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Wages in the East German Transition Process: Facts and Explanations

Wolfgang Franz and Viktor Steiner
Zentrum für Europäische Wirtschaftsforschung (ZEW)
Centre for European Economic Research, Mannheim

Abstract. *We analyze wage developments in the East German transition process both at the macro- and at the microeconomic level. At the macroeconomic level, we draw special attention to the important distinction between product and consumption wages, describe the development of various wage measures, labor productivity and unit labor costs in East Germany in relation to West Germany, and relate these developments to the system of collective wage bargaining. At the microeconomic level, we describe changes in the distribution of hourly wages between 1990 and 1997 and analyze the economic factors determining these changes by way of empirical wage functions estimated on the basis of the Socio-Economic Panel for East Germany. The paper also draws some conclusions on the likely future course of the East–West German wage convergence process.*

1. INTRODUCTION

The excessive increase of East German wages is seen by many observers as the main culprit for the dramatic employment decline and the unprecedented increase in unemployment in the transition process to a market economy (see, e.g., Sinn and Sinn, 1992; Siebert, 1993). At the beginning of the transition process, in most industries collectively bargained wages were set to reach parity with West German levels in 1994. Actual wage settlements were not related to economic conditions and productivity developments, but simply were set to catch-up to this prespecified target. The resulting employment losses were either viewed as inevitable by those who saw the future of the East German economy in a high-productivity, high-wage strategy or not related to wages at all, a view held publicly by West German union leaders who, at least in the beginning, dominated the collective bargaining process. Another important argument for a quick catch-up of eastern wages, popular among politicians and union leaders alike, was that East Germans would otherwise migrate to the west on a grand scale and congest already crowded labor and housing markets.

However, with sky-rocketing unemployment and the virtual breakdown of manufacturing industries the full adjustment of East German contract wages to West German levels has been postponed. Even at the turn of the twentieth century, wages in most East German industries were still considerably lower than in West Germany.

At least as important as the issue of the catching-up of East German wages at the aggregate level is the question whether wages are sufficiently differentiated by qualification, industry and region to account for differences in productivity levels in East Germany. Conventional wisdom holds that, due to socialist ideology, there was little wage differentiation in the former German Democratic Republic (GDR), and that the development to a market economy necessitates profound changes in the wage structure corresponding to changes in the relative demand for skills brought about by the restructuring process in the East German economy. It is also widely known that collective bargaining agreements have not allowed for this necessary adjustment of wages.

However, an important factor often overlooked in debates on wage flexibility in the East German economy is that centralized wage contracts were often not enforceable at the firm level and wages might well be more sensitive to economic conditions of single firms in the present East German situation than it has usually been the case under 'normal' circumstances in Western Germany. This new development in German industrial relations includes concession bargaining at the firm level and the fact that incumbent firms have been leaving or new firms have not been joining employers' unions on an unprecedented scale. Facing these developments and ever rising unemployment, the collective bargaining parties in the end agreed to allow effective wages at the firm level to be set below the contract wage under certain circumstances specified in special 'emergency' provisions known as '*Öffnungsklauseln*'. Therefore, it does not seem obvious *a priori* that the wage structure in East Germany is in fact as rigid as often described in the literature and to what extent collective bargaining agreements have affected the East German wage structure at the microeconomic level.

Owing to new production processes and profound changes in the organization of work, we would expect that the value of human capital acquired under socialism has depreciated in the transition process to a market economy. This conjecture, in fact, seems to be supported by empirical evidence, especially with respect to the depreciation of general labor market experience accumulated under socialism (Krueger and Pischke, 1995; Bird *et al.*, 1994; Steiner and Puhani, 1997; Steiner and Wagner, 1997). On the other hand, there is some evidence (Hunt, 1999a) that the economic returns to job mobility were quite high for the more motivated and better qualified workers at the beginning of the transition process. Given the great importance of general and firm-specific work experience for wage determination, these adjustments of the human capital stock have important implications for the speed of East–West German wage convergence (Burda and Schmidt, 1997; Steiner and Wagner, 1997) as well as changes in labor force participation and the development of household incomes in East Germany (Hauser and Fabig, 1999).

In this paper, the importance of the above-mentioned factors for the development and the structure of wages in East Germany is explored. At the macroeconomic level, we draw special attention to the important distinction between product and consumption wages, describe the development of various wage measures, labor productivity and unit labor costs in East Germany in relation to West Germany (Section 2), and relate these developments to the system of collective wage bargaining (Section 3). At the microeconomic level, we analyze the development of the distribution of hourly wages between 1990 and 1997 on the basis of the German Socio-Economic Panel (Section 4). In Section 5, we relate the observed changes in the wage distribution to the underlying economic factors, in particular human capital acquired through formal vocational education as well as general and firm-specific work experience. The results from empirical wage functions specified on the basis of the economic hypotheses derived in Section 5 and estimated on cross-section data for the years 1990, 1992, 1995 and 1997 are discussed in Section 6. In the concluding section we summarize our main results and draw some conclusions.

2. MACROECONOMIC DEVELOPMENTS: SOME BASIC FACTS

As a prerequisite for an informed discussion of the development of aggregate wages in East Germany some basic facts are to be outlined very briefly. To begin with, Table 1 displays the time pattern of various types of labor remuneration. A key variable for understanding the development of wages, especially in East Germany (but, to some extent, West Germany, too), is the wedge between product wages and consumption wages (see Franz, 1999, p. 275). Product wages affect the demand for labor and are defined as real labor cost of the firm, i.e., they include all taxes on labor paid by the firm and employers' social security contributions, deflated by the product price. In contrast, consumption wages affect labor supply and are defined as real net take-home pay, i.e., all taxes and employees' social security contributions are deducted, and are deflated by consumer goods prices. Hence, the wedge stems from taxes and contributions to social security contributions levied on firms and workers and, moreover, from diverging product and consumption prices, i.e., mainly from import prices and indirect taxes.

The development of the product wage and the consumption wage is particularly interesting: while the product wage more than doubled between 1990 and 1998, the increase in the consumption wage amounts to some 30 per cent during this period, with even a slight decrease since 1996. Put differently, the consumption wage in 1998 equals the product wage in 1990. The widening gap between these two wage measures is caused by the higher inflation rate of consumer prices in East Germany at the beginning of the 1990s as well as by an increasing tax wedge (similar to the situation in West Germany). The slow increase of consumption wages relative to product wages may explain the

Table 1 Development of wages in East Germany, 1990–98[a]

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Gross nominal wages[b]	9.78	14.25	17.65	18.64	19.64	21.24	21.91	22.35	22.39
Product wages[c]	11.33	19.11	21.01	21.62	22.09	23.56	24.10	24.55	24.60
Consumption wages[d]	8.73	10.41	10.47	10.61	10.57	11.07	11.46	11.35	11.32
Productivity growth[e]	−1.4	5.9	12.7	7.6	8.7	6.1	4.0	5.6	1.8
Unit labor costs[f]	24.0	52.7	12.3	2.6	−0.4	1.5	−0.7	−2.7	−2.0

Notes:
[a] Annual averages.
[b] Gross labor income divided by person-hours, in DM.
[c] Gross labor income including employers' contributions to social security divided by person-hours and deflated by the index of product prices (1991 = 100), in DM.
[d] Net labor income divided by person-hours and deflated by the consumer price index (1991 = 100), in DM.
[e] Productivity: real GDP divided by person-hours (in per cent).
[f] Unit labor costs: gross labor income including employers' contributions to social security divided by real GDP (growth rates in per cent).
Source: Franz (1999, p. 383).

disputes over 'fair wage developments' in East Germany. Equally important is the development of unit labor costs. Within the first three years under consideration, these increased tremendously. More dramatically, in 1992 gross wages in East Germany were roughly comparable to the respective level in the US with productivity levels in East Germany in the order of magnitude of those in Mexico (Siebert, 1993, p. 128).

The latter observation calls for a brief comparison of various labor market indicators between East and West Germany, as highlighted in Table 2. As to gross nominal wages, the East–West wage differential amounted to more than one-half in 1991. This gap decreased to about one-third by the mid-1990s and has remained fairly stable at that level since then. The increase in East German labor productivity of about one-third to about 60 per cent of the West German level is, of course, remarkable. However, it has to be stressed that part of this catching-up is due to the reduction in employment, which by itself causes higher productivity levels. Indeed, the decline in East German employment was tremendous: the number of employed persons (excluding self-employed people) fell from about 7 million persons in 1991 to around 5.5 million in 1999, i.e., by more than 20 per cent. During the same time the respective decline in West Germany was around 5 per cent.

