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A Comparative Analysis of East and West German Labor Markets Before and After Unification

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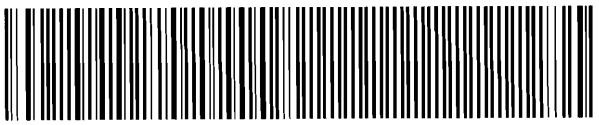

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A Comparative Analysis of East and West German Labor Markets Before and After Unification

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Abstract

This paper uses micro data to analyze the wage structures in East Germany and West Germany before and after unification. In 1988, the wage distribution in East Germany was much more compressed than in West Germany or in the U.S. Since the collapse of Communism and unification with West Germany, however, the wage structure in eastern Germany has changed considerably. In particular, wage variation has increased, the payoff to education has decreased slightly, industry differentials have expanded, and the white collar premium has increased. Although average wage growth has been remarkably high in eastern Germany, individual variation in wage growth is similar to typical western levels. The wage structure of east Germans who work in west Germany resembles the wage structure of native west Germans in some respects, but the experience-earnings profile is flat.

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The unification of East and West Germany provides a unique natural experiment to study a Soviet-style labor market undergoing a dramatic and rapid transition. Furthermore, the demise of the Communist regime in East Germany has enabled researchers to obtain large quantities of data collected during the Communist era for the first time. The availability of these data sets permits a detailed comparison of the operation of the labor market under different economic systems. In this paper we use several large micro data sets to compare the labor markets in East and West Germany before and after unification.

Specifically, we address the following questions: How did the income distributions compare in East and West Germany just before the collapse of East Germany? What factors determined wages in these countries? How has the transformation to a market-based economy affected the income distribution in eastern Germany? How do former East Germans who commute to work in west Germany or migrated to west Germany perform in the labor market? To provide another point of comparison for the wage structures, we also examine data for the U.S.

A number of observers have noted that East German physical capital is of little or no value. The main asset acquired by West Germany from unification is human capital. We therefore devote a great deal of attention to comparing educational levels and the value of education in East and West Germany.

Our main conclusion is that East Germans were well educated and received a substantial payoff to their education. Indeed, despite greater wage compression in East Germany, the rate of return to education was about the same in East and West Germany in 1988. After unification, the return to education fell slightly in eastern Germany. East Germans who commute to work in the west, have performed fairly well in the capitalist economy. Western unions have tried to impose a wage structure and bargaining structure on eastern Germany that mimics the western model. In some respects, we find that the wage structure of former East Germany is gradually approaching that of West Germany. Most significantly, wage dispersion has increased in eastern Germany, especially at the right-tail of the distribution.

The paper is organized as follows. Section I presents a brief summary of relevant institutional features of the East and West German labor markets and educational systems. Section II describes the data sets we use. Section III presents an international comparison of the wage structures in East Germany, West Germany, and the U.S., with particular emphasis on comparing the rate of return to schooling. Section IV examines changes that have taken place in the eastern German labor market since unification.

I. Labor Market Institutions

West Germany (FRG)

Collective bargaining is an essential labor market institution in West Germany[1]. German unions are generally organized nationwide along industry lines. The largest German labor union is the Deutscher Gewerkschaftsbund (DGB), which is an umbrella organization that includes 17 industry unions. Roughly 80 percent of all unionized workers are members of the DGB. Employers either bargain with the DGB member unions individually, or are members of a nationwide employer association that bargains on their behalf. The employer associations are also organized along industry lines. Although wage contracts are ultimately negotiated at the *Land* or plant level, the national unions publicize their wage demands, which then become a standard for other negotiations. The public sector and metal workers' unions are widely considered important pattern-setters.

A significant feature of the West German system is that it is possible for collective bargaining agreements to become "generally binding" for all employees and enterprises in an industry, regardless of whether they belong to the labor union or employer association. Either party to a collective bargaining agreement may petition the labor minister in the *Länder* to extend the contract to nonunion enterprises if more than half of employees in the relevant industry are employed by firms that were a party to the negotiated contract. Although only about one-third of German workers are union members, collective bargaining may affect as many as 90% of German workers because of contract extensions and spill-overs. Burda and Sachs (1988) note that the process of contract extension compresses regional wage differences.

Because a great many nonunion employees are covered by collective bargaining agreements, and because there is a good deal of spill-over even to nonunion workers who are not covered by legal contracts, the union-nonunion distinction is not particularly relevant in West Germany. As a consequence, researchers have found only a trivial wage differential between union and nonunion members in West Germany (see Schmidt, 1991). Due to the large role played by unions, one would

1) Our description of collective bargaining in West Germany draws heavily from Schmidt (1991) and Burda and Sachs (1988).

expect more wage compression and emphasis on seniority in West Germany than in a country with plant-level bargaining and weak unions, such as the U.S.

East Germany (GDR)

There was a great deal of centralization in the labor and product markets in East Germany[2]. All firms were owned by the state, and an elaborate plan directed the allocation of inputs, the distribution of outputs, wage levels, and prices. Only six broad compensation groups existed for production workers. Wage levels for these groups, however, varied by industry. But even within the wage groups there was extensive variation. Stephan and Wiedemann (1990) document that this variation was quite large and cannot be explained by the official wage norms, so that to some extent individual enterprises were able to deviate from the planned targets. Much of the "unplanned" variation comes from bonuses, which accounted for 6% of compensation, on average, in East Germany. Enterprises had more discretion over bonuses than over the base wage. East German workers were free to work for whichever firm they chose, but rationed housing may have frequently limited mobility.

East German plants were typically much larger than West German plants. Vortmann (1985) contends that East German enterprises used their discretionary power to attract the workers they needed. If an industry was at a disadvantage due to the wage targets specified in the government plan, firms could often circumvent the plan. Thus, the East German wage structure *should* exhibit some features that are common in western economies. Nevertheless, the Communist system operated like a large internal labor market, with rules and party membership playing an important role in the allocation of jobs and wages[3].

2) See Siebert and Schmieding (1991) for a discussion of the GDR economy, and of the restructuring effort under way.

3) This analogy has also been made by Vecernik (1991) in reference to Czechoslovakia.

A.The Educational Systems in Germany

Unlike the U.S., the German educational systems are characterized by a multitude of different kinds of schools, many of them offering alternative routes to a similar degree. Despite their common history, the education systems in East and West Germany have diverged significantly, making direct comparisons difficult. This section gives a basic description of the educational systems in the two Germanies. For more complete descriptions of the educational systems see Waterkamp (1987) on East Germany and Führ (1989) on West Germany.

West Germany

Figure 1 contains a tree-diagram outlining the education systems in East and West Germany. Primary school in West Germany starts at the age of six and comprises the first four grades. After grade four, the secondary school system branches into three alternative routes. The most basic branch (Hauptschule) lasts up to grade 9 (or 10 in some states) and combines general education with certain preparatory courses for more technical or clerical vocations. It is supposed to lead to a subsequent apprenticeship or vocational training. The middle branch (Realschule) has a different vocational focus than the Hauptschule, and offers a larger choice between liberal arts classes and courses with a more practical orientation. This branch ends after grade 10 and may lead to an apprenticeship, further education in vocational schools, or a switch into Gymnasium, which is the third branch of the secondary school system.

The Gymnasium is the most intellectually oriented track, and is designed to provide a thorough education in the liberal arts that prepares students for further academic training. Gymnasium ends after grade 13 with a general exam (Abitur) which serves as a prerequisite for access to the university system. The last two years of Gymnasium are roughly comparable to the first years of college in the U.S. Since the 1970s some states have introduced integrated secondary schools (Gesamtschulen) combining all the three branches and leading to the various secondary school degrees.

University training in West Germany is completely focused on the area of specialization and ends in a Diploma. The average time to completion was 6.9 years

in 1987 (Scheuer, 1990) and has increased even more since. In addition to academic universities there is another kind of post-secondary institution known as Fachhochschulen. These institutions offer a more practically oriented training usually in engineering or business disciplines; they are roughly comparable to professional colleges in the U.S. Furthermore, the courses of study are generally shorter than on universities (average length 4.4 years in 1987). Fachhochschulen can be entered after the 12th grade in Gymnasium or after completion of a Fachoberschule. The latter comprises grades 11 and 12 and can be entered with a Realschule degree or equivalent. It combines practical job oriented training in workshops with more general education.

Vocational training in West Germany consists usually of an apprenticeship in a business firm combined with part time schooling at a state run Berufsschule. Apprenticeships can last for two or three years during which apprentices earn a basic allowance from their employer. Berufsschule provides theoretical foundations for the profession in which an apprentice has trained as well as liberal arts education. A completed apprenticeship is prerequisite to many skilled jobs in industry, administration, and the service sector. Two to three years after completion trained workers can enroll in two year Fachschule which enables them to become master craftsmen in their field.

East Germany

Due to a series of reforms the educational system in East Germany is simpler. The main building block is the integrated Polytechnische Oberschule (POS), which is compulsory for everyone up to grade 10. Its quality and scope are generally regarded as comparable to the West German Realschule. Further secondary training is provided in the Erweiterten Oberstufe (EOS) for two more grades leading to the East German Abitur. Access to the EOS is conditional on grades and political factors. In addition, diversity in student representation based on social structure is a consideration in admission to the EOS.

Unlike in West Germany, admission to a university is conditional on an additional entry exam. Admitted are EOS graduates, graduates of Fachschulen (see below), young workers who completed a three-year apprenticeship with Abitur and graduates of the preparatory "Worker and Peasant Faculties" (see Glaessner, 1985 for details). These indirect routes to university serve the purpose of creating a student body that reflects the social structure of the population and are quantitatively much more

important than in the west. Since the seventies three quarters of the students seeking admission to a university have had some work experience or completed their military training. This has led to the gradual introduction of a one year practical training requirement for EOS graduates without professional training starting in 1976, basically lengthening their education by a year (Panorama DDR, 1983).

Admissions to the various fields are regulated by state plan reflecting the prospective needs of a profession. This planning was apparently not always fully effective: many university graduates were overqualified for their jobs in the seventies which led to a reduction in the number of admissions (Scheuer, 1990). This trend was reversed somewhat in the eighties. Most university programs in East Germany are designed to be completed in four years, a one year extension is only granted in exceptional cases. Only about three quarters of university courses are devoted to the major field of study, the rest is taken up by courses in Marxism-Leninism, languages, and sports.

Fachschulen in East Germany are post-secondary institutions comparable to the West German Fachhochschulen. They mainly trained engineers and technical experts, and since the 1970s they trained nurses. Fachschulen have three-year programs. They admit graduates of the EOS as well as young men and women with a completed practical training.

Like in the West, vocational training consists of a dual education combining an apprenticeship with vocational school (Berufsschule). These schools are usually part of the enterprise offering the apprenticeship. Most apprenticeship programs last two years.

II. Data Sets

The East German micro data used in this study come from the Survey on Income of Blue and White Collar Households in the GDR (Einkommensstichprobe in Arbeiter- und Angestelltenhaushalten). This is a cross-sectional survey that was conducted every two or three years by the Statistical Office of the GDR. The survey was intended to contribute "reliable information on the level and change of the incomes of blue and white collar households and about other aspects of the standard of living" in East Germany (Statistisches Amt, 1990). Aggregate results from the survey are published in the Statistical Abstract of the GDR and in other official

publications. We were able to obtain an IBM standard label tape containing the survey conducted in September 1988 from the former Statistical Office of the GDR. The survey was conducted in the year before the collapse of the GDR, and it is the last such survey taken before German unification. The survey contains data on 79,000 individuals in 28,000 households, or roughly 0.5% of the total population of the GDR. Krause and Schwarze (1990) provide an extensive description of the data set.

