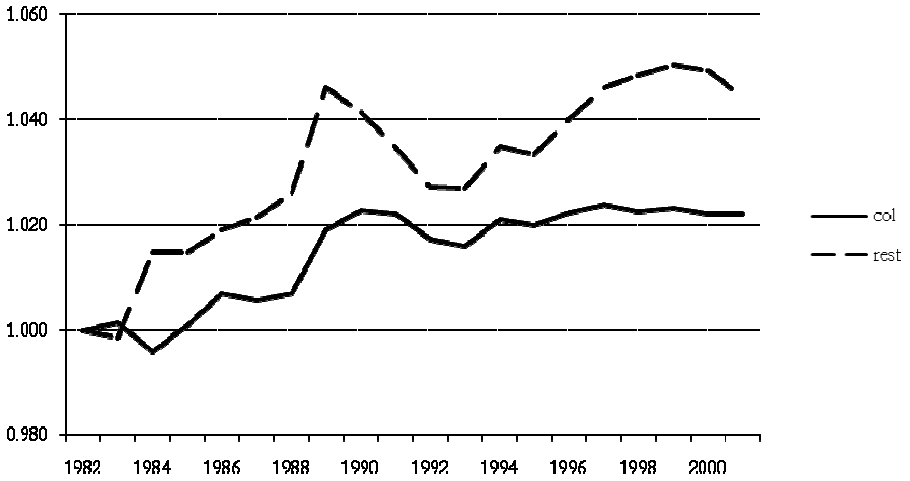


Figure 4b Evolution of Employment Rates by skill groups_US



Notes: Calculations are based on males aged 25 to 55. Values are indexed to 1 in year 1984 in West Germany and 1982 in the United States. Employment rate is the total employment over total supply of educational group. It is equal to one minus the unemployment rate of the relevant skill group.

Table 5 Decline in Union Coverage (West Germany)

Year	Share of Male Workers covered by Union Agreements
1985	90.00%
1995	87.40%
1996	87.10%
1997	86.50%
1998	81.10%
1999	78.00%
2000	75.90%
2001	75.20%
2002	74.70%
2003	74.70%
2004	71.70%

Source: Dustmann, Ludsteck and Schonberg (2007) and OECD Economic Outlook 1991

5. The Polarization of the Labor Market

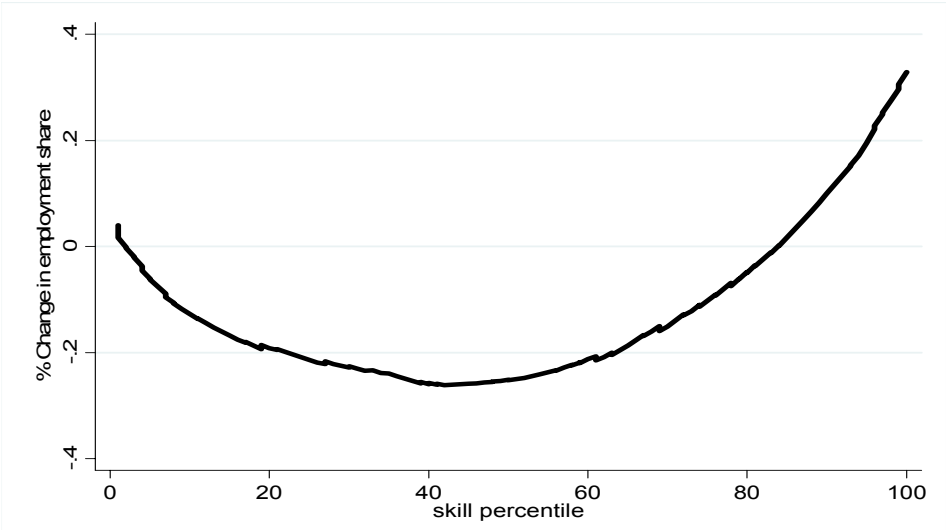
Recent studies provide evidence for polarization of work in the United States starting with 1987 (Autor, Levy and Murnane 2003, Autor, Katz and Kearney 2008). After 1987, inequality in the upper half of the earnings distribution continued to rise, while the inequality at the bottom of the distribution was more or less constant (see Figure 2). Autor et al. (2003) argue that this new trend can be explained with a more "nuanced view of skill-biased technological change" where the monotonic changes in skill demand are replaced with non-monotonic rises in skill demand. In other words, technological progress and declining cost of computers favor the type of jobs that require non-routine, cognitive and interactive tasks ("*abstract tasks"*) that are complementary to it and substitute the jobs which require routine analytical and mechanical tasks ("*routine tasks"*). As a result of this, demand for high-skilled workers that use abstract tasks increase, whereas the demand for middle-educated that perform routine tasks decline (bank employees, bookkeepers, office clerks, machine operators and so on).