Collective bargaining agreements in East and West Germany typically do not take into account that an increase in productivity due to dismissals does not represent real productivity gains stemming from, say, improved production techniques or investment in human capital. For example, the Council of Economic Experts (Sachverständigenrat, 1997, p. 266) estimated a difference of 0.5 percentage points between the conventionally measured productivity

Table 2 East–West German comparison of basic labor market indicators[a]

	1991	1992	1994	1996	1998
Gross nominal wages[b]	46.7	60.7	70.5	73.6	73.9
Labor productivity[c]	31.0	43.5	56.0	59.4	59.4
Unit labor costs[d]	150.6	139.4	126.0	124.0	124.1
Unemployment rates[e]	391.1	457.0	274.6	213.8	220.2

Notes:
[a] Ratios of East German to West German figures multiplied by 100; see text for explanations.
[b] Gross labor income per employee.
[c] Nominal GDP per employee.
[d] Domestic gross labor income per employee divided by labor productivity.
[e] Registered and hidden unemployment; for definition see text.
Source: Deutsches Institut für Wirtschaftsforschung (DIW), *Wochenbericht 17/99*, p. 31 (wages, productivity, unit labor costs); *Sachverständigenrat*, *Jahresgutachten*, various issues (for unemployment); calculations by the authors.

increase in West Germany in 1997 and the respective number corrected for employment declines and another 0.9 percentage points for converting the increase in average labor productivity into the rise in marginal labor productivity at normal employment, the latter figure representing a guideline for wage setting in a situation of normal employment. Although these calculations cannot be transferred directly to East Germany, they give an impression of how substantial East German productivity would have to be adjusted in order to obtain true productivity gains there. The same caveat holds for the comparison of unit labor costs.

Finally, the last row in Table 2 displays the ratio of official plus hidden unemployment in East Germany in comparison with West Germany. Hidden unemployment consists, for example, of people who are in active labor market policy programs or in pre-retirement schemes but would be registered as unemployed persons otherwise. Especially for East Germany hidden unemployment is tremendous: in 1998 registered unemployment amounted to around 1.4 million persons and hidden unemployment to 0.9 million people (the corresponding figures for West Germany are 2.9 and 1.0 million persons, respectively).

3. THE ROLE OF COLLECTIVE BARGAINING IN WAGE FORMATION

The exorbitant catching-up process of East German wages to West German levels, not justified by equivalent true productivity growth, had its impact on the actual operation of labor market institutions. At the beginning of the transformation process, the bargaining process was a one-sided game. The employer side was not adequately represented at the collective bargaining table

since it was represented by either former managers of state-owned firms or by representatives of West German firms who had little incentive to fight for low wages in East German firms, their prospective competitors in national and international markets. On the other hand, the old trade union, the Freie Deutsche Gewerkschaftsbund, was discredited by its collaborative behavior under the old regime. Consequently, its West German counterpart, the 'Deutsche Gewerkschaftsbund', which acts as the umbrella organization for 16 constituent industrial unions, was able to move into this virgin territory and organize workers with impressive ease. It was recognized by East German employers as the *de facto* negotiating partner in collective bargaining and was thereby able to conclude wage agreements in almost every industrial sector, in the public sector and some of the service industries. Another important role has been played by the Treuhandanstalt, the public agency in charge of privatizing state-owned firms, which had to deal with political pressure to financially support large industrial enterprises, especially in the manufacturing sector (to save the 'industrial core' of East Germany). This has probably also led to relatively high wage increases, especially in the manufacturing sector.

As is well known, wage bargaining in Germany takes place at the (regional) industry level. The outcome of those wage settlements concern, strictly speaking, only union members in firms which belong to the respective (regional) employers' association. In order to circumvent negotiated wage increases, unacceptable for the firm for economic reasons, the firm has, in principle, two options on legal grounds (see Fitzenberger and Franz, 1999, for details). First, the firm is free to make other wage contracts with non-unionized employees (but union membership must not serve as a selection criterion for different wage contracts) even if it belongs to the employers' association. This is not done frequently. Besides avoiding internal disputes, the major reason is that the worker presumably would join the union (union deterrence effect). Second, the firm can choose to leave the employers' association. But in this case the firm is committed to the negotiated wage rate until the collective agreement expires. But even afterwards or if the firm does not join the employers' association at all, a legal restriction (§77.3 law on labor relations in the firm, 'Betriebsverfassungsgesetz') prohibits employers from making a wage contract with their works council (but not with the individual worker) which undercuts a negotiated wage settlement unless this wage settlement explicitly gives room for such firm-specific contracts which is rarely the case.

Taken together, there are severe constraints for wages being flexible enough to meet economic requirement at the firm level, let alone to correct the catching-up process of wages in general. The result of these restrictions with respect to the operating of wage bargaining institutions is displayed in Table 3. To begin with, only one-half of all employees and one-quarter of all firms are covered by industry-level wage bargaining in East Germany whereas the figures for West Germany are two-thirds and almost one-half, respectively. These numbers correspond to the greater relevance of firm-level and employee-level wage bargaining in East Germany. More specifically, industry-level wage

Table 3 Level of wage bargaining in Germany by sector and firm size[a]

	Industry level		Firm level		Employee level	
Sector/Firm size	East	West	East	West	East	West
Sector[b]						
Mining, energy	87.3	76.4	7.9	21.6	4.8	2.0
Basic materials	48.8	75.2	9.4	8.0	41.8	16.8
Investment goods	40.0	74.0	10.8	5.9	49.2	20.2
Consumption goods	38.2	75.9	15.3	7.2	46.5	16.9
Construction	50.3	83.0	11.8	3.5	37.9	13.5
Trade	40.7	64.6	8.8	7.1	50.5	28.2
Transportation	39.3	52.5	34.8	24.0	26.0	23.5
Banks/Insurance	90.0	85.5	4.5	6.1	5.5	8.4
Public sector	90.0	88.7	8.7	8.1	1.2	3.2
Total	50.5	67.8	12.7	8.0	36.8	24.2
Firm size[c]						
1–4 employees	17.4	34.5	5.0	4.1	77.6	61.4
5–9	24.5	49.0	8.4	5.1	67.0	46.0
10–19	34.0	61.5	10.3	3.6	55.6	34.9
20–49	44.7	65.8	10.9	7.1	44.4	27.2
50–99	56.7	67.6	13.4	6.8	29.9	25.6
100–199	60.9	76.4	18.0	8.1	21.1	15.6
200–499	65.9	72.9	17.9	12.2	16.2	14.9
500–999	80.7	83.9	13.9	10.1	5.4	6.0
1,000 and more	81.5	79.1	14.0	14.4	4.5	6.5
Total	25.8	47.7	7.6	4.8	66.6	47.5

Notes:
[a] Figures are based on individual firm data (IAB-Betriebspanel) with at least one employee subject to social security contributions and are then estimated for the aggregates. Data refer to the year 1998.
[b] Sector: percentage of employees covered by industry/firm/employee-level wage bargaining, respectively, not all sectors included.
[c] Firm size: percentage of firms with numbers of employees covered by industry/firm/employee-level wage bargaining, respectively.
Source: Kohaut and Schnabel (1999).

bargaining takes place primarily in certain sectors such as banks, insurance, public sector, mining, energy and construction, and in large firms. Taken together, in East Germany industry-level wage bargaining is losing ground on a large scale.

Even more interesting is the erosion of industry-level wage contracts by breach of contract. For example, in the manufacturing sector of East Germany

around 14 per cent of all firms which are covered by negotiated wages undercut negotiated wages (with a more or less tacit agreement by the works council).[1] These firms had, strictly speaking, to commit a breach of the collective wage contract in order to ensure their economic survival.

Given that only parts of all employees' agreements are covered by collective bargaining one might be tempted to the view that, for those not covered, wages should be adjusted to balance demand and supply in the labor market and, hence, unemployment in the East should be caused by other factors than wage bargaining institutions. Indeed, wage policy is not the sole cause of massive joblessness in East Germany, and wage moderation alone will not iron out unemployment. Other factors clearly have been at work during the transition period, such as the breakdown of major markets in middle and eastern Europe, an economically inadequate conversion rate between the East German mark and the West German DM, the adoption of the whole institutional and legal framework from West Germany including all inflexibilities and rigidities, the heavy subsidies for investment in machinery and buildings which reduced capital costs to unprecedented levels and, thus, changed relative factor prices to the great disadvantage of labor, and so on. But, even in the light of these caveats, wage policy does share a considerable responsibility for the developments in East Germany: major mistakes were made at the beginning of the transformation process when wages were set at economic levels unsustainable by low productivity levels. To some extent, this failure was realized later on, but was corrected too hesitantly, if at all.