The survey contains detailed questions on various categories of income of individuals and households. In addition, the survey provides basic demographic and labor force information on each household member. Finally, a set of questions is asked about the households' ownership of cars and household appliances, such as televisions and dishwashers. A household is defined as an economic unit sharing income, and would include a household member who contributes to the household income but lives separately.

The sampling design of the survey is sufficiently different from typical household surveys conducted in western countries to warrant some elaboration. The basic sampling unit is not the residence of the household, it is the employer. Firms were selected by the central Statistical Office to participate in the sample to achieve a representative distribution across regions and industries. Within a selected firm a random sample of employees was drawn from payroll records. The household of the selected employee became a target household for the sample. The target respondent was contacted early in September 1988. At that time, the respondent received a record sheet similar to the questionnaire to prepare for the interview. The interviews took place at the end of September, and the respondent provided the information on all the members of the household (i.e., proxy responses). Earnings for the respondent, however, were supplied by the payroll office of the firm. The interviewer was supposed to have verified the firm-reported income amounts with the respondent and to supplement the payroll data if necessary[4]. Note that the individual that was interviewed may be someone other than the household head.

The firms selected for the sample comprise all state-owned enterprises, state-owned farms, and certain cooperatives in the trade sector. Excluded are other cooperatives, private enterprises, and joint ventures. Individuals working in such firms can still be part of the sample if they are members of the household of a target individual.

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4) The variance of earnings does not differ between self-respondents and proxy-respondents in the survey. Returns to education are slightly lower for proxy-respondents, however. Vortmann (1985) claims that the income levels for proxy-respondents are under reported.

A target household drawn within a sample firm was excluded from the sample if any one of the household members was currently a member of the armed forces or state security, or was a full-time employee of the party organization or other mass organizations like unions. A household was also excluded if the target respondent was an apprentice or working at her own home.

The sampling design leads to a number of problems. First, a household is more likely to be drawn for the sample if it has more earners. Thus, the sample is not representative of the households in the GDR and cannot be used for analyses of household characteristics. Secondly, the exclusion of certain sectors distorts the distribution of workers across industries. Despite these problems, we show below that the sample is reasonably representative of the employed population in East Germany[5].

To the extent possible, the income variables in the sample refer to monthly income during August 1988. Vortmann (1985) claims that this leads to some distortions in the income measure because August is unrepresentative with respect to sick time. Some sources of income, like employment bonuses and interest, accrue only on an annual basis. Respondents were asked to report annual income for 1987 for such categories, which we converted to monthly amounts by dividing by 12.

West Germany

For West Germany, we use the 1988 wave of the Socio Economic Panel (SOEP). The SOEP is a longitudinal survey of about 6,000 households that has been conducted annually since 1984. All household members 16 years old or older are interviewed directly; the survey follows sample members if they leave their original household. Proxy interviews are only utilized in rare cases. The panel deliberately over-sampled about 1,600 households with foreign-born individuals. We exclude this subsample from our analysis. Due to attrition, there were about 3,700 households left in 1988, with 7,600 interviewed individuals. The interviews for the panel are mainly conducted in March and April of each year. Most interviews were conducted

5) It is interesting to note that there are no missing values in the data set because individuals refused to respond to certain questions. However, the Statistisches Amt (1990) points out that the survey was voluntary. While the guidelines for the selection of respondents make provisions for the fact that complete refusals will occur, the Statistical Office does not provide statistics on the response rates.

by direct interviewer contact (about 60%); the remainder were conducted by mail and to a lesser extent by telephone.

The survey consists of a household questionnaire and separate questionnaires for each individual in the household. The questionnaires include a constant set of items asked in each wave. For the household these are questions concerning living quarters, household income and assets, and noninterviewed children. For the individuals information is collected on basic demographics, education, labor market participation, unemployment, earnings, taxes and social security contributions, time use, satisfaction with various aspects of life, health, and political preferences. In addition, there are topical modules on each wave.

Eastern Germany in Transition

In 1990 the SOEP initiated a special survey of the former East Germany, the so called SOEP-East. The first wave of the SOEP-East was conducted (mostly) in June 1990, just before the monetary union, and a follow-up survey was conducted (mostly) between March and May 1991. The first wave also included retrospective information on earnings in 1989. The sample consists of households drawn at random from municipalities in East Germany based on the Central Register of Population. A total of 2,179 households with 4,453 people over age 16 participated in the survey. Importantly, individuals were included in the follow-up survey even if they had moved to the western section of Germany. Although the SOEP-East was recently made available, the SOEP-West is not yet available for 1990 and 1991. We use the SOEP-East to examine the preliminary effects of the transition of the eastern German labor market.

United States

We use the March 1989 Current Population Survey (CPS) to estimate basic wage regressions and to describe the income distribution in the U.S. The CPS contains information on individuals in a sample of 56,500 households, one-quarter of which are asked questions on weekly earnings and union status. Weekly wages are examined for the U.S. and monthly wages for the Germanies. We suspect that wage dispersion in the U.S. would be even greater if monthly earnings were used instead

of weekly earnings because of variation in weeks worked. In some of our analysis, we also analyze the Outgoing Rotation Group Files for various years.

III. Distribution of Earnings and Returns to Education

We created samples of 18 to 65 year-old full-time, nonagricultural workers in East and West Germany and the U.S.[6]. For West Germany and the U.S. we also excluded self-employed workers. There are no self-employed workers in the East German data set. To the extent possible we have defined the variables to be comparable.

Table 1 reports means and standard deviations of the variables for each country. Mean earnings in East Germany were about 1200 Marks. The spread of the earnings distributions can be compared by looking at the standard deviations of log earnings and the interquartile ranges. Unsurprisingly, East Germany has the tightest distribution of earnings[7]. However, there is a significant spread in the distribution. The interquartile range of log earnings is 40% in East Germany, 50% in West Germany, and 75% in the U.S. The standard deviation of log earnings just for unionized workers in the U.S. is about the same as for all of West Germany (.41 vs. .44). Relatively tight earnings distributions are a feature of both parts of Germany. Figure 2 presents a graph of Kernel density estimates of the earnings distributions of male household heads. To make units comparable, all distributions have been shifted so that the median worker earns
the same amount in East German Marks in all countries. The West German and U.S. distributions exhibit greater positive skewness than the East German one.

6) We focus on full-time workers because our earnings data for the Germanies pertain to the monthly wage, and hours worked will greatly affect the amount of monthly income for part-time workers.

7) Atkinson and Micklewright (1991) and Vecernik (1991) find that the wage distributions were more compressed in the socialist economies of Czechoslovakia, Hungary, Poland, USSR, and Yugoslavia than in the U.K. and Austria in the late 1980s. They also find significant differences in the wage structures among eastern block countries, and different trends over time. The East German wage structure is compressed even by east block standards. See Bergson (1984) and Brown (1977) for earlier analyses of wage structures in Soviet-style economies.

Some caution should be exercised in comparing income distributions between the three economies[8]. First, the income measures are gross of taxes. The income tax system in East Germany was only moderately progressive with a maximum average tax rate of 20 percent for incomes above 15,120 Marks. West Germany, on the other hand, has a highly nonlinear tax schedule with an increasing marginal tax rate up to a maximum income of 130,032 DM in 1988. Thus, the tax system is rather progressive, and the net income distribution would be quite a bit tighter. We do not attempt to calculate net incomes since the tax system makes it hard to attribute taxes to husbands and wives in multiple-earner families.

A second difficulty is due to nonpecuniary benefits of employment. According to anecdotal evidence, one means of transferring additional resources to individuals favored by the East German regime was through greater access to goods. For example, a physician who was regarded as important would be given a house far below the normal cost. Valuing such transfers is difficult because often there was no market for comparable goods. Transfers in kind are not captured by our data, and their inclusion probably would increase the right-tail of the income distribution[9]. Nonpecuniary benefits are also omitted in our analysis of the West.

The third difficulty involves relative prices. Necessities were substantially subsidized in East Germany. For example, rent for a one bedroom apartment was some 75 Marks a month (6% of the average salary), a local bus ticket 20 Pfennigs, etc. On the other hand, luxuries were comparatively expensive, e.g., a Czech Skoda car cost 25,000 Marks. Therefore, in terms of real consumption possibilities, earners at the lower end of the distribution spent relatively much of their budget on necessities and were comparatively better off in East Germany than in the western economies. The opposite is true for the rich. Hence, the "real" income distribution in East Germany was much tighter than suggested by our measures of nominal income.

This last difference between the Germanies, which should be the most important concern, has evaporated with the monetary union beginning July 1990. Since wage contracts were converted to West German marks at a rate of one to one, the 1988 income distribution would have approximately characterized the situation at the beginning of the transition process. With the major exceptions of rents, the prices

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8) Hauser (1991) presents a careful discussion of problems in making distributional comparisons between East and West Germany.

9) We have estimated Engle curves for cars and other consumer durables in East Germany. These results indicate that, despite rationing, income was an important determinant of consumption.

and availability of goods changed quickly after monetary union. Hence, thinking of the distributions as characterizing the situation in the Germanies on the eve of political union in October 1990 is a plausible exercise. (The average exchange rate in 1991 was 1.66 D-Marks per U.S. dollar.)

Return to Table 1. The similarities between the Germanies are even more striking when comparing the family income distributions. The table reports log standard deviations for total family income. They are computed for the families in the sample with at least one full-time worker. This is the only group for which the East German data are roughly representative. The estimates indicate that family incomes in the two Germanies have a very similar level of dispersion. West Germany stands out as the only country where family income is less variable than individual earnings. Apparently, incomes between spouses there are strongly negatively correlated. Importantly, female labor force participation in West Germany is quite low (49.6% in 1988) compared to the U.S. (65%) and especially East Germany (81%).

Rate of Return to Schooling

Table 1 reports the distribution among five education categories. The results for East Germany correspond closely to the counts from the Labor Markets Monitor, the first labor market survey conducted in the new states after unification (see Bielinski and von Rosenblatt, 1991). As described in the Appendix, we constructed a continuous years of schooling variable using information on individuals' highest degree and post-secondary training. We present evidence below that our linearization works well in practice.

According to our continuous education measure, on average, workers in East Germany spend slightly more years in school than their counterparts in West Germany. This is primarily due to the importance of Fachschulen which were attended by 19 percent of East German workers, whereas only 6 percent of West Germans attended Fachhochschulen. The somewhat surprising finding that a larger fraction of the East German population has technical or academic training has also been observed by others. Scheuer (1990) attributes this to the fact that occupations like nurses are trained at the East German Fachschulen. Since we included them in the West German count for the "technical school" category we can discard this explanation. Enrollment in higher education grew rapidly in East German after World War II, but levelled off in the 1970s and 1980s; enrollment in higher

education in West Germany grew considerably in the 1970s and 1980s, surpassing the East German level.

We estimated standard ordinary least squares log-earnings regressions using either the unrestricted education dummies or the linear years of schooling variable. The results are shown in Table 2a. Surprisingly, the estimated rate of return to a year of schooling is the same in both parts of Germany: 7.7 percent higher earnings per year of schooling. This is in contrast to Schwarze (1991a, b), who reports a much lower return to education for men in East Germany (about 5.6 percent using this data set). Lower returns to higher education in East Germany than West Germany are also reported by Stephan and Wiedemann (1990) in a study of payroll data for 1988. Notice that our unrestricted dummy variable specifications (columns 2 and 4) also find a lower return to post-secondary education in East Germany.