However, "nuanced version of skill-biased technological change" does not have a direct prediction of the employment changes in non-routine *manual tasks* that require low skills (waiters, domestic staff). Goos and Manning (2007) apply the "general equilibrium effect" argument of Baumol (1967) in this context and predict that employment in manual tasks will increase because it is hard to computerize those tasks given the current technology. Autor et al. (2008) draw the task intensity by occupational skill for abstract, routine and manual tasks. They measure occupational skill by the mean years of education within an occupation's workforce. And they find that the use of abstract tasks monotonically increases with the occupational skill. On the other hand, use of routine tasks is concentrated mostly at the middle of the occupational skill distribution. And the requirement of routine tasks falls as the occupational skill increases.

Our findings from the relative demand and supply framework suggest increasing relative employment of skilled workers. This evidence seems contradictory to the evidence on polarization of work in both countries as some of the studies show a constant pattern in the skilled supply growth. The difference emerges due to the skill grouping to carry out a more comparable analysis across these two countries. In other words, an aggregation of the employment of skill category one and skill category two workers might conceal the recent decreases in the employment of those workers in the second skill category and the increases (or stability) in the employment of those in the first skill category in both countries. Since the way that the skill categories are constructed in this study might disguise this recent phenomenon, we carry out further analysis to investigate the polarization of jobs in both countries.

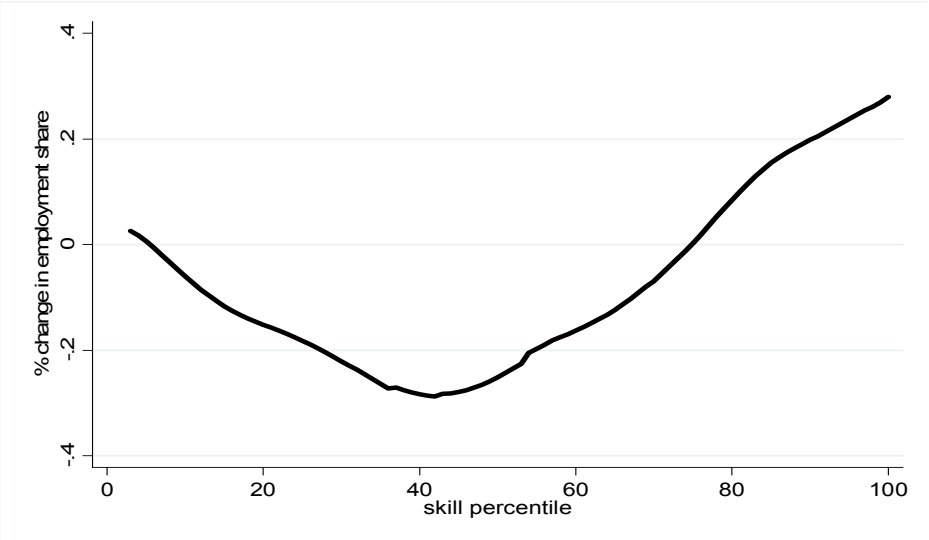
Following Dustmann et al. (2007) and Goos and Manning (2007), occupations are ranked based on the median wage of each occupation. We analyze the change in employment share of occupations from 1994 to 2003 in West Germany and from 1991 to 2001 in the United States. There are 203 occupations based on ISCO-88 code in GSOEP and 454 occupations in the CPS.[11] Figure 6 shows the percentage change in the share of total hours worked in the economy in the 1990s for both countries. We observe that employment changes showed a non-monotonic pattern. In other words, employment share of "*manual*" tasks which are expected to concentrate at the bottom of the skill distribution has grown or were stable, while the employment share of "middling jobs" has declined. Moreover, consistent with the more nuanced version of skill-biased technological change, employment share for highest-skill jobs increased sharply.