4. CHANGES IN THE EAST GERMAN WAGE DISTRIBUTION, 1990–97

Having described the main trends in the development of aggregate wages in East Germany, we now turn to the analysis of changes in the East German wage distribution. In particular, we analyze the development of hourly wages between 1990 and 1997 on the basis of the German Socio-Economic Panel for East Germany (GSOEP-East). Since the first wave of the GSOEP-East refers to the period immediately before German monetary union in July 1990, it is possible to draw a comparison between the wage structure of the former GDR and the structure established by 1997.[2]

In the first wave of the GSOEP-East in June 1990, about 4,000 persons in 2,000 households were interviewed. In the following waves, principally the same people were interviewed. Sample disparity has been partly compensated for by including new interviewees. Information on individual gross incomes

1. See Scheremet (1995, Table 2); the figure in this source refers to 1994, but is similar to that in 1998 according to still unpublished investigations.
2. Details on the GSOEP can be obtained from the webserver of the German Institute of Economic Research (DIW) in Berlin (http://www.diw-berlin.de/soep/).

and hours worked of the previous month makes it possible to calculate hourly wages. As our analysis uses real hourly wages, we can include short-time workers into the analysis, short-time work having been a widespread instrument of employment creation especially at the beginning of the transition process (see, e.g., Licht and Steiner, 1994). We also take into account fringe benefits like holiday or Christmas pay in the calculation of hourly wages, which constitute an increasingly important component of the wage package in East Germany. As we are interested in market determinants of wages, only gross wages are considered here, i.e. direct taxes and transfers are not taken into account. The sample analyzed below is restricted to employees aged between 19 and 65 years (men) respectively 60 years (women) covered by the social security system. Hence, civil servants, the self-employed and those with minor employment are excluded from the sample, as are people in education or training programs or on maternity leave. Since we expect structural differences in the development of male and female wages in the transition process, we split the sample by gender. The observations remaining after the various selections are listed in Table A.1 in the Appendix.[3]

A particularly simple and informative way to describe changes in the wage distribution over time is to plot various percentiles of the distribution, as we do in Figure 1. In the following discussion, we will mainly focus on the median to represent changes in the middle part of the distribution, the 10%-percentile to describe changes in the lower part and the 90%-percentile in the upper part of the wage distribution. To see whether wage changes in other parts of the wage distribution differ in a significant way, we also plot the 25%-percentile and the 75%-percentile. Annual growth rates of male and female wages at the median as well as the 10%-percentile and the 90%-percentile are plotted in the lower part of Figure 1 for the period 1991 to 1997.

The upper part of Figure 1 shows that the wage distribution was very compressed under socialism. In 1990, the male 90%-percentile of about 9.5 DM was less than twice the value of the 10%-percentile and just about 1.4 times the median. Female wages under socialism were slightly lower (the median wage of women was 5.7 DM compared to 6.6 DM for men), but the distribution of female wages was quite similar to that of men (see Table 4).

As the lower part of Figure 1 shows, the strongest wage increases occurred in the first year after unification, when the median nominal hourly wage increased by 45%. Even higher wage increases occurred in the upper part of the distribution: at the 90%-percentile the male (female) wage increased by almost 65% (55%). Compared to these excessive wage hikes, the increases of, respectively, about 45% and 35% in the lower part of the distribution seem almost modest.

The explanation for these astonishing differences probably is that, lacking any control from private owners or the Treuhandanstalt, the state agency for

3. For the analysis in this section we include all remaining observations after selections (1)–(8) in Table A.1 in the Appendix.

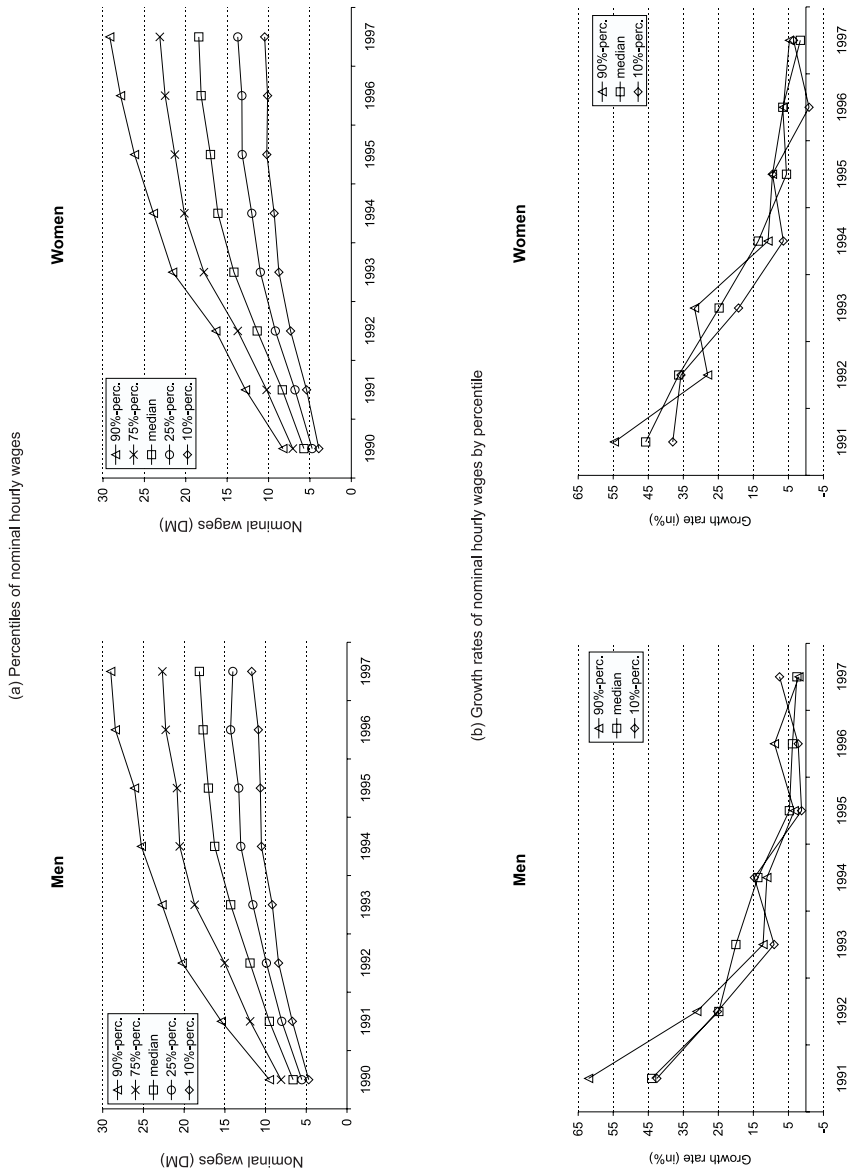

Figure 1

Source: GSOEP-East, own calculations.

Table 4 Changes in the distribution of hourly wages in East Germany and comparison with the West German wage distribution

	East Germany				West Germany	
	Men		Women		Men	Women
Percentile ratio	1990	1997	1990	1997	1997	1997
90/50	1.44	1.60	1.50	1.69	1.62	1.46
50/10	1.41	1.55	1.46	1.76	1.56	1.56
90/10	2.02	2.48	2.18	2.97	2.52	2.27

Source: GSOEP; own calculations.

the privatization of the East German economy, those who were still in charge of running the state-owned firms were in a position to grant themselves and their comrades from the socialist system generous wage increases immediately after unification. Once the privatization process was well under way, wage increases declined markedly, especially in the upper part of the wage distribution.

Judged by the growth rates of wages, we can distinguish between basically three periods: (i) the first two years after unification saw excessive increases in nominal wages; (ii) starting from a very high level, growth rates of nominal wages declined sharply in the period between 1993 and 1995; and (iii) in the subsequent period growth rates stabilized at a level of around 5 per cent, on average. Furthermore, the variance of growth rates across the wage distribution also diminished over time.

By the year 1997, this wage adjustment process had resulted in a pronounced increase in wage inequality, as measured by percentile ratios in Table 4. In the period 1990 to 1997, the ratio of the 90%-percentile to the 10%-percentile, which represents the spread of the wage distribution, increased from about 2.0 to 2.5 for men and from about 2.2 to 3.0 for women. Hence, overall wage inequality increased by more than 36 per cent for women compared to 25 per cent for men. For women, wage inequality was more pronounced in the lower part of the distribution, represented by the ratio of the median to the 10%-percentile, than in the upper part of the distribution (ratio of the 90%-percentile to the median). In contrast, the increase in wage inequality for men was spread fairly evenly across the distribution. For both men and women, the increase in wage inequality in the upper part of the distribution is mainly accounted for by the strong increase of wages in the 90%-percentile, as the comparison with the 75%-percentile in the upper part of Figure 1 shows.