How can these seemingly conflicting results be reconciled? Most importantly, higher education in West Germany takes longer than in the east. In 1987, the average university graduate took 6.9 years to complete his or her degree in the west while most graduates in the east finished in four years. But the higher education groups -- technical school and university -- are the groups that have the most pronounced differences in relative earnings between the east and the west. However, our conclusion is that the higher returns to these degrees in the west are just due to longer schooling, not to higher returns per year of schooling. Schwarze (1991a), on the other hand, mechanically assigns the same number of years of schooling to similar groups for both the east and the west. His results therefore have to reflect our dummy variable results.

We consider the continuous schooling measure more informative. For East and West Germans, a year of schooling means a year of foregone earnings, so in this respect the schooling coefficient is a measure of the return on a comparable investment[10]. There were no fees for higher education in either country. From this perspective, young Germans faced similar budget constraints in both parts of the country. The structure of the East German labor market apparently did not provide major disincentives for higher education, which is also borne out by the finding of similar mean years of education.

Furthermore, we provide some evidence in Figure 3 that the earnings-schooling relationship is indeed approximately log-linear in both parts of Germany. The figure displays the coefficients on dummy variables for each possible value the schooling

10) This is one of Mincer's (1974) essential insights.

variable can take[11]. The graph also shows the lines corresponding to the OLS regression estimates for the continuous schooling measure. The linear specification reflects the unrestricted earnings-education relationship rather well.

Finally, the continuous schooling measure allows a comparison with the U.S., which is shown in column (5) of the table. The rate of return to schooling in the U.S. was greater than 9 percent in 1989, almost 2 percentage points above the Germanies. The payoff to a year of education was unusually high in the U.S. in the late 1980s, but even in more typical years the payoff to education was probably higher in the U.S. than in the Germanies. Given the high cost of college tuition in the U.S., it is not surprising that the payoff to a year of education is greater in the U.S. than in the Germanies.

That we observe more schooling on average for the East German sample than for West German sample, of course, does not mean that the East Germans are necessarily better educated. The numbers may, for example, reflect that formal education has been more important in the east while there is more upgrading of skills on the job in the west. This is consistent with the much higher return to experience in West Germany (4 percent in the first year compared to 2 percent in the east). Notice, however, that the experience profiles in West Germany are also steeper than in the U.S.

Figure 4 presents a plot of age-earnings profiles estimated with dummy variables for three-year age groups in the two Germanies. Profiles for unskilled workers and university graduates are shown separately. Especially for unskilled workers, the East German profile is essentially flat. Figure 5 presents age-earnings profiles for men in the Germanies and the U.S. Again the much lower returns to work experience in East Germany are apparent.

The R^2 of the regressions in Table 2a are higher for West Germany than for the U.S. This is not surprising since there seems to be more emphasis on formal educational attainment and seniority compared to individual performance in German compensation systems. But the R^2 is highest for West Germany, around 45 percent, compared to 41 percent for the east. Thus, even in East Germany there is a good deal of earnings variation left over after accounting for the standard human capital factors. The system apparently left enough room for industry, firm, or individual specific factors to influence compensation significantly.

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11) There are nine points shown for East Germany despite the fact that education is only coded in six separate levels. Recall that additional values were created for university graduates under 30. We also separate out physicians since medical school requires an additional year of study.

It is useful to summarize this information with the following ANOVA table for the models in columns 1,3 and 5 of Table 2a:

ANOVA for Simple Earnings Regressions
Men and Women

	East Germany	West Germany	U.S.
Total variance	0.099	0.192	0.278
Explained variance	0.041	0.088	0.091
Residual variance	0.058	0.105	0.187

Although the total log-earnings variance in West Germany is twice that of the east, the same pattern emerges. Slightly less than half the variance is explained by standard human capital factors. This contrasts with the U.S. where the human capital variables explain about the same amount of earnings variance as in West Germany. The larger total variance in the U.S. is entirely due to the higher residual variation.

Table 2a also includes a dummy indicating gender; women receive 25 to 30 percent lower earnings than men in all three countries, other things held constant. Tables 2b and 2c report separate wage regressions for men and women. The estimated return to education is greater for women than men in all three countries.

Experience profiles differ little for men and women who work full-time in East Germany: they are flat in both cases. This contrasts sharply with the western countries where women's profiles are flatter than men's. One may suspect that this is related to the fact that labor force attachment of women is much greater in East Germany than West Germany. On the other hand, the U.S. has a female labor force participation rate that is much higher than West Germany's, but even greater expansion in the male-female wage gap with experience.

Thus, although the average male-female wage gap is about the same in both parts of Germany (25 percent), the gap varies substantially depending on education and experience. The following table summarizes these results.

Earnings Differential Between Men and Women

Years of Schooling	Years of pot. experience	East Germany	West Germany	U.S.
10	10	0.286	0.236	0.282
10	30	0.282	0.312	0.470
16	10	0.202	0.194	0.174
16	30	0.198	0.270	0.362

Table 3 reports some further regression estimates adding additional regressors. Columns (1) and (3) add dummy variables for marital status and marital status interacted with gender. There is little effect of marital status on the earnings of either men or women in East Germany while both West Germany and the U.S. have a large earnings differential between married men and women.

In column (2) we add a number of additional variables available on the East German data set. White collar employees earn about 4 percent more than blue collar workers. This contrasts with the large effects for the western countries (on the order of 20 percent), and is probably a reflection of communist ideology against white collar labor. Additionally, we find a 15 percent premium for workers who work on late shifts in East Germany. Such a positive premium has proved difficult to find with cross-sectional micro data for western countries, and may reflect the emphasis on rules in the socialist system.

In summary, these regressions document several differences between the East German, West German, and U.S. wage structures. Nevertheless, the results are supportive of Brown's (1977, p. 43) conclusion based on casual evidence: "The white-collared apart, the most remarkable feature of the comparison between Soviet-type and Western pay structures is their extent of similarity."

IV. The Eastern German Labor Market in Transition

The wage-setting institutions in eastern Germany have undergone a rapid and dramatic transformation. On midnight of June 30, 1990, formal monetary union took place. At this time East German wage contracts were converted to West German marks at a rate of one for one, and the legal, tax, and social insurance systems in the two Germanies were harmonized. In the month following monetary union, the East German economy sunk into a deep depression, with industrial output quickly falling to roughly half its 1989 level (see Akerlof, et al., 1991). Since the collapse of East Germany in late 1989, employment fell from 9.2 million in 1989 to 7.1 million in July 1991[12]. Unemployment increased from around 1% of the labor force to over 10% of the labor force. And even these numbers understate the extent of employment adjustment because a substantial number of employed workers who were put on short-time hours *(Kurzarbeit)*, early retirement, and public works jobs (see Bellman, et al., 1992).

Even before the monetary union, West German unions aggressively organized East German workers. In early 1990 the West German unions achieved remarkable success in organizing East German workers, in part because the old East German Communist unions were completely discredited. The structure of unions in eastern Germany is now similar to that in the west: unions organize and bargain along *Land*/industry lines, although some contracts are being negotiated for all new *Länder* simultaneously. The first round of bargaining in the summer of 1990 yielded mostly lump-sum wage increases. However, in some industries (e.g. chemical) large percentage base wage increases were negotiated. The construction industry immediately tied wages in the east to about 60% of the western level. Contracts were generally written for short time periods. Like in the west, the eastern unions have sought to prevent contract wages from varying with the performance of individual firms.

The second round of negotiations was held in the winter of 1990-91. In this round many sectors agreed to tie wages to a specified proportion of the western level, and schedules were set to gradually achieve parity with the west in 1994 or 1995. There is tremendous variance in the east-west wage ratio across industries. For example,

12) An estimated 400,000 workers migrated to the west or commute to work in the west. They are not included in these figures.

cleaning services in East Berlin pay 100% of the West Berlin level, while the eastern textile industry pays 43% of the western level. Most contracts set base wages at 50% to 60% of the western level. This exaggerates take home pay in the east, however, because bonuses and fringe benefits are much lower or nonexistent in the east. Furthermore, work hours are longer in the east and vacation time is shorter. Bispinck, et al. (1991) calculate that metal workers in Saxony earn 44.8% of the hourly wage of Bavarian metal workers, although the base wage is formally set at a 58.6% level. Many general contracts (Manteltrarifverträge) were also written in 1991. These contracts set general wage structures for a handful of skill levels. Workers were thereby classified into skill groups, causing some friction. Notably, in the public sector unions initially negotiated a contract that completely eliminated seniority pay. Workers went on strike against this contract, and it was subsequently modified. We also note that several firms are believed to not pay negotiated contract rates.

Another critical development in the east is the process of privatization, carried out by the Treuhand. As of November 1991, the Treuhand sold about 25% of East German companies to private concerns, and was subsidizing a sizable proportion of the remainder (see *The Economist*, March 21, 1992, p. 71). The Treuhand closed down only about 6% of east German companies. Akerlof, et al. contend that managers of Treuhand-operated firms have had little incentive or ability to resist union wage demands, which is partly responsible for the fast growth of eastern wages.

A. Results

One question that immediately arises in studying the economic transformation of the East German labor market is, how should the East German labor market be defined after unification? We choose to define the labor market based on geographic location. Thus, former East Germans who migrated west or commute to work in the west are not included in our sample of eastern Germany. As a practical matter, this is of little significance because migrants and commuters make up only about 0.5% of our sample[13]. On the other hand, it is instructive to study former East Germans

13) If we include the commuters and migrants in a wage regression using 1990 data, when they were observed in eastern Germany, their average residual is 0.12. Given the small number of commuters and migrants, this finding suggests that they would not have had a large influence on the estimated regression, had they remained in eastern Germany.

who we observe working in the western part of Germany separately. These workers provide a rough indication of how former East Germans would fare in the West German labor market, although one must be concerned about selective migration and commuting.

Since so many east German workers were placed on short-time hours (18% of our sample in 1991), we include short-time workers in our analysis. The German government subsidized short-time workers so they earned 63% to 68% of their previous pay. Firms were supposed to add another 22% to their pay, bringing short-time workers' pay up to 85%-90% of their previous level. In our sample, workers on short-time worked 32.8 hours per week, on average, compared to 43.1 hours for workers on regular-time hours.

B. Wage Growth and Dispersion

We first turn to the growth of wages, which Akerlof, et al. (1991) and others identify as the main source of the eastern German depression. Table 4 summarizes the rise in earnings in East Germany since 1988. The table is based on the Survey of Blue and White Collar households for 1988, retrospective earnings data from the SOEP-East for 1989, and current wage reports from the SOEP-East for 1990 and 1991. In spite of splicing together different wage series, the 1988 and 1989 data (both years before unification) are remarkably similar, suggesting that the data are comparable. East German wages grew rapidly between 1989 and 1991. (The CPI increased by about 6% between 1988 and March 1991, so these wage changes can be thought of as mostly real changes)[14]. Between 1989 and 1990 the average wage increased by 12.5%, and between 1990 and 1991 it increased by another 22.8%. Over the period 1989-1991 wages grew by 38.3%. This growth is even more impressive in view of the fact that nearly one-fifth of workers were placed on short-time hours.