Figure 5a Changes in Employment Share_W. Germany



[11] Since some jobs appear or disappear in the German data set, we cannot analyze the changes in employment shares of 28 occupations.

Figure 5b Changes in Employment Share_United States



Note: Sample includes people of age 25 through 55 who were employed in the United States and W. Germany. The labor supply measure is based on sample weight and adjusted for annual hours of work. Locally weighted smoothing regression (bandwidth 0.8) is used.

Tables 6 and 7 list the top and bottom ten occupations by job growth. The first two columns name the occupations and show the percentile it belongs to in the occupational skill distribution, which is determined by median wages in each occupation. And the next six columns are taken from Meyer and Osborne (2005). They show the *attributes of occupations* based on six categories, namely reasoning, mathematical development, language usage, specialized vocational training, physical strength and care. These columns give us an idea about the task input of the occupations listed. We observe that employment decline has been higher in occupations in the 3rd and 4th deciles which include machine operators (metal finishing operators, power production plant operators, chemical process plant operators and so on) and office clerks (accounting and bookkeeping clerks) to a greater extent. And employment increase has been higher in occupations concentrated at the two ends of the skill distribution. Our findings are consistent with previous evidence and suggest that employment of people performing routine tasks declined, while employment of those performing non-routine manual or analytical tasks increased over the 1990s in both countries. (Goos and Manning 2007, Dustmann, Ludsteck and Schönberg 2007, Spitz-Oener 2006).

Autor et al. 2008 show that polarization observed in the US in the 1990s is a demand-side phenomenon. Wage changes by earnings level in the 1980s and 1990s are positively correlated with the employment changes by skill level in both decades. Besides demand-side explanations, Goos and Manning (2007) investigate alternative hypothesis for job polarization like changes in labor supply, the role of international trade and/or the changes in the structure of demand for different products. However, although these explanations can account for the trends in some specific occupations, they do not have the broad explanatory power of the "revised version of skill-biased technological change" as outlined in Autor, Levy and Murnane (2003).

The evolution of inequality at the bottom and top of the earnings distribution coincided with the demand changes that occurred as a result of job polarization in the United States. In particular, the difference between the earnings at the 90th and 50th percentile rose from 0.623 in 1982 to 0.640 in 1991 and then sharply increased to 0.732 in 2001. On the other hand, sharp rise in the difference between the median and the earnings at the 10th percentile in the 1980s (from 0.746 to 0.834) was followed by a slight decline in inequality in the 1990s. It seems that the pattern of changes across the wage distribution partially fits to the story of job polarization in West Germany. The reversal of declining inequality in the upper half of the distribution after 1992 and the moderate increase afterwards was in accordance with the job polarization hypothesis. However, the recent surge in the difference between the median earnings and the earnings at the 10th percentile seems contradictory to the story. But we know that the model developed by Autor et al. (2003) implies an increase in upper-tail inequality, while it can either increase or decrease lower-tail inequality depending on the direction of competing effects (i.e. q-complementarity or labor supply effects) at work. Our results imply a dominance of labor supply effect over q-complementarity effect. Also, trends towards decentralization in West Germany, which is a labor market characterized by industry-level bargaining lead to slower growth in wages in the 1990s compared to 1980s in the lower percentiles of the wage distribution. Hence, episodic changes can be an important factor in explaining the rising earnings inequality at the bottom of the distribution as well as dominant labor supply effects.

6. Conclusions

This paper has analyzed the recent trends and the differences in earnings inequality in the United States and West Germany with a major focus on educational earnings differentials. Our findings confirm the pattern of changes in wage structures from the previous studies. In particular, moderate rise in earnings inequality in the 1990s replaced the sharp increases from the previous period in the United States. On the other hand, increasing upper tail inequality combined with rapid expansion of lower tail inequality in the 1990s replaced the stable earnings structure in West Germany during 1980s. Close correspondence between the educational wage differentials and the overall inequality suggests education as one of the important sources of earnings inequality.