It seems interesting to compare the degree of wage inequality prevailing in East Germany at the end of the observation period with the West German level, which has changed very little since the early 1980s (Steiner and Wagner, 1997, 1998). By 1997, overall wage inequality for East German men has reached roughly the same level as in West Germany, both in the upper and in the lower

part of the wage distribution. In contrast, female wages in East Germany are distributed much more unequally than in West Germany now, and this higher inequality relates both to the lower and the upper part of the wage distribution (see Table 4).

What are the main economic factors driving changes in the distribution of hourly wages? Macroeconomic factors outlined in Section 3 have certainly played an important role as far as collective wage bargaining outcomes have affected employees differently depending on the sector of employment and firm size. However, it is unlikely that these factors can explain a large part of the widening of the wage distribution in general, and gender differences in wage growth in particular. To explain the observed changes in the wage distribution requires a more detailed microeconomic analysis, to which we now turn.

5. HUMAN CAPITAL AND THE EAST GERMAN WAGE STRUCTURE

In contrast to its obsolete physical capital stock, East Germany is generally considered to be well endowed with human capital. Compared to West Germany, the share of skilled labor, that is people with a completed apprenticeship training or higher vocational training ('master craftsman'), is fairly high in East Germany. The latter group includes both people with a vocational qualification obtained after completed apprenticeship training and conditional on having passed a special examination after some years of work experience in a particular trade (*Meisterprüfung*) and people with some higher vocational training at school (*Fachschule*).[4] On the other hand, the share of unskilled labor is relatively small in East Germany and the share of highly skilled labor ('graduates'), i.e. people with a degree from a university or polytechnic (*Fachhochschule*), is comparable to the West German level. Differences between the East and West German skill structure for the labor force as a whole are even greater than for the sub-population of employed people (see Table 5).[5]

The most interesting change in the East German skill structure concerns the decrease in the share of unskilled employees and the concurrent increase of non-employed people in the labor force, especially among women. At the same time, the share of graduates among all East German employees increased both for men and women. By the year 1995, the share of graduates in the East German population exceeded the West German share, and this difference was especially large for women. On the other hand, the share of unskilled women

4. In West Germany, this latter type of vocational training is much less important than it was in the former GDR.
5. We thank our colleague Martin Falk for providing us with these calculations based on the Labor Force Survey ('Mikrozensus') for the years 1991 and 1995 held at the ZEW.

Table 5 The skill structure of employment and the labor force in East and West Germany (shares in per cent)

Education/Vocational qualification	Men			Women		
	East		West[a]	East		West[a]
	1991	1995	1995	1991	1995	1995
Employees						
Unskilled	3.3	2.8	9.6	5.4	3.8	15.3
Skilled	65.9	68.8	66.4	61.3	60.6	72.5
Master craftsman[b]	17.4	13.6	10.6	23.9	23.0	4.7
Graduate	13.4	14.9	13.5	9.5	12.6	7.5
Labor force						
Unskilled	9.7	10.3	24.6	5.3	12.0	27.1
Skilled	61.3	61.0	62.3	63.1	60.6	60.5
Master craftsman[b]	20.8	18.4	3.9	18.6	17.7	3.7
Graduate	8.3	10.3	9.2	13.0	9.6	8.6

Notes:
[a] The share of unskilled labor among foreigners is much higher than among natives in Germany. Since the share of foreigners is very low in East Germany, figures for West Germany only include natives.
[b] Master craftsman include people with higher vocational education obtained at school (*Fachschule*), which was very common in the former GDR.
Source: Labor Force Survey ('Mikrozensus') 1991 and 1995.

in the East German labor force increased substantially, while the share of female graduates decreased perceptibly during this period. In contrast, the share of male graduates in the labor force increased a bit more than their employment share, implying an increase in unemployment or non-employment among this group. To some extent, these gender differences can be explained by the strong increase in female participation in public works programs, which have been, and still are, very much concentrated on the skilled and, in particular, women with university education (see Kraus *et al*., 2000).

In market economies, wage differentiation by skill arises either because of the productivity effects related to educational and vocational attainments or innate individual characteristics that are correlated with skills. Conventional wisdom holds that there was little wage differentiation by skill in the former GDR. However, although there is some evidence that the East German wage structure was indeed more compressed than in West Germany (see Section 4), differentials due to educational attainment seem to have been more or less of similar magnitude (Krueger and Pischke, 1995; Steiner and Puhani, 1997; Steiner and Wagner, 1997; Steiner and Hölzle, 2000). Hence, the observed

compression of the wage distribution in the former GDR was the result of smaller rewards to innate abilities or to labor market experience.

According to human capital theory, labor market experience is a proxy for general human capital acquired on the job. Owing to new production processes and profound changes in the organization of work, we would expect the value of labor market experience accumulated in the former socialist economy of the GDR has depreciated in the transition process to a market economy. Therefore, we also expect rather flat experience–wage profiles when looking at the East German wage structure after unification, an expectation which seems to be supported by empirical evidence (Krueger and Pischke, 1995; Bird *et al.*, 1994; Steiner and Puhani, 1997; Steiner and Wagner, 1997). However, as suggested by Steiner and Wagner (1997), experience–wage profiles may differ between the private and the public sector because in the latter wages are linked closely to age and, in particular, years worked in the public sector.

According to human capital theory, firm tenure is a proxy for firm-specific human capital investment which has a stronger effect on labor productivity and, hence, increases wages in excess of returns to general labor market experience. In East Germany, the effect of firm tenure on wages is likely to depend on the stage of the transition process. In the first stage, when formerly state-owned conglomerates were privatized on a large scale and profitable new enterprises were set up, the returns to job mobility for the more motivated and better-qualified workers were probably quite high. There is some evidence that this indeed can be observed and that returns to job changing fell substantially in later periods (Hunt, 1999a). This also suggests that in later periods tenure effects may have been an important factor in the development of East German wages.

Several other labor supply factors may have affected the wage structure in the East German transition process. Since unification, employment of women has dropped sharply and female unemployment, especially long-term unemployment, has increased correspondingly. On the other hand, there seems to have been little downward pressure on wages and only a modest decline in the female labor force participation rate (Steiner and Kraus, 1995; Hunt, 1999b). Owing to their high level of formal education and vocational training, the easy availability of childcare facilities, but also socialist ideology supported by good career prospects and the tax system, female labor force participation in the former GDR was one of the highest in the world. Since some of these factors have changed in the transition process, childcare facilities in particular are no longer provided by firms and those provided by communities or private institutions are either rationed or expensive (Hunt, 1997, p. 5), we would expect only those women with a relatively high market wage remain in the labor force. Indeed, there seems to be some evidence that women with poor labor market opportunities have disproportionately left the labor force after having been laid off, and this may have affected the female wage structure (Hunt, 1999b). This conjecture is also compatible with the observed changes in the skill distribution of women; see Table 5 above.

Early retirement has been, and still is, an important means of employment adjustment in the first stage of the East German transition process (Licht and Steiner, 1994). In view of the reduction and restructuring of employment on a grand scale and the resulting devaluation of human capital of older workers accumulated under socialism, early retirement was seen as the easiest way to adjust the workforce. Since elderly employees who did not take advantage of this option are most likely a very special group with a high market wage, selectivity effects are also expected to be important with respect to age.

Another labor supply factor which may have affected the East German wage structure are migrants and commuters to West Germany because they may comprise persons with certain characteristics, which may give rise to yet another selectivity effect. The large flows of migrants to Western Germany at the beginning of the transition process and the persistently high number of commuters aroused much concern among politicians and the East German public that they were losing the more qualified and motivated part of the workforce to West Germany. However, Pischke *et al*. (1994) do not find conclusive evidence for the hypothesis that commuters are a self-selected group of employees.

6. EMPIRICAL WAGE FUNCTIONS

In the following empirical analysis, we try to quantify the relative importance of the human capital factors potentially influencing the East German wage structure. For this purpose, we estimate generalized wage functions with the logarithm of hourly wages as the dependent variable and a number of human capital indicators related to the discussion in the previous section. Furthermore, we examine whether potential selection effects referred to above affect the estimated wage functions for employees.

Following the discussion in the preceding section, we proxy an individual's human capital by dummies for education and vocational training (unskilled, master craftsman and graduate, with skilled as the base category), actual labor market experience, and firm tenure. A central implication of human capital theory is that individual wages increase with labor market experience at a decreasing rate because the older one gets the less profitable additional investments in human capital become (Franz, 1999). Empirically, this should show up in concave wage–experience profiles, which we model by including linear and quadratic experience terms in the estimated wage functions. In order to test whether firm tenure increases wages in excess of labor market experience (which includes tenure) we also include a linear and quadratic term in tenure in the wage function. Indirectly, this also allows us to test for the positive effect of job mobility on wages in the first phase of the East German transition process referred to above; given the validity of this hypothesis, we would expect a negative effect of firm tenure on individual wages.