In spite of dramatic growth, wages in the east are still only about 40% of the west German level. Nevertheless, the east German real wage growth is a marked contrast

14) One cautionary note is that, although the average CPI was relatively stable between 1988 and 1991, there were wide differences in the rate of inflation for many goods. For example, rental costs jumped 58% in January 1991, while food prices increased 15%, clothing and shoe prices decreased 30%, and furniture prices decreased 20% between 1989 and January 1991. The rapidly changing prices of consumer goods are likely to have distributional consequences that go beyond changes in the wage structure.

to that of other former East-block countries. For example, in the last quarter of 1991 real wages were lower by 43% in Bulgaria, 26% in Czechoslovakia, 8% in Hungary, 0.2% in Poland, and 20% in Romania relative to their 1990 level (see Boeri and Keese, 1992). The unique relationship between eastern and western Germany has clearly cushioned the transition to a market based economy for East Germany.

For the subsample of individuals who were working in both 1990 and 1991, earnings grew by 24 percent. Using longitudinal data from the SOEP-East, we can decompose the variability in individuals' log wage growth between 1990 and 1991 according to the type of job change using the formula:

$$\sigma^2 = \Sigma \left[p_i\sigma_i^2 + p_i(\mu_i-\mu)^2 \right]$$

where σ^2 is the total variance of the change in log wage, σ_i^2 is the variance of the change in log wage for group i, p_i is the fraction of the sample belonging to group i, μ_i is the mean wage change for group i, and μ is the change in the grand mean.

Table 5 contains the results of this decomposition. The overall variance in log earnings growth for individuals in East Germany (.056) during this period of dramatic transformation is lower than the level Abowd and Card (1989) report for the U.S. (over 0.12), but higher than the typical level that we find for West Germany using the SOEP for 1984-89 (0.036)[15]. (In terms of standard deviations, the figures are: 0.24 for eastern Germany, 0.35 for the U.S., and 0.19 for West Germany.)

Nearly 85% of employed East Germans in 1990 and 1991 remained employed by the same firm, and 77% remained on the same job. Ten percent of east German workers reported changing jobs without any intervening unemployment. Over two-thirds of the total variance in log earnings growth is due to individuals who remained on the same job. Job-changers who did not suffer intervening unemployment contributed 20 percent of the total variance.

Looking cross-sectionally, it is clear from Table 4 that earnings variability increased in eastern Germany following unification. The variance of the level of monthly earnings (in DM) increased each year since 1988, and was 150% greater in 1991 than in 1988. Notice also that the coefficient of variation of earnings increased from 0.30 to 0.35, in spite of the large increase in mean earnings. However, the standard deviation of log monthly earnings shows no clear trend. The level of wage dispersion in eastern Germany still has a long way to go before it reaches the West

15) The U.S. figure is based on log annual earnings.

German level, however. In West Germany, the coefficient of variation of monthly earnings was consistently around 0.44 between 1984 and 1989.

Table 6 gives the ratio of various percentiles of the earnings distribution relative to the median for eastern Germany, West Germany, and the U.S. in selected years. The wage distribution in eastern Germany was notably stable between 1988 and 1990, but the top 20 percent of wage earners gained significantly on the median earner in 1991. The increase in earnings dispersion in east Germany occurred mainly at the upper-tail of the wage distribution. On the other hand, the wage structure in West Germany was conspicuously stable in the 1980s, especially compared to the U.S.

To explore changes in the east Germany wage structure further, Figure 6 presents a graph of earnings growth between 1988 and 1991 for each percentile of the earnings distribution. That is, the figure gives the percentage wage increase for a worker occupying each percentile of the wage distribution in 1991 relative to a worker occupying the same percentile of the distribution in 1988. It is quit clear that the increase in earnings variability occurred primarily because of an expansion of the right-hand tail of the distribution: the top 10% of the wage distribution had extraordinary income growth. Recall that Figure 2 showed that the right-hand tail of the East German wage distribution in 1988 was unusually short compared to West Germany and the U.S.

The left-hand tail of the eastern German wage distribution experienced about average wage growth after unification. This finding is significant because one may suspect that the Communist government in East Germany artificially raised the earnings of low-income workers, and that the move to a market economy would have had a greater effect on the low-wage earners. There are two explanations for why the low-wage earners were not especially hurt by unification. First, Figure 2 indicates that there was not a great disparity in the left-hand tails of the wage distribution between East and West Germany just before unification. Second, after unification union contracts and government policies may be maintaining low-skill workers' wages above their equilibrium level in eastern Germany. As shown below, the fact that the unemployment rate is now much higher for less-educated workers in eastern Germany suggests that there may be some merit to this view. Table 7 investigates the extent of year-to-year mobility in workers' earnings in eastern and

western Germany[16]. Workers are cross-classified by quintile of the earnings distribution each year. There is greater earnings mobility in eastern Germany than western Germany, especially for workers in the middle of the earnings distribution. In 1991, nearly 40% of the top fifth of wage earners in eastern Germany were not in this income class in the preceding year, whereas in West Germany only about 13% of workers joined the top 20% in a typical year.

In Table 8 we summarize the characteristics of the top 10% of wage-earners in eastern Germany in 1991, the group that has undergone the most significant change in relative earnings since unification[17]. Compared to the rest of wage-earners, the top 10% is much more likely to hold professional or executive positions, to have higher education, to work in private firms, to live in a large city (e.g., Berlin, Leipzig, Dresden), to be self-employed, and work in a newly founded firm. These are characteristics that are associated with top wage-earners in the West. About half of workers in the top 10% of the wage distribution in 1991 were in the top 10% of the wage distribution in 1990. Earnings grew by over 50% between 1990 and 1991 for the top 10% of earners, compared to 25% for all others. Since the top 10% of wage earners still have some distance to go until they are as relatively successful in the east as in the west, the evolution of this group would be especially interesting to track in the future.

C. Wage Regressions For Eastern Germany

Table 9 presents simple wage regressions using each cross-section of the SOEP-East survey. For comparison, the first column reports estimates for East Germany in 1988, and the second column reports estimates for West Germany in 1988. The 1988 East German survey yields coefficient estimates and an R-square that are very close to the SOEP-East for 1989, again suggesting that the 1988 East German survey is reasonably representative of the work force[18].

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16) Because more recent data are not available, we use data for 1988 and 1989 for West Germany. Mobility was only slightly higher between 1984 and 1985, which was a recessionary period in West Germany.

17) We included self-employed workers in Table 8 because of interest in entrepreneurship. Self-employed workers are excluded from all other results.

18) Oddly, the experience profile is steeper in 1989 than 1988. Upon further investigation, we found that this result is due to a few outliers with low experience. The other coefficients are not

There are a number of interesting changes in the wage structure in East Germany between 1988 and 1991. First, the rate of return to education fell from .077 to .062, suggesting that education attained under the Communist system is somewhat less valuable in the transitionary period. Official government statistics on earnings, which are summarized in Figure 7, also show fairly stable educational differentials[19]. According to these data, earnings increased by between 31% and 37% between 1988 and July 1991, depending on educational level. Workers with no training experienced the most earnings growth, followed by university graduates.

Second, the already flat experience profiles in East Germany have become slightly flatter by 1991. We also find very low returns to seniority. Evidently, experience in the Communist labor market is now of less value. Third, the male-female wage gap has narrowed. The labor force participation rate for women in East Germany fell, moving it in the direction of west German women, but the rate fell by almost as much for men. Fourth, the explanatory power of the regressions has dropped considerably, with the R^2 falling from 41% to 28% between 1990 and 1991. Finally, the residual variance increased by 47% (from .050 to .074) between 1990 and 1991. These findings suggest that there have been major changes in the valuation of individuals' characteristics since unification.

In other specifications, we have added a dummy variable indicating whether a worker is on short-time hours, and a dummy indicating white collar status. Workers on short-time hours earn about 23% less (t-ratio = -12) than full-time workers, other things being equal. This differential is about what one would expect since firms are required to supplement short-time workers' pay to 85% to 90% of their previous level. Including the short-time dummy reduces the return to education slightly and increases the male-female wage gap by about 4 points.

Interestingly, white collar workers in the east now earn an 11% wage premium over blue collar workers (t-ratio = 6.2). This may be contrasted with the 4% white collar premium in East Germany in 1988, and the 19% premium in West Germany in 1988 that we document in Table 3. As far as white collar work is concerned, the wage structure in east Germany is approaching that in the west. We have also examined the evolution of industry wage differentials in eastern Germany. Specifically, we added (broad) industry dummy variables to the wage regressions in Table 9, and estimated industry wage differentials for East and West Germany. We

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greatly affected if these outliers are deleted.

19) The underlying data are from Bielinski, et al. (1991) and our tabulations of the 1988 East German survey.

then took deviations of each industry coefficient from the average, assigning a differential of 0 to the omitted industry. To illustrate the evolution of industry wage differentials in eastern Germany relative to those in western Germany, Figure 8 presents graphs of the east Germany differentials in 1990 or 1991 versus the West German differentials in 1988[20]. The figures are striking. In 1990 east German industry wage differentials were extremely compressed, ranging less than 15% from highest to lowest paid industry; in West Germany the range was nearly 40%. Moreover, the correlation between the east and west German industry wage differentials was statistically insignificant in 1990.

By 1991, the east German industry wage differentials were far more dispersed, with a range of 40% between the highest and lowest paid industry. Finance, insurance and real estate increased its position relative to the mean industry by 25 percentage points, while relative pay in the service industry fell by 10 points. Moreover, the pattern of industry differentials in eastern Germany now more closely resembles the west German pattern. The rapid change in the eastern inter-industry wage structure is probably due, in large part, to German unions' success in negotiating industry-level contracts that follow a similar pattern to western contracts.

D. Easterners Who Work in the West

A small number of eastern Germans surveyed in the SOEP-East migrated to the west since the initial wave of the survey was conducted[21]. For a sample of 20 migrants we have complete wage and demographic information. An additional 97 sampled individuals work in the west but live in the east. These 117 easterners who work in the west have virtually the same level of education as easterners who work in the east, but are about 8 years younger, are much more likely to be men, are less likely to hold white collar jobs (37% vs. 53%), and have much lower tenure (.8 vs. 11 years). Bielinski and von Rosenbladt (1991) estimate that 28% of commuters received on-the-job training in a 3 month period in 1991, as compared to 17% of those who do not commute.

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20) We use 1988 West German data because 1991 data are not yet available. The West Germany industry wage structure is very stable over time, however. For example, we find that between 1988 and 1989 the correlation in the industry differentials for West Germany was .95. See Helwege and Wagner (1991) for a comparison of industry wage differentials in the U.S. and West Germany.

21) See Akerlof, et al. (1991) for a landmark study of migration between eastern and western Germany.

The average easterner who works in the west earns 2,990 DM per month, which is 83% more per month than the average for easterners who work in the east, but about 15% less than the average west German. The relatively small gap in earnings between easterners who commute or migrated to the west and native west Germans is noteworthy because the commuters/migrants have extremely low tenure and do not possess other observable characteristics that are particularly highly rewarded in the west German labor market.

Column 6 in table 9 presents the estimated log-earnings equation for the small sample of eastern Germans who work in the west. Although the estimates are extremely imprecise, they reveal some interesting patterns[22]. First, the return to education for workers who were educated in the east but work in the west is relatively large (.065). Although some caution is warranted because of the sampling variance, this finding nonetheless suggests that the high level of education east Germans received under the Communist system will receive a reasonable payoff as the east approaches a western-style market economy. Second, the experience profile is virtually flat, again suggesting that work experience gained under the Communist system is of little value. Third, the male-female wage gap is greater for easterners who work in the west. Finally, the residual variance in earnings is quite close to the level for West Germany in 1988.