Results obtained through the relative demand and supply framework indicates that faster growth in relative skilled employment was a major factor in compressing the West German earnings distribution over the whole period. In both countries, rising educational attainment explained most of the changes in the employment of skilled workers leaving a secondary role to institutional factors. However, the differences in wage-setting institutions explained all of the differences in skill supply growth in both countries over the whole period. Our findings provide some support for Krugman hypothesis. In particular, we observe rising skill premium in the United States (0.84% per year) and declining relative employment rate of high-skilled workers. On the other hand, much slower increase in skill premium (0.44% per year) in West Germany occurred at the expense of higher unemployment rates among low-skilled labor.

Sub-period analysis in both countries reveals the probable outcome of recent developments towards decentralization in the West German labor market. In particular, we observe stronger influence of wage-setting institutions (26%) on differential growth

in relative skill supplies in the 1980s and a weaker impact (13%) in the 1990s. Another interesting finding of sub-period analysis is the differences in relative demand for skilled labor in both countries besides the differences in relative skill supplies. This finding provides some support for an alternative explanation by Acemoglu (2003) to understand the educational wage differentials. He argues that differences in technology adoption between countries might be the reason underlying educational wage differentials. According to our findings, there was a faster growth in relative demand in the United States compared to West Germany in the 1980s. However, in the second period, relative demand for skilled labor increased somewhat faster in West Germany. Further analysis on this argument might be an interesting topic for future research.

Lastly, we provide evidence for a recent phenomenon in the labor markets, which is the polarization of jobs. We find that in accordance with the predictions of the model proposed by Autor et al. (2003), the share of employment in occupations that require abstract tasks and manual tasks have increased in both countries, whereas the share of employment in the middling jobs have declined.

References

Acemoglu D. (2002a), 'Technical Change, Inequality and the Labor Market', *Journal of Economic Literature*, **40(1)**, 7-72.

Acemoglu D. (2003), 'Cross-Country Inequality Trends', *The Economic Journal,* **113(485)**, 121-149.

Autor D.H., Katz L. F., Krueger A. B. (1998), 'Computing Inequality: Have Computers Changed the Labor Market?', *Quarterly Journal of Economics*, **113(4)**, 1169-1213.

Autor D. H., Levy F., Murnane R. (2003), 'The Skill Content of Recent Technological Change: An Empirical Exploration' *The Quarterly Journal of Economics*, **118(4)**, 1279-1333.

Autor D. H., Katz L. F., Kearney M. S. (2008), 'Trends in US Wage Inequality: Revising the Revisionists', *Review of Economics and Statistics,* **90(2)**, 300-323.

Baumol W. J. (1967), 'Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis', *American Economic Review*, **57**, 415-426.

Blau F. D., Kahn L. M. (1996), 'International Differences in Male Wage Inequality: Institutions versus Market Forces', *Journal of Political Economy,* **104(4)**, 791-896.

Burkhauser R. V., Couch K. A., Houtenville A., Rovba L. (2004), 'Income Inequality in the 1990s: Re-forging a Lost Relationship?', *Journal of Income Distribution*, **12(3-4)**, 8-35.

Card D., Kramarz F., Lemieux, T. (1999), 'Changes in the Relative Structure of Wages and Employment: A Comparison of the United States, Canada and France', *Canadian Journal of Economics,* **32(4)**, 843-877.

Dinardo J., Fortin N., Lemieux T. (1996), 'Labor Market Institutions, and the Distribution of Wages, 1973–1992: A Semi-parametric Approach', *Econometrica*, **64(5)**, 1001–1044.

Dinardo J., Lemieux T. (1997), 'Diverging Male Wage Inequality in the United States and Canada, 1981-1988: Do Institutions Explain the Difference?' *Industrial and Labor Relations Review,* **50(4)**, 629-651.

Dustmann C., Johannes L., Schonberg U. (2007), 'Revisiting the German Wage Structure', *University of Rochester mimeograph.*

Freeman R., Katz L. F. (1993), *Working Under Different Rules*, Russell Sage Foundation, New York, NY.

Goldin C., Katz L. F. (2007), 'Long-Run Changes in the Wage Structure: Narrowing, Widening. Polarizing', *Brookings Papers on Economic Activity*, **2**, 135-167.