Since it seems likely that both the returns to labor market experience and to tenure depend on the level of vocational/educational qualification, we have included interaction terms between these variables in the wage functions. However, these interactions turned out statistically insignificant in preliminary estimates of the wage functions and were, therefore, not included in the final specification reported below. For the reason given above, we have also interacted the experience terms with a dummy for public sector employment.

To account for other structural factors potentially affecting wages, we control for firm size, industry and region in the estimation of the wage functions. To some extent, these factors can explain wage differentials as far as collective wage bargaining outcomes have affected individuals differently depending on sector of employment, firm-size and, less importantly, region (see Section 3). Although the reasons for the substantial industry and firm-size effects found for most market economies are not well understood, their empirical importance has been established in several econometric studies (for Germany see, e.g., Gerlach and Hübler, 1995; Möller and Bellmann, 1995).

Since we are mainly interested in structural changes in wage determination during the transition process, the analysis is carried out for single years in order to allow the regression coefficients to change over time. To save space, estimation results are only reported for the years 1990, 1992, 1995 and 1997. These years also correspond to the three different phases of the East German wage adjustment process referred to in Section 4. To allow all regression coefficients to differ by gender, the empirical wage functions were estimated separately for males and females. Sample means of the variables in the wage functions are described in Table A.2 in the Appendix.

To test for potential selection effects due to the factors mentioned in Section 5, we estimated the wage functions using the standard two-step procedure due to Heckman (1979).[6] It turned out that selectivity effects are indeed important in the estimation of wage functions for East Germany. Detailed estimation results of selectivity-corrected wage functions are reported in Table 6A for men and in Table 6B for women. The following discussion focuses on the main results with respect to the human capital variables defined above, estimation results for firm size, industry and region effects are briefly discussed at the end of this section.

6. In the first step, the individual probability of being employed was estimated by way of cross-section probit equations separately for men and women and for each year. In the second step, selectivity-corrected wage functions were estimated by OLS including the inverse Mills ratio calculated on the basis of the first-step probit coefficients as an additional regressor. The coefficients in the wage functions are identified by the exclusion of various household variables (other household income, number of children, marital status) included in the employment probit equations. For details on this two-step procedure to correct for selectivity bias see Heckman (1979) or Franz (1999). Detailed estimation results for the probit employment equations are available from the authors upon request (e-mail: steiner@zew.de).

Table 6A Selectivity-corrected cross-section wage functions for East German men[a]

	1990		1992		1995		1997	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Constant	1.759	0.066	2.457	0.083	2.470	0.090	2.874	0.084
Formal qualification (unskilled)								
Skilled	0.063	0.041	−0.016	0.055	0.018	0.055	−0.077	0.049
Master craftsman	0.257	0.043	0.141	0.060	0.152	0.060	0.083	0.056
Graduate	0.372	0.047	0.222	0.062	0.300	0.068	0.208	0.057
Labor market experience (yrs.)	0.002	0.003	0.003	0.005	0.001	0.005	0.007	0.005
Experience squared/100	−0.005	0.006	−0.014	0.012	−0.007	0.013	−0.021	0.012
Experience × public sector	–	–	0.006	0.008	0.007	0.009	−0.005	0.008
Exp. sq. × public sector	–	–	−0.002	0.017	−0.003	0.021	0.029	0.020
Firm tenure (yrs.)	0.004	0.002	−0.007	0.003	0.011	0.004	0.013	0.004
Tenure squared/100	−0.005	0.006	0.028	0.008	−0.020	0.011	−0.025	0.011
Firm size (<20 employees)								
20–199	0.045	0.027	0.109	0.025	0.099	0.030	0.110	0.025
200–1,999	0.061	0.027	0.137	0.029	0.171	0.033	0.195	0.031
≥ 2,000	0.078	0.028	0.176	0.032	0.261	0.040	0.303	0.035
Industry (mechanical engin.)								
Agriculture, forestry, fishing	−0.247	0.023	−0.103	0.039	−0.260	0.064	−0.338	0.057
Energy, mining	0.110	0.026	0.183	0.041	−0.006	0.049	0.103	0.053
Chemical products etc.[b]	−0.006	0.025	0.084	0.044	−0.164	0.054	−0.067	0.051
Stone, clay, glass, construction	0.023	0.023	0.190	0.032	−0.031	0.039	−0.018	0.037
Primary and fabricated metals	0.044	0.024	0.040	0.039	−0.054	0.048	0.081	0.046
Textiles, apparel, food, tobacco	−0.090	0.032	−0.035	0.046	−0.097	0.061	−0.039	0.060
Wholesale and retail trade	−0.118	0.037	−0.013	0.044	−0.082	0.060	−0.098	0.049
Transportation	0.008	0.027	−0.019	0.036	−0.144	0.046	−0.093	0.046
Public sector[c]	0.014	0.024	−0.097	0.073	−0.185	0.100	−0.047	0.076
Banking, insurance	0.147	0.187	−0.139	0.090	−0.046	0.146	0.244	0.131
Business services	−0.039	0.066	0.174	0.089	−0.077	0.098	0.006	0.136
Personal services[d]	−0.223	0.086	−0.097	0.098	−0.265	0.126	−0.286	0.090
Missing or unassignable	−0.028	0.046	0.001	0.073	−0.208	0.080	−0.051	0.104
Region (East Berlin)								
Mecklenburg	−0.036	0.031	−0.055	0.046	−0.167	0.054	−0.095	0.062
Brandenburg	−0.054	0.028	−0.105	0.044	−0.090	0.050	−0.093	0.059
Sachsen-Anhalt	−0.056	0.028	−0.093	0.042	−0.150	0.048	−0.095	0.060
Thüringen	−0.029	0.029	−0.146	0.042	−0.179	0.049	−0.181	0.059
Sachsen	−0.052	0.026	−0.112	0.040	−0.146	0.048	−0.150	0.057
Inverse Mill's ratio[d]	−0.152	0.052	−0.055	0.040	−0.146	0.046	−0.170	0.027
No. of observations	1,383		975		864		771	
R^2	0.399		0.263		0.295		0.431	

Notes:
[a] S.E. = heteroskedasticity-consistent standard errors.
[b] Chemical products, oil products, lumber, furniture, paper, printing.
[c] Education, healthcare, welfare services, public utilities and public administration.
[d] For definition see text.

Table 6B Selectivity-corrected cross-section wage functions for East German women[a]

	1990		1992		1995		1997	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Constant	1.435	0.069	2.049	0.078	2.498	0.116	2.686	0.119
Formal qualification (unskilled)								
Skilled	0.136	0.032	0.108	0.043	0.065	0.063	0.041	0.066
Master craftsman	0.427	0.034	0.288	0.046	0.204	0.068	0.214	0.071
Graduate	0.544	0.042	0.480	0.054	0.347	0.075	0.357	0.078
Labor market experience (yrs.)	0.006	0.003	0.003	0.005	0.002	0.005	0.007	0.006
Experience squared/100	−0.016	0.007	−0.005	0.012	−0.005	0.014	−0.019	0.015
Experience × public sector	–	–	0.027	0.008	0.021	0.008	0.005	0.008
Exp. sq. × public sector	–	–	−0.065	0.018	−0.043	0.021	−0.003	0.020
Firm tenure (yrs.)	0.003	0.002	0.009	0.003	0.019	0.004	0.022	0.004
Tenure squared/100	0.000	0.008	−0.024	0.010	−0.037	0.013	−0.045	0.014
Firm size (<20 employees)								
20–199	0.092	0.026	0.079	0.027	0.119	0.030	0.154	0.030
200–1,999	0.080	0.026	0.144	0.027	0.180	0.030	0.236	0.034
≥ 2,000	0.116	0.029	0.182	0.030	0.231	0.033	0.287	0.035
Industry (mechanical engin.)								
Agriculture, forestry, fishing	−0.144	0.036	−0.041	0.067	0.019	0.088	−0.239	0.109
Energy, mining	0.111	0.043	0.204	0.057	0.285	0.083	0.095	0.123
Chemical products etc.[b]	0.067	0.034	0.081	0.059	−0.028	0.077	−0.143	0.085
Stone, clay, glass, construction	0.091	0.036	0.150	0.073	0.125	0.089	0.004	0.082
Primary and fabricated metals	−0.004	0.042	−0.036	0.084	0.085	0.098	−0.048	0.092
Textiles, apparel, food, tobacco	−0.024	0.034	−0.059	0.058	−0.172	0.086	−0.314	0.076
Wholesale and retail trade	0.027	0.031	0.047	0.050	−0.047	0.071	−0.120	0.068
Transportation	0.073	0.038	0.088	0.051	0.028	0.080	−0.105	0.079
Public sector[c]	0.066	0.029	−0.077	0.075	−0.038	0.096	−0.045	0.095
Banking, insurance	0.132	0.056	0.180	0.056	0.180	0.074	0.041	0.080
Business services	0.155	0.063	0.245	0.068	0.152	0.095	0.047	0.084
Personal services[d]	0.042	0.053	−0.003	0.060	−0.188	0.084	−0.348	0.092
Missing or unassignable	−0.027	0.064	−0.056	0.062	−0.046	0.086	−0.219	0.098
Region (East Berlin)								
Mecklenburg	−0.037	0.035	0.018	0.037	−0.074	0.048	−0.073	0.051
Brandenburg	−0.090	0.033	−0.012	0.038	−0.076	0.045	−0.141	0.047
Sachsen-Anhalt	−0.092	0.032	−0.035	0.035	−0.109	0.043	−0.177	0.044
Thüringen	−0.089	0.032	−0.041	0.039	−0.141	0.046	−0.167	0.045
Sachsen	−0.084	0.031	−0.062	0.033	−0.127	0.040	−0.200	0.041
Inverse Mill's ratio[d]	−0.106	0.046	−0.054	0.032	−0.116	0.037	−0.105	0.035
No. of observations	1,261		845		758		718	
R^2	0.422		0.407		0.461		0.517	