E. Unemployment

An important issue in addition to wage structure changes concerns the evolution of unemployment in east Germany. Unemployment in east Germany soared after unification, as it has in other former East-block countries. The probability of being unemployed in east Germany is inversely related to education level. We calculate that in 1991 the unemployment rate was 6% for university graduates, 2% for master craftsmen, 10% for workers with apprenticeship training, and 33% for workers with no post-secondary training. There was hardly any unemployment in 1988 in East Germany. The unemployment rates by education level in West Germany are much lower, especially at the low-end of the education distribution. For example, Abraham and Houseman (1992) find that the unemployment rate in West Germany for workers with no post-secondary training in 1989 is 11.6%. We also find that the unemployment rate is almost twice as high for women than men in east Germany

22) In preliminary work, we have found qualitatively similar results for a larger sample of commuters using data from the 1991 Labor Markets Monitor survey.

(13% versus 7.6%), and that the probability of being unemployed increases with age.

If the unemployed are very different from the employed in terms of unobserved characteristics, truncation bias may affect our regression estimates. On the other hand, this may not be a tremendous problem because much of the unemployment is due to plant closings and mass layoffs, which affect a wide cross-section of workers. Furthermore, we find that the results are qualitatively similar if we estimate the regressions for eastern Germany using just the subsample of individuals who were continuously employed between 1989 and 1991. This finding suggests that the differences in the wage structure that we document between 1989 and 1991 are not due to the changing composition of the samples.

VI. Summary and Conclusion

We can summarize our main conclusions as follows.

(1) In 1988 the wage structure was more compressed in East Germany than in West Germany, even though West Germany has low wage variability by U.S. standards.

(2) In spite of the considerable wage compression in East Germany, education was relatively highly rewarded. Wage differentials based on education were fairly similar in East and West Germany. Furthermore, East Germans who migrated to western Germany after the collapse of East Germany appear to earn a comparable return to their education as native West Germans. Since East Germans are highly educated, this finding suggests that the unified Germany will have considerably more human capital.

(3) Average earnings of eastern Germans grew rapidly following unification -- by as much as 30 to 40 percent. Surprisingly, this great leap in wages occurred without unusually high variability in earnings growth across individuals. The cross-sectional variance in earnings growth in eastern Germany in 1990-91 was below the typical level for the U.S., but above the typical level for West Germany.

(4) Wage regressions for 1990 and 1991 already show signs that the East German wage structure is quite different than it was in 1989. White colar workers in eastern Germany now earn a substantial premium, although not as large a

premium as white collar workers earn in the west. Similarly, the industry wage structure in eastern Germany is approaching the West German structure. The remarkably low level of dispersion in earnings that we documented for East Germany in 1988 is gradually increasing, primarily because the right-tail of the distribution is stretching out. In addition, experience profiles have flattened out, suggesting that work experience gained under the Communist system is now of little value.

(5) Eastern Germans who are observed working in western Germany earn almost as much as native West Germans, and with the major exception of work experience, they appear to earn similar payoffs to their characteristics as West Germans.

(6) The wage structure in eastern Germany, however, still has a long way to go until it mirrors the wage structure in western Germany. In particular, we expect that it will be a long time until the experience-earnings profile becomes as steep in east Germany as it is in west Germany. Although wages served mainly a book-keeping function in the former East Germany, they now serve as signals to firms and workers. The impact of the remaining differences in the wage structures on migration and capital flows between eastern and western Germany seems to us to be a worthy topic of future study.

We think the facts documented in this paper are consistent with the view that German unions and government policies have maintained wages of low-skill workers above their current equilibrium level. Unions have imposed a wage structure that more closely mirrors the western wage structure. Government policy has protected low-skill workers. The *Treuhandanstalt* has pursued a policy of deliberately seeking new owners who would maintain employment, and the introduction of West German labor law has made it difficult to layoff workers or to deviate from union contracts. As a consequence, after unification high-income earners improved their position relative to middle-income earners, but low-income earners did not lose any ground relative to middle-income earners. The unemployment rate soared for low-skill workers, suggesting that employers demand for low-skill workers is low given their required compensation.

Appendix

Derivation of Years of Schooling

For the U.S., years of school completed is collected directly in the Current Population Survey. For East Germany and West Germany, years of schooling must be inferred from the worker's degree.

Education in our 1988 East German survey is measured in six discrete categories. The groups are: less than 10th grade, completed 10th grade at a POS, apprenticeship training, master craftsmen, technical school (Fachschule), and university. Unfortunately, this is a rather coarse grouping; in particular, secondary school degrees and post-secondary qualifications are not coded separately. We report results with four education dummies as well as for a continuous schooling measure. The latter measure was constructed as follows. Nine years of schooling were assumed for workers who did not complete school, ten years if 10th grade were completed. The first group is rather unimportant and was lumped together with the second in the dummy variable regressions (this will be the base group). Two years of apprenticeship training was assumed although a basic allowance is paid during this time by the employer. Four years of training was assumed for master craftsmen. Technical school lasts for 3 years and requires completion of the EOS or a two year practical training yielding a total of 15 years of education. Finally, university courses last usually four years beyond EOS, yielding a total of 16. Since the mid seventies an additional one year practical training requirement was introduced for EOS graduates. Thus, we assumed an additional year of schooling for everyone with university education who is under age 30.

For the West German survey we have more complete information on educational attainment. In particular, secondary school degrees and further training are coded separately. Education categories are formed as follows. Anyone who does not report any post-secondary training becomes part of the base group. The second group comprises everybody who completed an apprenticeship, Berufsfachschule, or schools for public-sector occupations. The third group comprises graduates of Fachschulen and anyone who reports holding a position as master craftsman. The next group includes graduates of Fachhochschulen and everyone who went to nursing

school since this group has been trained at East German Fachschulen since the seventies. University graduates form the last group.

The continuous schooling measure was constructed using both the information on the secondary school degree and post-secondary training. For the group with no post-secondary education the number of years to complete secondary school was used. Ten years of education were assumed for the category reporting other degrees (largely special schools) and 9 years for anyone with no secondary degree. For completed apprenticeship, Berufsfachschule, public-sector training, and nursing schools two years were added. For graduates of Fachschulen 3.5 years were added since they require a completed apprenticeship and can last for one or two years. We assumed Fachhochschule to last four years. It can be reached by a variety of different routes. For graduates with Abitur or Fachhochschulreife 13 and 12 years of secondary school were used. For graduates of Hauptschule and Realschule three years of schooling beyond secondary school were assumed before Fachhochschule can be entered. Six years of university training were assumed yielding a total of 19 years for everyone with Abitur. We used 20 years for everyone who does not report Abitur, since they probably reached university on a more roundabout route, e.g. by attending Fachhochschule first.

Some of our assumptions may be debatable. For example, it is unclear whether for a certain degree only the minimum number of years necessary should be counted or a higher number if a more roundabout route was chosen. Helberger (1988) reviews the German literature and discusses these issues in detail without reaching a clear conclusion.

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Table 1

Descriptive Statistics with Standard Deviations in Parentheses[a]

Variable	*East Germany* (1)	*West Germany* (2)	*U.S.* (3)
Monthly Earnings[b]	1179.14	3814.11	425.54
	(359.04)	(1798.46)	(242.16)
Log Earnings	7.026	8.154	5.914
	(0.315)	(0.438)	(0.527)
Interquartile Range of Log Earnings	0.389	0.492	0.751
Net Monthly Family Income[c]	1970.38	3579.78	3340.57
	(746.20)	(2009.90)	(1889.06)
Standard Deviation of Log Family Income	0.402	0.421	0.648
Years of School	13.06	12.32	12.94
	(1.78)	(2.72)	(2.68)
10th Grade or less	0.051	0.137	--
	(0.219)	(0.343)	
Compl. Apprenticeship	0.594	0.617	--
	(0.491)	(0.486)	
Master Craftsman	0.056	0.087	--
	(0.229)	(0.282)	
Technical School	0.189	0.062	
	(0.391)	(0.241)	0.222
			(0.416)
University	0.111	0.098	
	(0.314)	(0.297)	

Table 1 (continued)

Variable	*East Germany* (1)	*West Germany* (2)	*U.S.* (3)
Age	38.35	39.01	37.64
	(11.30)	(11.57)	(11.57)
Experience	19.31	20.69	18.71
	(11.35)	(11.79)	(12.02)
Female	0.463	0.288	0.471
	(0.499)	(0.453)	(0.499)
Married	0.748	0.641	0.612
	(10.434)	(0.480)	(0.487)
White Collar	0.493	0.481	--
	(0.500)	(0.500)	
Public Servant	--	0.136	--
		(0.343)	
Shift Work	0.188	--	--
	(0.390)		
Sample Size	43,532	2,496	8,118

Notes:

[a.] Data for East Germany are from the 1988 Survey of Blue-and White Collar Households; for West Germany from the 1988 wave of the Socioeconomic Panel; for the U.S. from the March 1989 CPS. Samples consist of nonagricultural, fulltime employed men and women. For West Germany and the U.S. self-employed workers are deleted.

[b.] Earnings refers to gross earnings in the month prior to the interview plus one twelvth of annual bonuses for the previous year for the German data sets. For the US, earnings is gross weekly earnings on the main job.

[c.] Family income is total net monthly family income for August 1988 plus one twelvth of total annual income for the previous year for the East German data, formed as the sum of the separate income categories. For West Germany, it is the answer to the question "What was the net income of your household last month." For the U.S., it is gross total family income for 1988 divided by 12.

Table 2a

Returns to Education: Men and Women[a]
(Standard errors in parentheses)

Independent Variable	*East Germany* (1)	(2)	*West Germany* (3)	(4)	*U.S.* (5)
Intercept	5.927	6.717	6.786	7.521	4.494
	(0.009)	(0.006)	(0.040)	(0.030)	(0.029)
Years of Schooling	0.077	--	0.077	--	0.093
	(0.001)		(0.002)		(0.002)
Compl. Apprenticeship	--	0.139	--	0.190	--
		(0.005)		(0.020)	
Master Craftsman	--	0.274	--	0.350	--
		(0.007)		(0.029)	
Technical School	--	0.361	--	0.491	--
		(0.006)		(0.032)	
University	--	0.489	--	0.734	--
		(0.006)		(0.028)	
Experience	0.020	0.019	0.045	0.041	0.032
	(0.000)	(0.000)	(0.002)	(0.002)	(0.001)
Exp.-squared (/100)	-0.035	-0.033	-0.077	-0.071	-0.048
	(0.001)	(0.001)	(0.005)	(0.006)	(0.003)
Female	-0.234	-0.232	-0.251	-0.250	-0.302
	(0.002)	(0.002)	(0.015)	(0.015)	(0.010)
R^2	0.414	0.410	0.457	0.432	0.329
σ_ε	0.241	0.242	0.323	0.331	0.432
Sample Size	43,532	43,532	2,496	2,496	8,118

Note:

a. Dependent variable is log monthly earnings for East and West Germany, and log weekly wage for U.S. See notes to Table 1 for additonal details on the samples.