Goos M., Manning A. (2007), 'Lousy and Lovely Jobs: the Rising Polarization of Work in Britain', *The Review of Economics and Statistics*, **89(1)**, 118-133.

Gottschalk M., Joyce M. (1998), 'Cross-National Differences in the Rise in Earnings Inequality: Market and Institutional Factors', *The Review of Economics and Statistics,* **80(4)**, 489-502.

Grabka M., Shwarze J., Wagner G. (1999), 'How Unification and Immigration Affected the German Income Distribution', *European Economic Review*, **43**, 867-878.

Hammermesh, D. (1993), *Labor Demand.* Princeton: Princeton University Press.

Heilend F. (2004), 'Trends in East-West German Migration from 1989 to 2002', *Demographic Research*, **11(7)**, 173-194.

Katz L. F., Murphy K. M. (1992), 'Changes in Relative Wages, 1963-1987: Supply and Demand Factors', *The Quarterly Journal of Economics,* **107(1)**, 35-78.

Kohn K. (2006), 'Rising Wage Dispersion, After All! The German Wage Structure at the Turn of the Century', *Discussion Paper Series*, **2098**, IZA.

Krueger A.B., Pishcke J. (1995), 'A Comparative Analysis of East German and West German Labor Markets: Before and After Reunification', *National Bureau of Economic Research Comparative Labor Markets Series*, Chicago and London: University of Chicago Press.

Krugman P. (1994), 'Past and prospective causes of high unemployment', *Economic Review*, **79(4)**, 23-43, Federal Reserve Bank of Kansas City.

Launov A., Joachim W., Klasen S. (2004), 'Unemployment Benefits and Unemployment Rates of Low-Skilled and Elder Workers in West Germany: A Search Equilibrium Approach', *Discussion Paper Series*, **1161**, IZA.

Levy F., Murnane R. J. (1992), 'US Earnings Levels and Earnings Inequality: A Review of Recent Trends and Proposed Explanations', *Journal of Economic Literature,* **30(3)**, 1333-1381.

Nickell S., Layard R. (1999), 'Labor market institutions and economic performance', *The Handbook of Labor Economics*, Ashenfelter O. and Card D. (eds), Elsevier, Amsterdam.

Puhani P. (2003), 'A Test of the 'Krugman Hypothesis' for the United States, Britain and Western Germany', *Discussion Paper*, **03-18**, Center for European Economic Research.

Spitz-Oener A. (2006), 'Technical Change, Job Tasks and Rising Educational Demands: Looking Outside the Wage Structure', *Journal of Labor Economics,* **24**, 235–270.

Appendix

Table 6a Top Ten Occupations by Job growth in West Germany

Occupation	Skill percentile	Reason	Math	Lang	SVP	Str	Care
Mining Engineer, Metallurgist, Relat.	99	5.18	5.09	5.09	7.82	1.91	0
Financial, Administration Dept. Manager	99	4.88	4.63	4.63	8.25	1.13	0
Lifting Truck Operator	11	2.24	1.41	1.52	3.03	2.06	0
Garbage Collector	10	1.49	1.02	1.04	1.91	1.87	0
Police Inspector, Detective	81	3.13	2.04	2.79	4.25	1.96	0
Pre Primary Edu. Teach. Assoc. Pro.	80	5.00	4.00	5.00	7.00	2.00	1
Office, Hotel Related Cleaner	1	3.67	2.87	3.27	6.07	2.13	0
ComputerProfessional	95	4.62	3.85	4.62	7.08	1.38	0
Nursing Associate Professional	48	2.00	1.00	1.50	2.00	1.00	0
Electrical Engineer	93	5.13	5.13	5.13	7.93	1.67	0

Notes: Sample includes prime age males who were employed at least one week. The last six columns shows the job attributes and they are taken from the Meyer and Osborne (2005). Reason stands for "reasoning development". Math stands for "mathematical development". Language stands for "language use". And they all vary between 1 and 6. SVP stands for "specialized vocational training and it varies between 1 and 9. Str stands for "physical strength" and it varies between 1 and 5. Care stands for care work. And it can take value either 0 or 1.