Notes:
[a] S.E. = heteroskedasticity-consistent standard errors.
[b] Chemical products, oil products, lumber, furniture, paper, printing.
[c] Education, healthcare, welfare services, public utilities and public administration.
[d] For definition see text.

6.1. Returns to formal qualification

As mentioned above, statistical tests show that the returns to formal qualification do not depend on labor market experience or on firm tenure, as is the case for West Germany (see Steiner and Wagner, 1997, 1998). Therefore, and because of the semi-logarithmic specification of the wage functions, the regression coefficients of the dummy variables for qualification groups in Tables 6A and 6B, *ceteris paribus*, approximately express the wage differentials between the corresponding qualification group and the base category (unskilled workers).[7] For example, the value of the coefficient on the dummy variable for an employee with a university degree (graduate) for 1990 of 0.372 shown in Table 6A means that the hourly wage of male graduates exceeded the wage of an unskilled worker with otherwise the same characteristics by about 45 per cent (= $\exp(0.372 - 1) \times 100$). In contrast, the wage differential between graduates and master craftsmen was rather small, and there was no wage differential between skilled and the small group of unskilled male workers in the former GDR. Female wage differentials between the highly skilled and skilled workers were even more pronounced than for men, with university graduates earning one-and-a-half times the hourly wage of skilled workers (*Facharbeiterinnen*) in the 'Workers' and Peasants' Republic'. There was also a wage differential of about 15 per cent between skilled and unskilled women in 1990.

The development of the estimated education/vocational wage differentials over time shows some unexpected results. First, the relative wage of skilled East German men did not increase over time; if anything, the relative wage of skilled workers declined, although the negative coefficient in 1997 is not significantly different from zero. For women, the positive wage differential of skilled relative to unskilled labor had vanished by 1995. Second, the positive wage differential master craftsmen earned relative to skilled laborers in 1990 had disappeared by 1997. For women, such a wage differential still exists, but relative to 1990 at a much lower level. Third, both for men and women the graduate wage differential declined perceptively during the transition period, but substantial differentials still remain for both sexes. The graduate wage differential for women is larger than that for men and both are comparable in magnitude to the respective graduate wage differentials prevailing in West Germany (see Steiner and Wagner, 1997, 1998).

6.2. Returns to labor market experience and firm tenure

As mentioned above, returns to labor market experience in East Germany do not seem to depend on the level of formal qualification, as is the case for West Germany. As regards the hypotheses on changes of returns to labor market experience in the East German transition process referred to in Section 5, they

7. For coefficients large in absolute value, the approximation of the wage differential by the coefficient becomes increasingly inaccurate.

Table 7 *F*-tests of the significance of labor market experience and tenure effects on wages

	Men				Women			
	1990	1992	1995	1997	1990	1992	1995	1997
Experience	0.48	3.07*	1.01	1.76	2.75	0.22	0.06	0.80
Experience × public sector	–	3.92*	3.36*	4.81*	–	6.42*	4.07*	1.17
Firm tenure	4.00*	7.43*	8.60*	12.05*	6.87*	5.50*	20.72*	21.84*

Note: *F*-tests are based on the joint significance of the linear and quadratic term of each variable in the wage equations reported in Tables 6A and 6B; an asterisk indicates that the linear and quadratic terms are jointly significant at least at the 5 per cent level.

are only partially supported by our estimation results. To test these hypotheses, we performed the following statistical tests summarized in Table 7.

Interaction dummies between experience and 'public sector' were included in the regressions to account for the direct dependence of wages in this sector on labor market experience and age, respectively, due to special collective bargaining agreements[8] for this sector taken over from West Germany immediately after unification. Table 7 shows that, with one exception, this interaction effect is always statistically significant, which implies higher returns to labor market experience if employed in the public sector. Moreover, wages do not increase with general labor market experience if not employed in the public sector.

Since labor market experience also includes tenure at the current firm, the estimated tenure effect measures the additional return of staying an additional year with the same firm conditional on years of labor market experience. As the *F*-tests in Table 7 show, tenure effects are always highly significant.

On the basis of these tests and the plots of the estimated wage–experience profiles in the upper part of Figure 2, we draw the following conclusions. First, the observation that, compared to West Germany and other market economies, returns to labor market experience were very low in the former GDR is supported by the rather flat wage–experience profiles both for men and women obtained for 1990. Subsequently, labor market experience was completely devalued both for men and women working in the private sector of the economy. However, for those keeping their job or getting a new job in the public sector, the returns to labor market experience increased substantially after unification. This increase was much larger for women than for men, though. For example, while the wage differential of a male employee with 10

8. These agreements, contained in the 'Bundesangestelltentarifvertrag' (BAT), among other things stipulate more or less automatic individual wage increases every two years of employment on top of overall wage increases in the public sector.

