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The East German Wage Structure in the Transition to a Market Economy

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by

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Abstract: An important question for the development of the East German labour market in the transition to a market economy is whether wage differentials by qualification, industry or region which were relatively small in the former GDR adjust to those in market economies which are more in line with differences in productivities and economic conditions. We estimate empirical earnings functions to quantify the contribution of various important factors shaping the earnings distribution in the East German transition process. Estimation is based on the first six waves of the Labour Market Monitor which is a representative panel data set of the East German working-age population covering the period 1990 to 1992. The specification of the estimated earnings functions is motivated by the various hypotheses of the development of the East German wage structure in the transformation process. Although we do find some similiarities with the existing wage structure in West Germany, the East German wage structure still differs in some important dimensions.

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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 (Akerlof et al, 1991; Sinn / Sinn, 1992; Siebert, 1992). Soon 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 simple were set to catch-up to this pre-specified target (surveys of East German labour market developments are provided in Franz, 1992, 1993). 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 otherwise East Germans would migrate to the west at a grand scale and congest already crowded labour and housing markets. However, with sky-rocketing unemployment and the virtual breakdown of manufacturing industries the recognition of economic realities have in the end reached the bargaining table. A speedy catching-up of wages to West German levels is still on the agenda, but the deadline for wage equalization has now been set for 1996.

Aside from the hotly debated issues of catching-up of wages and the equalization of living standards in united Germany, an important question is whether wages are sufficiently differentiated by qualification, industry or region to account for differences in productivities and economic conditions in East Germany. Conventional wisdom holds that, due to socialist ideology, there was little wage differentiation in the former 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 conventional wisdom that collective bargaining agreements have not allowed for this necessary adjustment of wages (see, e.g., Siebert, 1992:124-128; Sachverständigenrat, 1993:235-236).

However, as concerned statements of representatives of both unions and employers' organizations suggest, these centralized agreements often were 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 West Germany. Reasons for this apparently new development in German industrial relations include concession bargaining at the firm level and the fact that incumbent firms have been leaving or new firms have not been joining employers' unions at 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 "Öffnungs-klauseln". It therefore seems not obvious a priori that the wage structure in East Germany is in fact rigid and thus hinders the transition process to a market economy. Nor is there much empirical evidence on the existence and relative size of wage differentials by qualification, firm and industry characteristics or region.

This paper contributes to an evaluation of this and related issues. In particular, we focus on the factors influencing the East German wage structure and on the question on whether the emerging wage structure corresponds to that observed in other market economies, especially in West Germany. To this end, we estimate earnings equations based on a rich panel data set for the East German labour market covering the first two years of the transition process. The paper is set up as follows. In section 2, we discuss various hypotheses on the development of the East German wage structure in the transition process which form the basis for the specification of the earnings equations described in section 3. Estimation results from these earnings equations are summarized and discussed in section 4, and section 5 contains our conclusions.

2 Factors Influencing the East German Wage Structure

There are various hypotheses which try to explain the development of the East German wage structure in the transformation process. These hypotheses, which motivate the specification of the earnings equation in section 3, are briefly summarized below with special reference to their implications for the structure of wages.

Industry Shifts and Restructuring

The process of "de-industrialization" in East Germany on the one hand, the modernisation of the infrastructure, the improvement of housing quality as well as the increased demand for services by firms and households lacking before the regime switch on the other hand have led to shifts in labour demand both within and between manufacturing and service industries. In addition, the relative to other countries very high employment share in farming has sharply decreased since unification. These changes were brought about by the virtual breakdown of trade with the former trading partners, for which there were several reasons: break-up of the former COMECON trading system, quadrupling of the exchange rate in the wake of the currency union and huge wage increases since then.