Table 2b

Returns to Education: Men[a]
(Standard errors in parentheses)

Independent Variable	*East Germany* (1)	(2)	*West Germany* (3)	(4)	*U.S.* (5)
Intercept	6.008	6.759	6.767	7.497	4.473
	(0.012)	(0.009)	(0.042)	(0.034)	(0.037)
Years of Schooling	0.071	--	0.075	--	0.085
	(0.001)		(0.003)		(0.002)
Compl. Apprenticeship	--	0.106	--	0.153	--
		(0.008)		(0.024)	
Master Craftsman	--	0.226	--	0.303	--
		(0.009)		(0.031)	
Technical School	--	0.321	--	0.515	--
		(0.009)		(0.038)	
University	--	0.419	--	0.699	--
		(0.009)		(0.032)	
Experience	0.020	0.019	0.049	0.046	0.042
	(0.001)	(0.001)	(0.003)	(0.003)	(0.002)
Exp.-squared (/100)	-0.036	-0.035	-0.083	-0.079	-0.061
	(0.001)	(0.001)	(0.006)	(0.006)	(0.004)
R^2	0.305	0.300	0.419	0.394	0.310
Sample Size	23,382	23,382	1,778	1,778	4,297

Note:

a. Dependent variable is log monthly earnings for East and West Germany, and log weekly for the U.S. See notes to Table 1 for additional details on the samples.

Table 2c

Returns to Education: Women[a]
(Standard errors in parentheses)

Independent Variable	*East Germany* (1)	(2)	*West Germany* (3)	(4)	*U.S.* (5)
Intercept	5.589	6.448	6.523	7.298	4.177
	(0.014)	(0.009)	(0.083)	(0.051)	(0.044)
Years of Schooling	0.085	--	0.082	--	0.103
	(0.001)		(0.006)		(0.003)
Compl. Apprenticeship	--	0.162	--	0.232	--
		(0.008)		(0.039)	
Master Craftsman	--	0.357	--	0.446	--
		(0.016)		(0.083)	
Technical School	--	0.394	--	0.430	--
		(0.008)		(0.062)	
University	--	0.582	--	0.770	--
		(0.010)		(0.063)	
Experience	0.019	0.019	0.042	0.036	0.023
	(0.001)	(0.001)	(0.005)	(0.005)	(0.002)
Exp.-squared (/100)	-0.033	-0.032	-0.075	-0.064	-0.037
	(0.001)	(0.001)	(0.011)	(0.011)	(0.005)
R^2	0.294	0.292	0.283	0.252	0.270
Sample Size	20,150	20,150	718	718	3,821

Note:

a. Dependent variable is log monthly earnings for East and West Germany, and log weekly wage for the U.S. See notes to Table 1 for details on the samples.

Table 3

Additonal Earnings Regressions
(Standard errors in parentheses)

Independent Variable	*East Germany* (1)	(2)	*West Germany* (3)	(4)	*U.S.* (5)
Intercept	5.912	5.855	6.770	6.802	4.589
	(0.009)	(0.011)	(0.039)	(0.040)	(0.029)
Years of Schooling	0.077	0.077	0.076	0.069	0.073
	(0.001)	(0.001)	(0.002)	(0.003)	(0.002)
Experience	0.020	0.021	0.042	0.042	0.025
	(0.000)	(0.000)	(0.002)	(0.002)	(0.001)
Exp.-sq. (/100)	-0.036	-0.038	-0.075	-0.074	-0.040
	(0.001)	(0.001)	(0.005)	(0.005)	(0.003)
Female	-0.203	-0.195	-0.174	-0.244	-0.220
	(0.005)	(0.005)	(0.022)	(0.022)	(0.015)
Married	0.009	0.014	0.081	0.075	0.162
	(0.004)	(0.004)	(0.019)	(0.018)	(0.014)
Female * married	-0.043	-0.044	-0.136	-0.118	-0.175
	(0.005)	(0.005)	(0.030)	(0.030)	(0.019)
White collar	--	0.040	--	0.188	0.203
		(0.003)		(0.015)	(0.011)
Civil servant	--	--	--	0.025	--
				(0.027)	
Public sector	--	--	--	-0.036	--
				(0.017)	
Federal	--	--	--	--	0.088
					(0.023)

Table 3 (continued)

Independent Variable	*East Germany* (1)	(2)	*West Germany* (3)	(4)	*U.S.* (5)
State and local	--	--	--	--	-0.079 (0.014)
Late shift	--	0.143 (0.003)	--	--	--
Union	--	--	--	--	0.221 (0.012)
Black	--	--	--	--	-0.092 (0.015)
Other non-white	--	--	--	--	0.009 (0.024)
Sample size	43,532	43,532	2,496	2,496	8,118
R^2	0.415	0.443	0.462	0.502	0.391

Note:

a. Dependent variable is log monthly earnings for East and West Germany, and log weekly earnings for the U.S. See notes to Table 1 for further details on the samples.

Table 4

Summary of Monthly Earnings in Eastern Germany Since 1988
(Standard deviations are in parentheses.)

Year	Average monthly earnings measured in: Logs	D-M	Coefficient of Variation (DM)
1988	7.03	1,179.1	.30
	(.32)	(359.0)	
1989	7.02	1,182.3	.32
	(.37)	(382.8)	
1990	7.15	1,331.4	.31
	(.29)	(410.4)	
1991	7.35	1,635.2	.35
	(.32)	(568.9)	

Notes:
Data for 1989 have been inflated by 6% to adjust for bonus payments. The average bonus payment was 6% of total compensation in 1988 and 1990. Workers placed on short-time hours are included 1989-1991. 1991 figures exclude east Germans who migrated west or commute to work in the west; if these individuals are included the mean of log earnings is 7.38 and the standard deviation is .35.

Table 5

Variance Decomposition for Change in Log Wage,
Eastern Germany, 1990-91

Group	Percent of sample (p_i)	Mean (μ_i)	Variance (σ_i^2)	$[p_i(\mu_i-\mu)^2]/\sigma^2$ (percent)	$(p_i\sigma_i^2)/\sigma^2$ (percent)
New job with intervening unemployment	1.1	0.106	0.068	0.4	1.4
New job without intervening unemployment	9.6	0.350	0.097	1.9	16.7
Same employer under new ownership	5.9	0.240	0.047	0.0	5.0
Changed job within firm	6.7	0.279	0.038	0.1	4.6
No job change	76.8	0.228	0.051	0.4	69.8
Total	100.0	0.245	0.056	2.7	97.3

Notes: Data set is SOEP-East. Sample size is 1,443.

Table 6

Various Percentiles of the Earnings Distribution
as a Percentage of the Median

	Percentile in the Earnings Distribution				
A. East Germany					
	10th	25th	50th	75th	90th
1988	68.08	82.10	100	121.12	141.91
1989	65.45	81.82	100	118.18	142.73
1990	70.01	83.32	100	120.90	143.84
1991	69.63	82.89	100	123.83	159.40
B. West Germany					
	10th	25th	50th	75th	90th
1984	62.49	79.37	100	129.99	171.00
1985	62.15	79.02	100	130.62	173.44
1986	62.31	78.40	100	130.17	173.94
1987	61.25	77.44	100	130.33	175.94
1988	62.49	78.25	100	129.68	173.08
1989	62.31	79.19	100	130.50	171.88
C. U.S.					
	10th	25th	50th	75th	90th
1979	58.00	70.00	100	145.00	200.00
1984	51.54	69.23	100	153.85	215.38
1991	49.31	67.62	100	152.30	225.42

Note:
Data for East Germany are from the Survey of Blue- and White-Collar Households for 1988 and from the SOEP-East for 1989-91. 1989 figures for East Germany exclude bonuses. Data for West Germany are from the Socio-Economic Panel. Data for the U.S. are outgoing rotation group files from the Current Population Survey; earnings refer to usual weekly earnings.

Table 7

Transition Matrix by Quintile of the Earnings Distribution

Eastern Germany, 1990-91
Earnings in 1991

		Bottom	Second	Third	Fourth	Top
	Bottom	0.581	0.210	0.114	0.066	0.028
Earnings	Second	0.256	0.369	0.239	0.107	0.031
in	Third	0.107	0.234	0.308	0.276	0.072
1990	Fourth	0.045	0.117	0.242	0.314	0.255
	Top	0.010	0.069	0.097	0.210	0.614

West Germany, 1988-89
Earnings in 1989

		Bottom	Second	Third	Fourth	Top
	Bottom	0.790	0.167	0.024	0.011	0.007
Earnings	Second	0.158	0.625	0.171	0.045	0.000
in	Third	0.042	0.181	0.601	0.172	0.004
1988	Fourth	0.007	0.027	0.196	0.650	0.120
	Top	0.002	0.000	0.007	0.123	0.869

Notes:
Data are from the Socio-Economic Panels and refer to full-time employed men and women. Earnings are gross monthly earnings plus 1/12 of annual bonuses.

Table 8

Means of Selected Characteristics of Top 10%
and Bottom 90% of Wage Earners, Eastern Germany, 1991

Characteristic	Top 10%	Bottom 90%
Gross Monthly Earnings	2972 (757)	1502 (359)
Percent of Compensation due to Bonus	1.96%	1.59%
Average Percentile Rank in 1990 Distribution	78.8	46.8
Earnings Growth 1990-91	52.2% (73.8%)	25.7% (31.1%)
Weekly Hours	49.5 (10.9)	41.8 (8.2)
Female	21.7%	47.9%
Age	43.0 (9.6)	38.5 (10.5)
Years of Tenure	12.3 (12.1)	10.8 (10.4)
Years of Schooling	14.4 (1.7)	12.5 (2.2)
Technical School	32.2%	17.5%
University	30.7%	10.1%

Table 8 (continued)

Characteristic	Top 10%	Bottom 90%
Short Time	4.8%	18.1%
White Collar	72.0%	48.9%
Professional	47.6%	14.1%
Executive	9.5%	0.5%
Self-Employed	12.2%	3.3%
Private Firm	68.8%	54.9%
Works in Newly Founded Firm	9.5%	3.1%
Firm Size > 200	51.3%	53.2%
City > 100,000	48.7%	27.7%
Sample Size	189	1684

Notes:
Standard deviations are in parentheses. Except for firm size and tenure, the difference between the top 10% and bottom 90% is statistically significant at the 1% level for each characteristic.

Table 9

Earnings Equations Before and After Unification
(Standard errors are in parentheses)
Dependent Variable: Log Monthly Earnings

Independent Variable	East Germany 1988	West Germany 1988	Eastern Germany[a] 1989	Eastern Germany 1990	Eastern Germany 1991	Easterners in West[b] 1991
Intercept	5.927	6.786	5.777	6.216	6.481	7.151
	(0.009)	(0.040)	(0.041)	(0.032)	(0.045)	(0.217)
Years of Schooling	0.077	0.077	0.074	0.065	0.062	0.065
	(0.001)	(0.002)	(0.003)	(0.002)	(0.003)	(0.017)
Experience	0.020	0.045	0.037	0.018	0.014	0.004
	(0.000)	(0.002)	(0.002)	(0.002)	(0.002)	(0.013)
Exp.-squared (/100)	-0.035	-0.077	-0.063	-0.028	-0.020	-0.010
	(0.001)	(0.005)	(0.005)	(0.004)	(0.005)	(0.037)
Female	-0.234	-0.251	-0.224	-0.208	-0.198	-0.389
	(0.002)	(0.015)	(0.012)	(0.010)	(0.013)	(0.084)
R^2	0.414	0.457	0.414	0.410	0.284	0.273
σ_ε	0.241	0.323	0.286	0.224	0.272	0.355
Sample Size	43,532	2,496	2,213	2,246	1,795	117

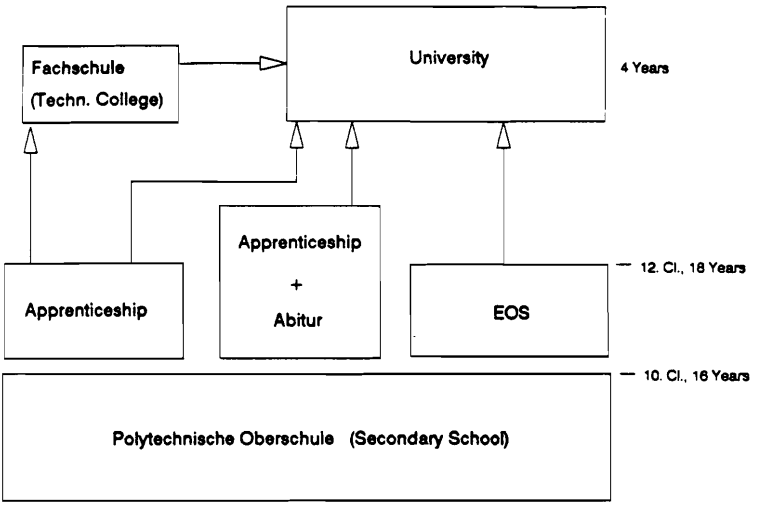
Notes:

a. Wages have been inflated by 6% to adjust for bonuses in 1989.

b. Easterners in West includes 20 East Germans who migrated to western Germany, and 97 East Germans who commute to work in western Germany.