Table 6b Bottom Ten Occupations by Job growth in West Germany

Occupation	Skill percentile	Reason	Math	Lang	SVP	Str	Care
Metal Molder, Coremaker	17	2.68	1.68	1.48	3.78	2.58	0
Metal Polisher, Tool Sharpener	21	2.62	1.46	1.27	3.85	2.31	0
Glazier	14	3.00	1.67	2.00	6.67	2.67	0
Ore, metal furnace, plant operators	21	4.00	2.00	2.00	6.00	2.00	0
Power production plant operator	56	2.89	2.19	2.19	4.53	2.42	0
Well Driller, Borer, related worker	67	2.76	1.59	1.47	4.41	1.06	0
Fruit, Veg. Nut Proc. Mach. Operator	4	-	-	-	-	-	-
Chemical Process Plant operator	50	-	-	-	-	-	-
Civil Engineering technician	47	4.00	3.00	4.00	5.50	1.50	0
Teller, other counter clerk	34	3.25	2.75	2.63	4.00	1.25	0

Notes: Sample includes prime age males who were employed at least one week. The last six columns shows the job attributes and they are taken from the Meyer and Osborne (2005). Reason stands for "reasoning development". Math stands for "mathematical development". Language stands for "language use". And they all vary between 1 and 6. SVP stands for "specialized vocational training and it varies between 1 and 9. Str stands for "physical strength" and it varies between 1 and 5. Care stands for care work. And it can take value either 0 or 1.

Table 7a Top Ten Occupations by Job growth in the United States

Occupation	Skill percentile	Reason	Math	Lang	SVP	Str	Care
Food counter, fountain (food prep. & service occupations)	7	2.10	1.40	1.30	2.30	2.50	0
Nuclear Engineers	98	5.33	5.06	4.97	1.94	1.78	0
Speech Therapists	56	5.00	4.67	5.00	7.33	2.00	1
Personnel, trainings and labor relations specialists	27	4.72	3.56	4.40	6.84	1.40	0
Computer Science Teachers	80	-	-	-	-	-	-
Animal caretakers	10	2.23	1.41	1.46	3.46	1.28	0
Mining Engineers	91	5.60	5.60	5.60	8.40	1.20	0
Physical therapists	98	4.00	2.75	3.75	6.75	2.50	1
Physicians' assistants	56	5.00	4.00	5.00	7.00	2.00	1
Business and Promotion Agents	83	-	-	-	-	-	-

Notes: Sample includes prime age males who were employed at least one week. The last six columns shows the job attributes and they are taken from the Meyer and Osborne (2005). Reason stands for "reasoning development". Math stands for "mathematical development". Language stands for "language use". And they all vary between 1 and 6. SVP stands for "specialized vocational training and it varies between 1 and 9. Str stands for "physical strength" and it varies between 1 and 5. Care stands for care work. And it can take value either 0 or 1.

Table 7b Bottom Ten Occupations by Job growth in the United States

	Skill percentile	**Reason**	**Math**	**Lang**	**SVP**	**Str**	**Care**
Brickmasons, stonemasons & tile setters	62	3.69	2.92	2.77	6.62	2.85	0
Paperhangers	37	3.50	2.33	2.33	6.67	2.00	0
Shoe machine operators	3	2.13	1.19	1.65	2.81	2.32	0
Railroad brake, signal and switch operators	60	3.00	1.00	2.00	6.00	3.00	0
Technicians	60	4.00	3.00	4.00	5.50	1.50	0
Marine and Naval Architects	100	5.33	5.33	5.33	7.33	1.67	0
Heat treating equipment operators	29	2.17	1.33	1.21	3.00	2.25	0
Supervisors, material moving equipment operators	69	2.24	1.41	1.52	3.03	2.06	0
Machinery maintenance occupations	27	3.63	2.63	2.75	6.13	2.00	0
Business, commerce and marketing teachers	79	-	-	-	-	-	-

Notes: Sample includes prime age males who were employed at least one week. The last six columns show the job attributes and they are taken from the Meyer and Osborne (2005). Reason stands for "reasoning development". Math stands for "mathematical development". Language stands for "language use". And they all vary between 1 and 6. SVP stands for "specialized vocational training and it varies between 1 and 9. Str stands for "physical strength" and it varies between 1 and 5. Care stands for care work. And it can take value either 0 or 1.