In a competitive labour market these demand shifts would lead to some increase in search unemployment and to changes in relative wages. In East Germany, employment adjustments through wage flexibility was severely restricted by the dominance of union-dominated collective bargaining and institutional regulations (see below). Nevertheless, we would expect some downward wage pressure in those industries where product demand virtually broke down after monetary union. In view of sky-rocketing unemployment, unions agreed to delay the process of catching-up to West German wage levels by 1994 and, due to the realities at the level of individual firms, wage drift became negative in some industries. There is also some evidence (Geib et al., 1992) that the level of effective wages has been below contract wages in certain segments of the East German labour market.

Hence, in industries with expanding demand and little exposure to competition from trade with West German and international firms, like construction and services, we would expect positive wage differentials relative to industries heavily exposed to competition, expecially manufacturing. Since the regional concentration of certain industries was very high in the former GDR, we also expect demand shifts to affect regional wage differentials.

Wage bargaining

The literature on wage determination in East Germany has usually stressed the importance of collective bargaining between monopoly unions and employers' associations (see, e.g., Franz, 1991; Burda / Funke, 1993, Paqué, 1993). Put simply, the story here is the following: In 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 behaviour under the old regime. Consequently, its West German counterpart, the "Deutsche Gewerkschaftsbund", which acts as the umbrella organization for sixteen constituent industrial unions, was able to move into this virgin territority 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.

Given the fact that union organization was particularly successful in the manufacturing sector, where the powerful and determined IG Metall, the former West German union representing a large fraction of all employees in manufacturing, was leading wage negotiations, we would expect particularly strong wage effects in this sector. 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 in manufacturing. However, since this sector was particularly hard hit by employment reductions caused by demand side factors, these effects are expected to be mitigated to some extent by concession bargaining at the firm level, growth in the number of firms not belonging to an employers organization and the application of special "emergency" provisions ("Öffnungsklauseln").

Related to both the industry shift and the wage bargaining hypotheses is the end-game interpretation of the wage bargaining process in declining industries, as discussed by Lawrence / Lawrence (1985) for the U.S. in the eighties and proposed by, inter alia, Franz (1992) as an explanation for wage determination in East Germany. This hypothesis tries to explain why workers in declining industries may manage to raise their wages relative to those of workers in other industries, despite suffering a relative decline in product demand and in the derived demand for labour. The long-run elasticity of the demand for labour depends on the responsiveness of both the level of investment to wages, and the capital intensity of new investment to wages. In an end

game situation, where an industry is clearly dying, investment will be low whatever the level of wages since firms already have more capital than needed. In this case, the elasticity of demand for labour is low and the trade union has an incentive to raise wages and appropriate the quasi rents of the firms. This reasoning obviously depends on a low wage elasticity of labour demand, on which the evidence is mixed (see Akerlof et al. 1991; Burda / Funke, 1993; Licht / Steiner 1994).

Another important dimension of the wage structure is the regional differentiation of wages, e.g. by states (*Länder*), which is also expected to be heavily influenced by centralized wage bargaining. As it is well known, regional wage differentials in West Germany have remained suspiciously stable over decades despite of fundamental changes in economic conditions in the *Länder*. The rigidity of the regional wage structure has been attributed by some observers (see, e.g., Paqué, 1993) to the "principle of equal pay for equal work", a principle which has also featured prominently in political rhetoric on living conditions in Germany after unification. Since the institutional setting of wage bargaining in West Germany has been transferred to the east, we would expect regional wage differentials to be unimportant if industrial structure is taken into account

Efficiency wages

Several variants of efficiency wage theory argue that a firm's strategy to cut wages relative to other firms might in fact increase labour costs measured in efficiency units. One popular variant of this theory is based on the argument of "fairness" or "equity" (Akerlof / Yellen, 1990). It implies that employees compare their wages to some reference group performing a similiar task and adjust their work effort if they see, in their subjective assessment, a discrepancy between effort and remuneration. In the present context, this hypothesis could be relevant in the case of newly founded firms in Eastern Germany, many of which are owned by western companies. Since employees in eastern establishments of western firms might compare their remuneration with their western collegues performing the same task in the same company, firms may have to pay efficiency wages to secure an efficient level of work effort. A positive wage differential in newly established firms would therefore be compatible with this variant of efficiency wage theory. However, it would also not be in conflict with more orthodox explanations of wage determination, e.g. higher capital intensity and, hence, labour productivity in these firms.