Figure 1

East Germany



West-Germany

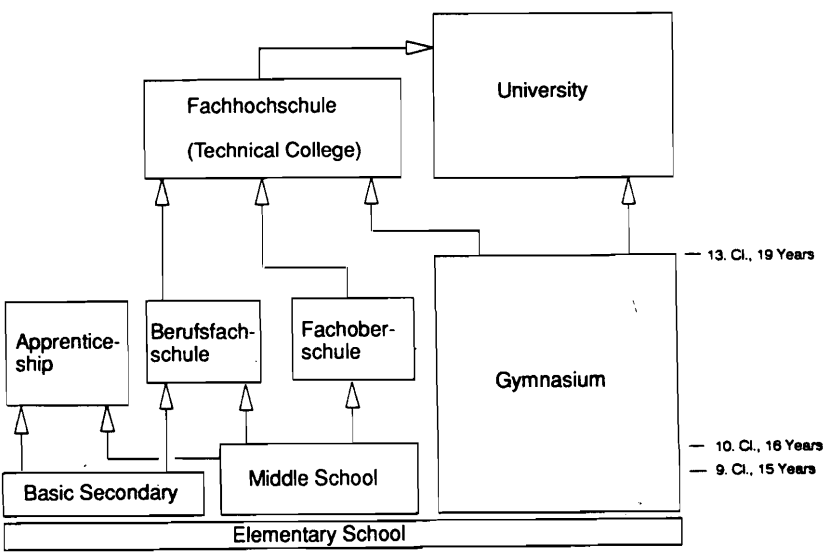


Figure 2

Dist. of Earnings, Working Male Heads

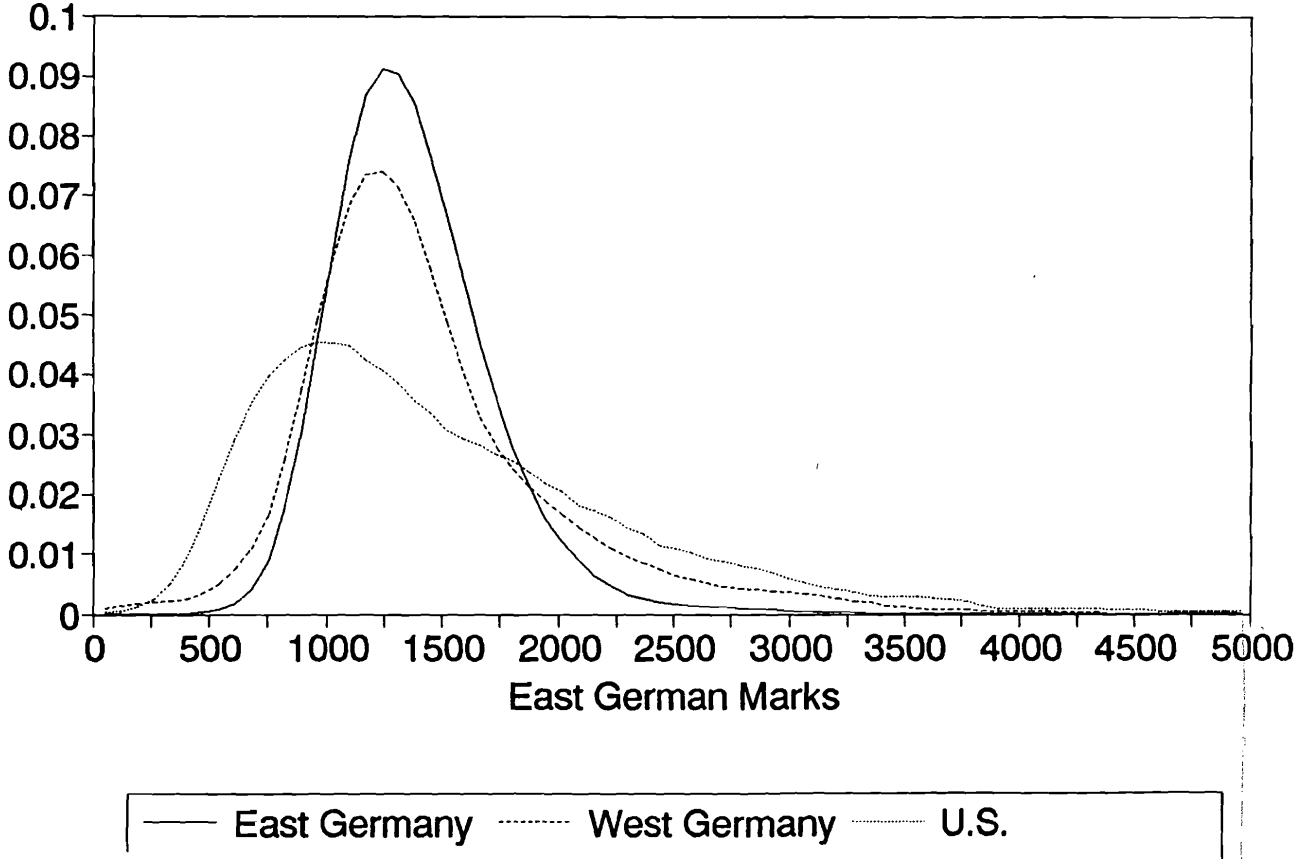
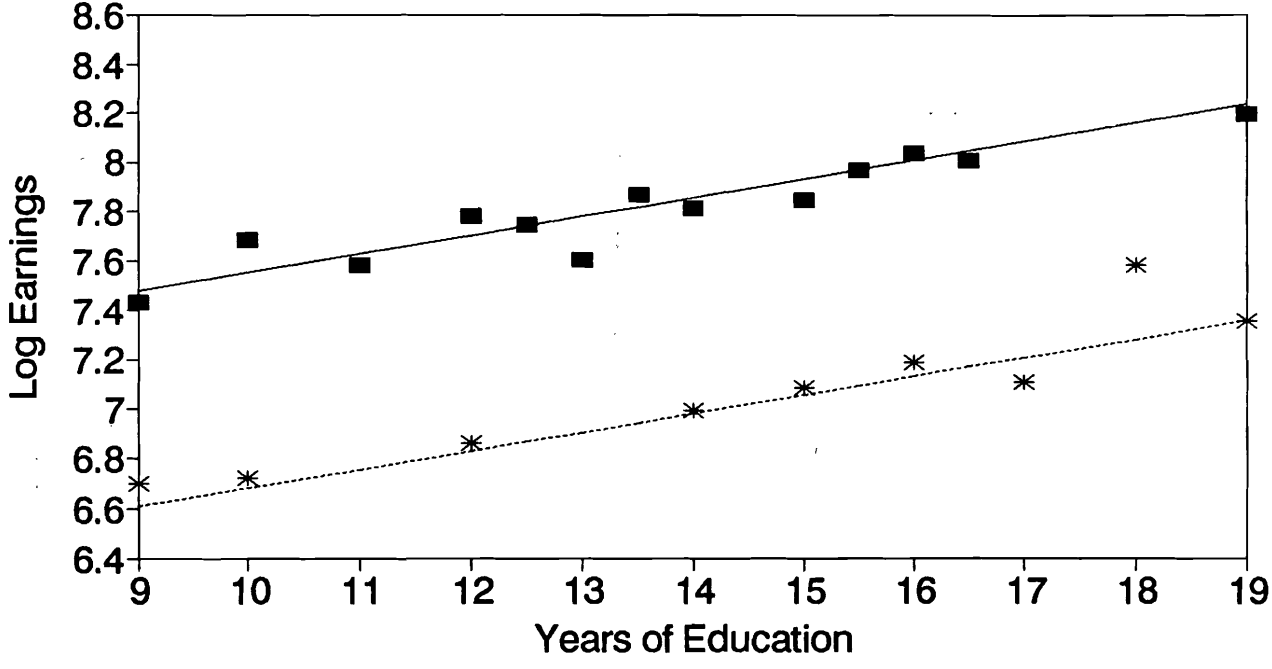