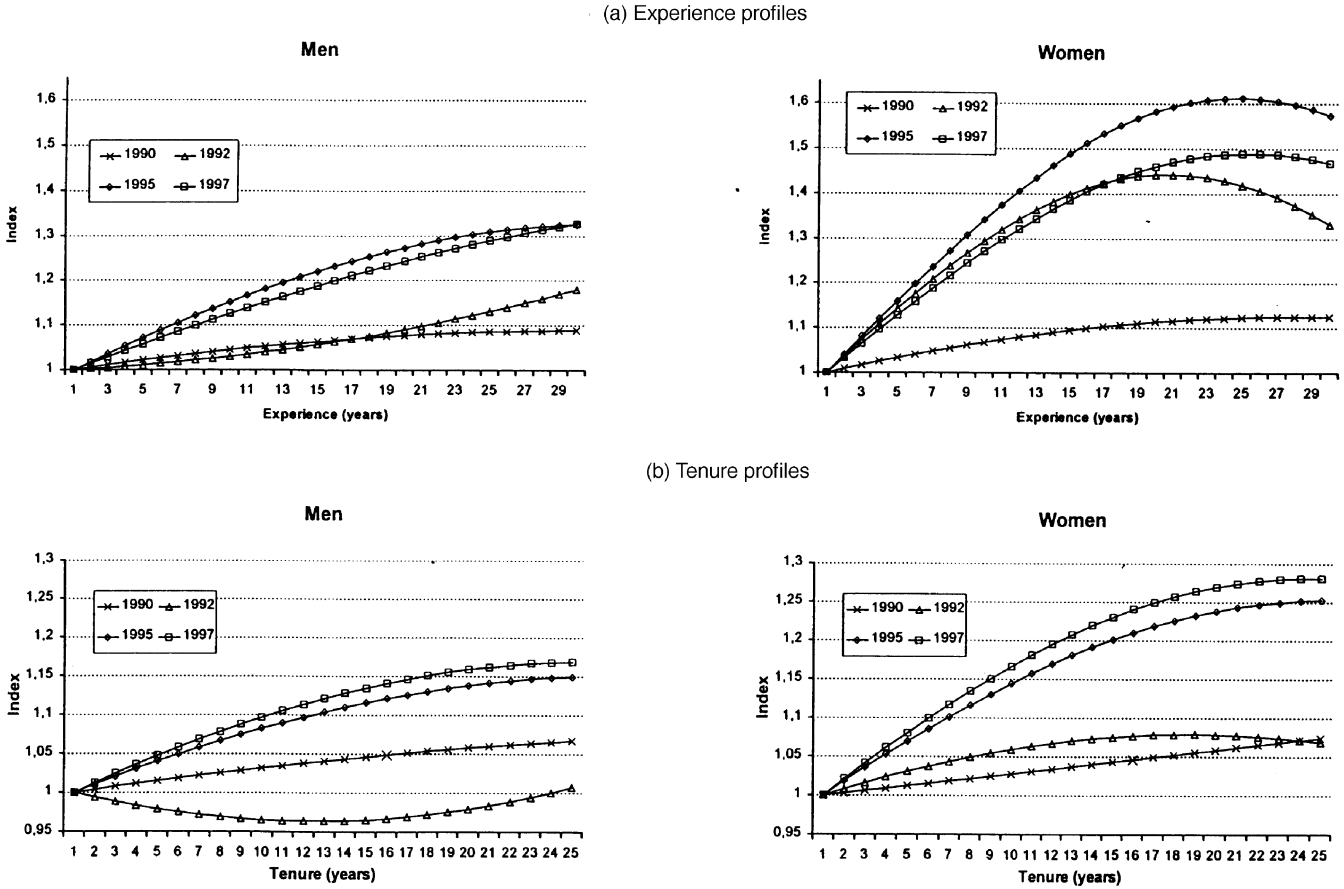

Figure 2

Notes: Based on estimated wage equations in Tables 6A and 6B; labor market experience includes tenure with the current firm.

(20, 30) years of labor market experience relative to a reference person just starting work, *ceteris paribus*, increased from a meager 5 (8, 9) per cent to a modest 13 (24, 33) per cent between 1990 and 1997, the respective female wage differentials increased by about 20 (35, 35) percentage points in the same period. For women, these wage differentials are, on average, much higher than the female experience differentials prevailing in West Germany and are similar in magnitude to those estimated for West German men (see Steiner and Wagner, 1997, 1998).

The share of women employed in the public sector among all East German female employees is much higher than that for men, and this gender difference has substantially increased over time. According to data from the Labor Force Survey ('Mikrozensus'), about a third of all East German women were employed in the public sector in 1991, compared to only about 15 per cent of all East German men. By 1995, the share of women employed in the public sector has increased to about 43 per cent in East Germany, compared to about one-third in West Germany. In contrast, the share of East German men employed in the public sector has not changed during this period; by 1995 it obtained the same level as in West Germany. To some extent, this gender difference can be explained by the high incidence of public works programs and publicly financed training programs among East German women with higher education (see Kraus *et al*., 1999, 2000).

The pronounced upward-shift of the female wage–experience profiles in the public sector together with the substantial increase of the share of women working in this sector is an important factor for the observed gender differences in the development of the East German wage distribution after unification discussed in Section 4. The public sector offered women a much better shelter against the devaluation of their human capital acquired under socialism, because women became increasingly employed in the public sector, at least in relative terms, where wages are predominantly determined by formal qualification and labor market experience. In contrast, the share of men working in the public sector remained at a relatively low level, and for the great majority of men employed in the private sector general human capital acquired under socialism was devalued completely after unification.

The plots in the lower panel of Figure 2 show that the effect of firm tenure on wages was rather small and quite similar for men and women before unification. Given that little job mobility existed before unification, there was little difference between the effects of general labor market experience and firm tenure on individual wages.[9] After unification, tenure profiles became much steeper, especially for women. For men, returns to tenure even became negative immediately after unification, which is compatible with the observation by Hunt (1999a) referred to above that returns to job mobility were very high in the first phase of the transition process. For subsequent years, however, estimated wage-tenure profiles are also upward-sloping for men, if to

9. Note the differences in scale between the upper and lower parts of Figure 2.

a much smaller extent than for women. This result, too, seems compatible with the observation made by Hunt (1999a) that returns to job changing fell substantially in later periods. However, it is not clear to us why tenure profiles differ by gender in this respect.

6.3. Firm-size, industry and regional effects

We now turn to some other important factors, such as firm size, industry and region, which may have affected the East German wage structure through the German collective bargaining system outlined in Section 3.

As estimation results in Tables 6A and 6B show, firm-size differentials, *ceteris paribus*, seem to have been relatively small under socialism, but increased quite substantially after unification. In 1997, large companies (more than 2,000 employees) paid about 30 per cent higher wages than small firms (up to 20 employees). Since this large wage differential exists in spite of equal levels of the (observed) level of human capital within the same economic sector, it seems likely that firm-level trade unions and works councils, which are more prevalent in large enterprises, achieved wage increases beyond the level set in industry-level collective bargaining agreements. This conjecture is also supported by the persistence of comparable firm-size wage differentials in West Germany.[10]

Except for a few sectors (agriculture and forestry, trade and services), industry wage differentials were low in the former GDR. Although significant wage differentials have evolved in a few sectors of the East German economy, wages are still rather little differentiated by sector compared to West Germany (see e.g. Möller and Bellmann, 1995) or other developed market economies. In East Germany, there is a relatively large positive wage differential in banking and insurance, although only for male employees, whereas wage differentials are strongly negative in personal services, for female employees in light industries (textiles etc.), and in trade. On the other hand, neither in the still over-sized public sector nor in the obsolete heavy industry sector has noticeable pressure on wages occurred. This again shows that in sectors with relatively powerful unions and little competition, the relative position of wages can be held up even when the economy undergoes fundamental structural changes.

Finally, even after controlling for differences in human capital and industry structure, wages in the former GDR differed by region, i.e. the Länder. Surprisingly, these regional wage differentials were larger for women than for men, and this gender difference also more or less persisted over time. As expected, the reunited labor market of Berlin brought about stronger wage increases in East Berlin than in the other East German states. It may come as a surprise that the regional wage differential obtains its smallest (absolute) value in the economically most backward states of Mecklenburg-Vorpommern and

10. Gerlach and Hübler (1995) summarize theoretical approaches to the relationship between firm size and wages and also present an empirical analysis for West Germany.

Brandenburg, whereas it is relatively high in the more economically prosperous states of Thüringen and Sachsen. However, this could be explained by the fact that part of the regional wage differentials is already accounted for by the industry and firm-size dummies. For example, the comparatively low observed wage level in the state of Mecklenburg-Vorpommern is mainly explained by the very large negative coefficient of the dummy for the agriculture and forestry sector, which is still predominant in this region. Likewise, the relatively high observed average wage in Thüringen, which is a more industrialized state, can to some extent be explained by the firm-size effect.

7. SUMMARY AND CONCLUSIONS

Nominal wages in East Germany increased dramatically in the first years after unification, which had very different effects on labor costs, and the standard of living of East Germans. While the product wage more than doubled between 1990 and 1998, the increase in the consumption wage amounts to some 30 per cent during the same period, which is far less than may have been expected by the East German people on the eve of unification. Thus, the relatively slow increase of consumption wages relative to product wages may explain the heated disputes over 'fair wage developments' in East Germany. On the other hand, the strong increase in East German unit labor costs after unification, which still exceeded the West German level by a wide margin at the end of the 1990s, has resulted in a dramatic decline of employment and extremely high unemployment.

Regarding the structure of wages, we find diverse results concerning the impact of industrial structure on the development of wages. Firm-size differentials increased quite substantially after unification, especially in relatively large firms. Since this large wage differential exists in spite of equal (observed) levels of human capital within the same economic sector, it seems likely that firm-level wage bargaining, which is more prevalent in large enterprises, achieved wage increases beyond the level achieved in industry-level collective bargaining agreements. On the other hand, wages are still rather little differentiated by sector compared to West Germany or other developed market economies, although significant wage differentials have evolved in a few sectors of the East German economy. In particular, neither in the still over-sized public sector nor in the obsolete heavy industry sector has noticeable pressure on wages occurred. Hence, there is evidence that in sectors with powerful unions and little competition, the relative position of wages can be held up even when the economy undergoes fundamental structural changes.

While East German wages increased substantially across the wage distribution, there was also a pronounced increase in wage inequality. The upper ranks of the wage distribution experienced the highest increases in real wages although there were also marked improvements for the lower ranks. Over the whole period, wage inequality among women was higher than among

men. By 1997, overall wage inequality for East German men had reached roughly the same level as in West Germany, both in the upper and in the lower part of the wage distribution. In contrast, female wages in East Germany are distributed much more unequally than in West Germany now, and this higher inequality relates both to the lower and the upper part of the wage distribution. Since observable human capital has not changed dramatically in East Germany since unification, this increase in inequality must be related to increased rewards for innate abilities which have become more important in the more flexible East German labor market.