Other variants of efficiency wage theory relate to the avoidance of adverse selection, job turnover and shirking by means of a high wage strategy. The most popular of these hypotheses is the shirking variant of the efficiency wage theory which points out that, given costly and imperfect monitoring of effort, firms offer above-average wages as an incentive to their employees to avoid shirking. Since monitoring effort tends to be more difficult in larger firms, this hypothesis offers an explanation of the firm-size wage differentials often observed in market economies (see, e.g., Katz, 1986, for a survey of efficiency wage theory). An alternative explanation would be that larger firms employ more qualified workers and have therefore to pay higher wages. Hence, an interpretation of a positive correlation between wages and firm size in terms of the shirking hypothesis (or any other variant of efficiency wage theory) would at least require that qualification be taken into account.

Human Capital

In contrast to its obsolete physical capital stock, East Germany is generally considered to be well endowed with human capital. In 1990, more than 50 percent of all East German employees had completed apprenticeship training, compared to 60 percent in West Germany, and only 10 percent had no vocational training, compared to about 20 percent of all West German employees. Furthermore, almost one in four of all East German employees had completed a technical college ("Fachschule"), whereas in West Germany the percentage of employees with a similar vocational qualification was only about eight percent. Adding this latter group and those with university education, the share of employees with higher vocational eduaction in East and West Germany is quite similar -- 11 and 12 percent, respectively. A noteworthy difference in vocational attainment between the former GDR and West Germany is the much higher share of women with technical college education in East Germany which, at the beginning of the transition process, was seven times as high as in West Germany (Bielenski / Magvas / Parmentier, 1992:148).

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 (Krueger / Pischke, 1992), wage differentials due to educational attainment seem to have been more or less of similar magnitude (Krueger / Pischke, 1992; but see Schwarze, 1991 and Bird / Schwarze / Wagner, 1994 for somewhat different results). There is also some evidence that experience-earnings profiles in the former GDR were much flatter than in West Germany (Schwarze, 1991; Krueger / Pischke, 1992; Bird / Schwarze / Wagner, 1994).

Due to new production processes and profound changes in the organization of work, the value of labour market experience accumulated in the former socialist economy of the GDR will depreciate in the transition process to a market economy. We would therefore expect rather flat experience/earnings profiles when looking at the East German wage structure after unification, an expectation which seems to be supported by some empirical evidence (Krueger / Pischke, 1992; Bird / Schwarze / Wagner, 1994). There is also some evidence that the restructuring process of the East German economy has been accompanied by "dequalification" of part of the labour force, where employees with higher vocational qualification seem to have been affected most. In particular, survey results for 1991 show that a significantly higher proportion of them had jobs which, in their opinion, required less vocational qualification than the jobs they had at the beginning of the transition process. On the other hand, employees with completed apprenticeship training ("Facharbeiter") seem to be better equipped to cope with changing skill requirements in this process; on average, they reported little change in this respect (Bielenski / Magvas / Parmentier, 1992:151).

Other labour supply factors

Several other labour supply factors may have affected the wage structure in the East German transition process. These include the very high female labour force participation rate, early retirement schemes and short-time work as widespread means of employment adjustment, and migration and commuting to West Germany.

Since unification, employment of women has dropped sharply and female unemployment, especially long-term unemployment, has increased correspondingly, while there seems to have been little downward-pressure on wages and only a modest decline in the female labour force participation rate. However, taking into account that those who lost or voluntarily left their job rationally collect unemployment benefits for some time before they withdraw from the labour market, "effective" female labour force participation in East Germany may be much lower now than the statistics show.[1] Due to their high level of formal education, the easy availabiltiy of child-care facilities, but also socialist ideology supported by good career prospects and the tax system, female labour 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, in particular child-care facitlities are no longer provided by firms and those provided by communities or private institutions are either rationed or expensive, we would expect that only those women with a relatively high market wage remain in the labour force. As it is well known from the labour economics literature, this "self-selection" of individuals in particular labour force states may have important effects on the wage structure.