Figure 3

Unrestr. Ln Wage–Education Relationship



Fitted Regression Lines for Continuous Education Measure Shown

■ West Germany ✳ East Germany

Figure 4
Age–Earnings Profiles

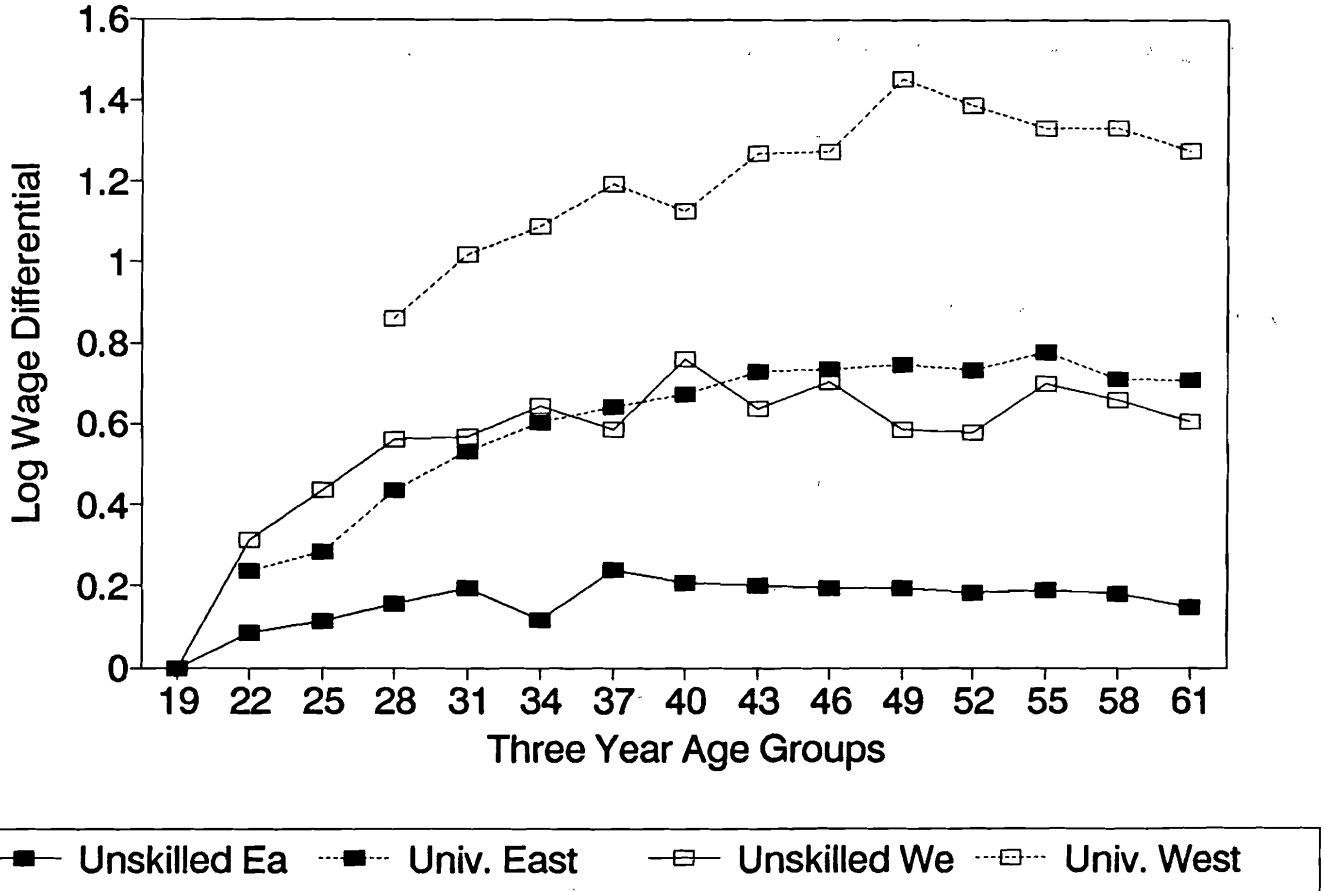


Figure 5

Age Earnings Profiles: Men

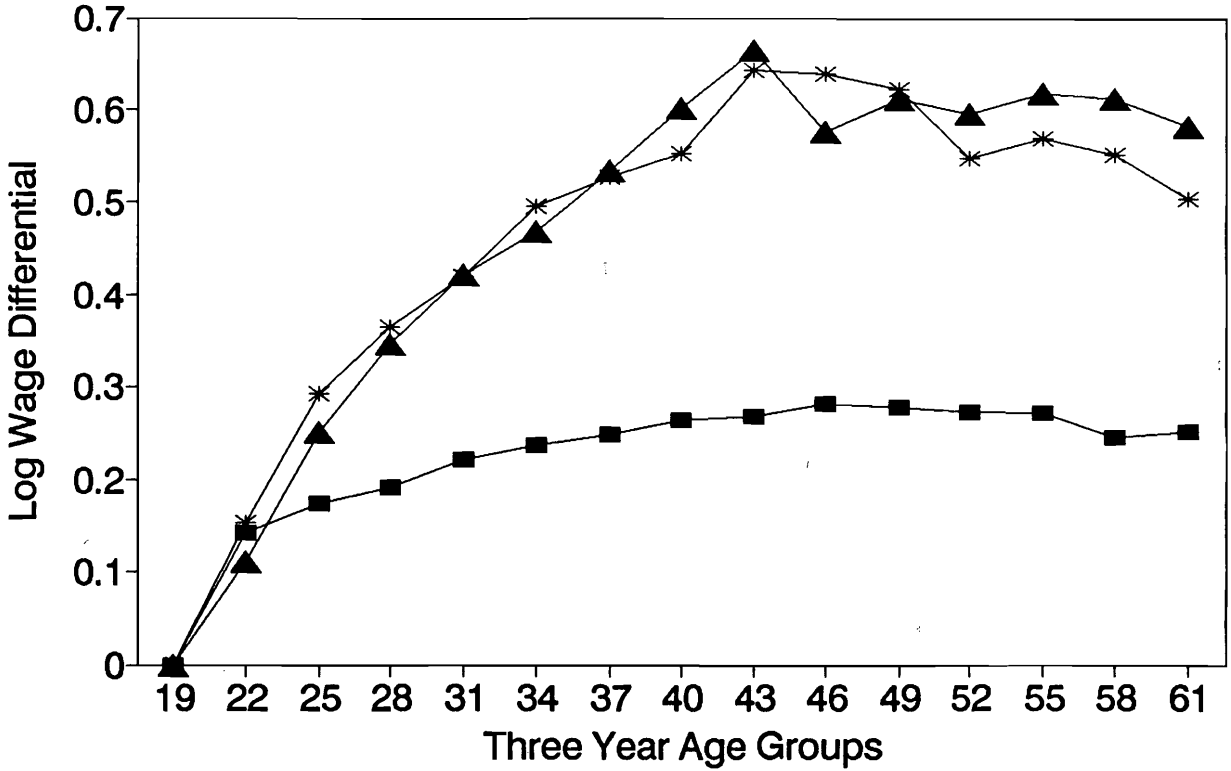


FIGURE 6


Wage Increases 1988-1991 by Percentile
Percentage Increase
60
55
50
45
40
35
30
0
10
20
30
40
50
60
70
80
90
100

FIGURE 7

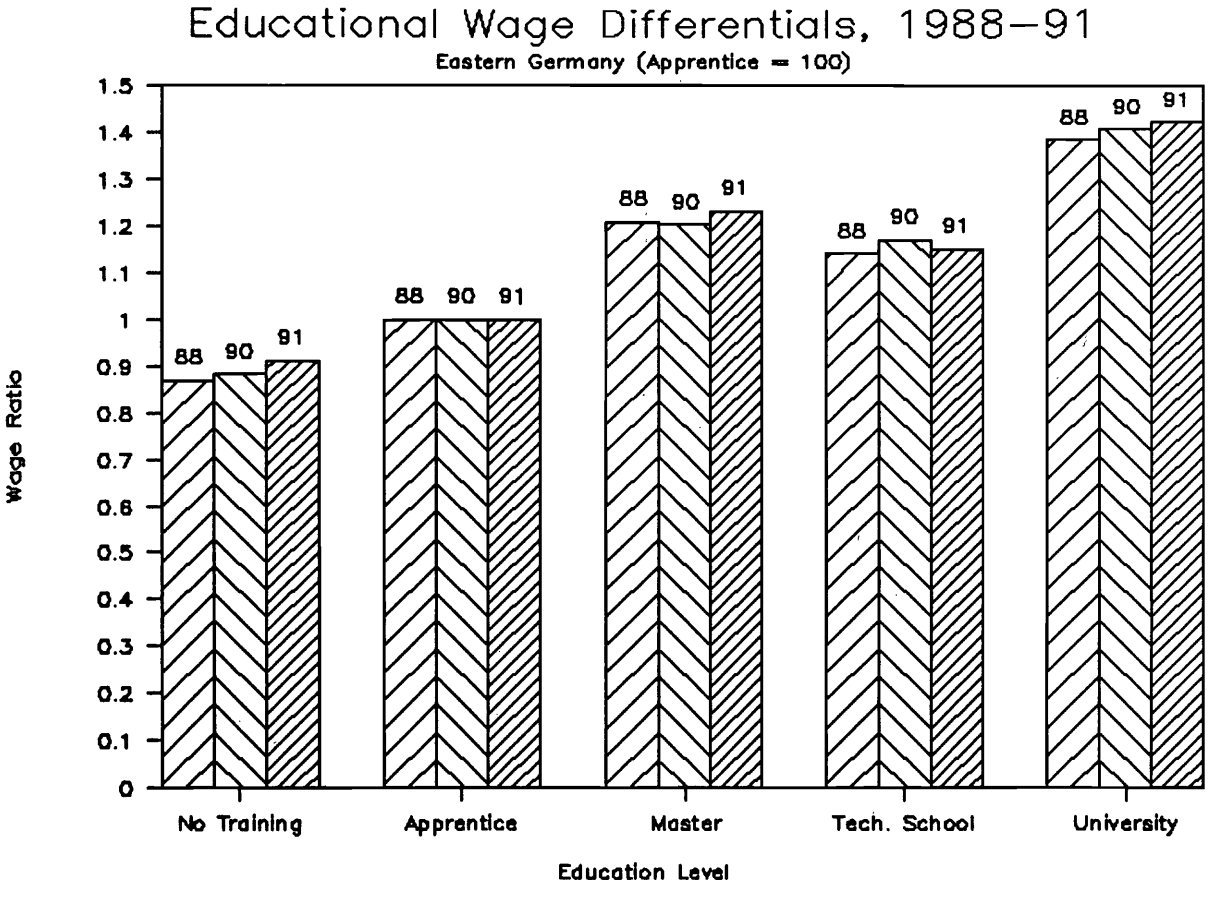
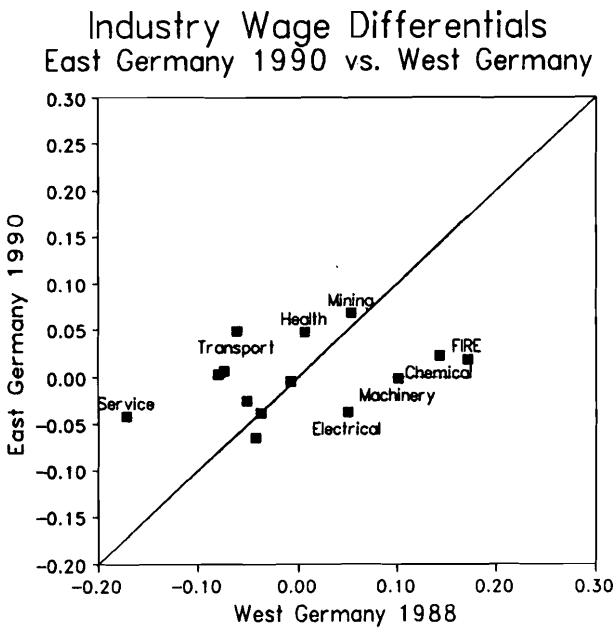

Educational Wage Differentials, 1988–91
Eastern Germany (Apprentice = 100)
Wage Ratio
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
88 90 91
88 90 91
88 90 91
88 90 91
88 90 91
No Training
Apprentice
Master
Tech. School
University
Education Level

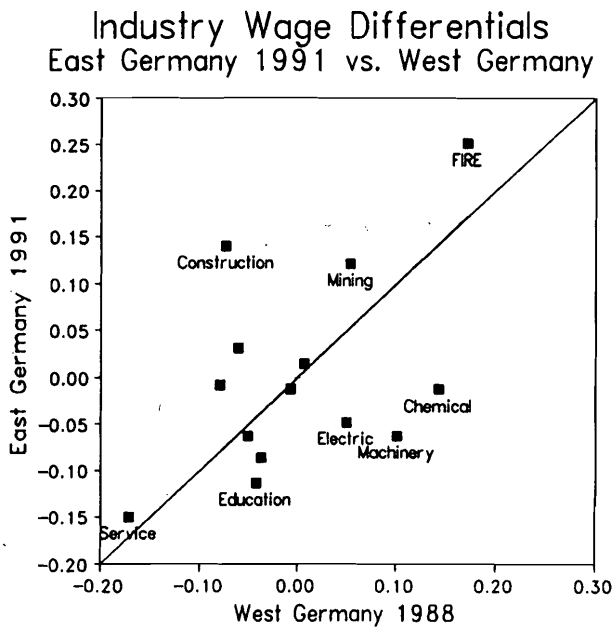
FIGURE 8

Comparison of Industry Wage Differentials



OLS Regression Line:

East = 0.02 + 0.15 West R^2 = 0.13
(0.04) (0.11)



East = 0.03 + 0.56 West R^2 = 0.24
(0.10) (0.29)