Substantial wage differentials between occupational groups already existed in the former GDR: university graduates earned substantially higher wages than persons with a vocational background, and unskilled women received the lowest wages during socialism, too. Hence, the equality of earnings under socialism turns out to be a myth. After unification, the relative wage of unskilled East German men has not increased and the positive wage differential earned by skilled relative to unskilled women had vanished by 1995. The positive wage differential master craftsmen earned relative to skilled laborers under socialism disappeared for men and was substantially reduced for women. For both men and women, the graduate wage differential declined perceptively during the transition period. The graduate wage differential for women is still larger than that for men and both are comparable in magnitude to the respective graduate wage differentials prevailing in West Germany.

Compared to West Germany and other market economies, wage–experience profiles in the former GDR were rather flat and differed little by gender. Since unification, the human capital acquired through general work experience was completely devalued for both men and women working in the private sector of the East German economy. However, for those keeping their job or getting a new job in the public sector, the returns to labor market experience increased substantially after unification. This increase was much larger for women than for men. After unification, wage profiles became markedly steeper with respect to firm tenure, especially for women. Since these gender-specific differences are neither related to observed variables nor potential selection effects, it is not clear how they can be explained.

The pronounced upward-shift of the female wage–experience profile in the public sector together with the substantial increase of the share of women working in this sector is an important factor for the observed gender differences in the development of the East German wage distribution after unification. To a large extent, this also explains the fact that the still existing wage differential between East and West Germany has become much smaller for women than for men. However, it seems unlikely that the very large share of women working in the public sector, often employed on heavily subsidized public works programs, is sustainable in the future. In the private sector of the East German economy it will still take a long time before wages have adjusted to West German levels.

APPENDIX

Table A.1 Stepwise selection of samples (cases) and sample attrition (in per cent)

	Men		Women	
	Cases	%	Cases	%
1990				
All cases	2,237		2,526	
(1) Between 19 and 65/60 years	2,012	10.06	2,033	19.52
(2) Employed	1,885	6.31	1,848	9.10
(3) Not self-employed	1,792	4.93	1,802	2.49
(4) Not marginally employed, not civil servant or military service	1,767	1.40	1,799	0.17
(5) Not in education/full-time training, not on maternity leave	1,739	1.58	1,637	9.01
(6) With valid monthly earnings	1,596	8.22	1,510	7.76
(7) Above the lower social security threshold[a]	1,539	3.57	1,435	4.97
(8) With valid hourly wage	1,528	0.71	1,427	0.56
(9) With valid information on all variables[b]	1,514	0.92	1,407	1.40
1992				
All cases	2,063		2,323	
(1) Between 19 and 65/60 years	1,864	9.65	1,867	19.63
(2) Employed	1,560	16.31	1,391	25.50
(3) Not self-employed	1,450	7.05	1,345	3.31
(4) Not marginally employed, not civil servant or military service	1,400	3.45	1,328	1.26
(5) Not in education/full-time training, not on maternity leave	1,353	3.47	1,205	9.26
(6) With valid monthly earnings	1,241	8.28	1,132	6.06
(7) Above the lower social security threshold[a]	1,236	0.40	1,116	1.41
(8) With valid hourly wage	1,127	8.82	1,006	9.86
(9) With valid information on all variables[b]	1,109	1.60	992	1.39
1995				
All cases	1,967		2,218	
(1) Between 19 and 65/60 years	1,756	10.73	1,743	21.42
(2) Employed	1,455	17.14	1,365	21.69
(3) Not self-employed	1,326	8.87	1,305	4.40
(4) Not marginally employed, not civil servant or military service	1,261	4.90	1,267	2.91
(5) Not in education/full-time training, not on maternity leave	1,197	5.08	1,098	13.34
(6) With valid monthly earnings	1,123	6.18	1,038	5.78
(7) Above the lower social security threshold[a]	1,113	0.89	1,018	1.93
(8) With valid hourly wage	1,033	7.19	915	10.12
(9) With valid information on all variables[b]	1,019	1.36	904	1.20
1997				
All cases	1,958		2,166	
(1) Between 19 and 65/60 years	1,697	13.33	1,688	22.07
(2) Employed	1,285	24.28	1,184	29.86
(3) Not self-employed	1,156	10.04	1,109	6.33
(4) Not marginally employed, not civil servant or military service	1,066	7.79	1,050	5.32
(5) Not in education/full-time training, not on maternity leave	1,006	5.63	905	13.81
(6) With valid monthly earnings	942	6.36	858	5.19
(7) Above the lower social security threshold[a]	942	0.00	857	0.12
(8) With valid hourly wage	939	0.32	857	0.00
(9) With valid information on all variables[b]	926	1.38	844	1.52

Notes:
[a] The lower social security threshold is one-seventh of the reference amount of monthly earnings; for the selected years these amounts were: 1990: 200 DM; 1992: 300 DM; 1995: 450 DM; 1997: 520 DM (Westdeutschland 1990: 470 DM; 1992: 500 DM; 1995: 580 DM; 1997: 610 DM); see http://www.bfa-berlin.de
[b] All variables included in the estimation of the selectivity-corrected wage equations, see Section 5 in the text.

Table A.2 Means of variables in the wage equations

	Men				Women			
	1990	1992	1995	1997	1990	1992	1995	1997
Nominal hourly wages	6.961	12.984	18.232	19.625	6.076	12.162	17.659	19.235
Log hourly wages	1.898	2.517	2.838	2.914	1.756	2.448	2.804	2.882
Formal qualific. (unskilled)[a]								
Skilled	0.667	0.703	0.696	0.688	0.636	0.589	0.577	0.583
Master craftsman	0.187	0.155	0.149	0.139	0.224	0.273	0.282	0.276
Graduate	0.120	0.122	0.123	0.143	0.083	0.104	0.113	0.109
Labor market experience	18.170	18.819	19.142	18.422	16.469	17.000	17.251	16.506
Experience squared	4.850	4.671	4.788	4.520	3.846	3.804	3.896	3.729
Experience × public sector	2.623	3.702	3.398	3.941	5.023	7.529	8.338	8.396
Exp. sq. × public sector	0.686	0.968	0.908	1.060	1.071	1.610	1.889	1.960
Firm tenure	13.684	9.392	7.827	7.977	11.824	8.233	7.386	8.070
Tenure squared	3.056	2.069	1.573	1.492	2.298	1.541	1.312	1.369
Firm size (<20 employees)								
20–199	0.277	0.372	0.394	0.419	0.317	0.370	0.304	0.323
200–1,999	0.373	0.260	0.197	0.163	0.362	0.227	0.242	0.226
≥ 2,000	0.280	0.172	0.128	0.146	0.209	0.187	0.170	0.169
Industry (mechanical engin.)								
Agriculture, forestry, fishing	0.168	0.059	0.046	0.030	0.089	0.032	0.022	0.021
Energy, mining	0.068	0.058	0.042	0.040	0.030	0.027	0.014	0.015
Chemical products[b]	0.067	0.070	0.055	0.061	0.055	0.035	0.036	0.028
Stone, clay, glass, construction	0.114	0.161	0.265	0.248	0.038	0.028	0.042	0.043
Primary and fabricated metals	0.061	0.084	0.076	0.076	0.038	0.020	0.020	0.019
Textiles, apparel, food, tobacco	0.043	0.029	0.022	0.035	0.073	0.045	0.029	0.036
Wholesale and retail trade	0.044	0.068	0.081	0.077	0.125	0.134	0.120	0.145
Transportation	0.097	0.118	0.101	0.093	0.061	0.063	0.053	0.036
Public sector[c]	0.142	0.192	0.158	0.192	0.329	0.454	0.477	0.475
Banking, insurance	0.001	0.007	0.008	0.012	0.013	0.047	0.055	0.043
Business services	0.012	0.014	0.023	0.023	0.006	0.019	0.026	0.042
Personal services	0.005	0.011	0.016	0.013	0.023	0.033	0.034	0.037
Missing or unassignable	0.020	0.021	0.018	0.013	0.025	0.019	0.038	0.024
Region (East Berlin)								
Mecklenburg	0.121	0.100	0.116	0.107	0.113	0.104	0.113	0.096
Brandenburg	0.154	0.165	0.165	0.172	0.155	0.150	0.151	0.144
Sachsen-Anhalt	0.190	0.199	0.183	0.172	0.192	0.204	0.182	0.201
Thüringen	0.167	0.175	0.179	0.187	0.174	0.175	0.181	0.177
Sachsen	0.309	0.292	0.299	0.312	0.301	0.276	0.295	0.306
Inverse Mill's ratio[d]	0.119	0.191	0.203	0.336	0.224	0.323	0.301	0.434
No. of observations	1,383	975	873	775	1,261	852	769	722

Notes:
[a] Base categories of dummy are given in parentheses.
[b] Chemical products, oil products, lumber, furniture, paper, printing.
[c] Education, healthcare, welfare services, public utilities and public administration.
[d] For definition see text.

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