In addition to short-time work, early retirement was the other quantitatively important means of employment adjustment in the first stage of the East German transition process (Licht / Steiner, 1994). Given that the reduction and restructuring of employment on a grand scale with the reduction of accumulated human capital especially among the older age groups was widely considered inevitable, early retirement, depending on certain age limits either directly or after an extended unemployment spell, was seen as the easiest adjustment policy which also made room for younger employees. 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 important with respect to age.

Another labour supply factor which may have affected the East German wage structure are migrants and commuters to West Germany because they are supposed to comprise persons with certain characteristics giving rise to still another selectivity-effect. The large flows of migrants to West 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 loosing the more qualified and motivated part of the workforce to West Gemany. However, Pischke / Staat / Vögele (1994) analyze potential determinants for migration and commuting to West Germany and do not find conclusive evidence for the hypothesis that commuters are a self-selected group of employees.

3 Empirical Earnings Functions

In the following empirical analysis we try to quantify the relative importance of the factors discussed in the previous section in shaping the Eastern German wage structure. To this end we estimate generalized earnings functions with the log of earnings as the dependent variable and a set of explanatory variables related to the

[1] There is some evidence for this hypothesis which shows that the conditional re-employment probabilitity -- the hazard rate from unemployment -- for married females with small children is relatively low (see Steiner, 1993).

hypotheses developed in the previous section. Our specification of the earnings function differs in several aspects from that in previous studies. First, in contrast to other authors (Schwarze, 1991; Bird / Schwarze / Wagner, 1994) we do not consider a strict human capital interpretation of the earnings equation appropriate for describing the wage structure in East Germany. We rather follow a more eclectic approach and include a richer set of explanatory variables in the earnings equation which allows us to interpret the various hypotheses summarized in section 2 within this empirical tool. Second, estimation is based on a large panel data set for the East German labour market -- the "Labour Market Monitor". Third, in contrast to previous empirical studies which have been mostly based on cross-sectional analysis we take advantage of the panel structure of our data base, i.e. repeated observations on the same individuals, and also try to correct of sample-selectivity bias in the earnings equations.

The data come from the first six waves of the Labour Market Monitor (LMM) commissioned by the Institut für Arbeitsmarkt- und Berufsforschung (Institute for Employment Research, IER, the research institute of the Federal Labor Office). The IER-LMM is a 0.1 per cent random sample of the former GDR resident population (including East-Berlin). In the first survey in November 1990, about 10,000 individuals born between 1926 and 1974 were interviewed The respondents were re-interviewed in March, July and November 1991 as well as in July and November 1992. In the fourth wave, addtional individuals born in 1975 were included in the survey to maintain the lower age limit in the sample. For a general description of the IER-LLM see Bielenski / Magvas / Parmentier (1992).

The availabilty of panel data enables us to take into account for individual effects in the earnings equation. These individual effects should account for all time-invariant unobservable factors which may affect earnings, usually interpreted as unobserved abilities in the literature. In addition, the panel structure of the data set also allows us to model unobserved time effects. Estimation of the earnings equation can either condition on these individual effects (fixed-effects) or treat them as random. The random-effects estimator is based on the assumption that the individual effects are uncorrelated with the explanatory variables in the model and makes use of both the time and cross-section variation in the data, whereas the fixed-effects estimator only uses the former information. Given our relatively short observation period, most of the variation in the explanatory variables included in the earnings equation is cross-sectional rather than in the time domain. Since the fixed-effects estimator would therefore yield rather imprecise parameter estimates, we will base our analysis on the random-effects model with respect to the individual effects. We also include time dummies to control for time-varying effects affecting all individuals alike, such as macroeconomic factors or changes in institutional regulations.

Given this specification, the parameters of the earnings equation and the error components can be estimated by generalized (weighted) least squares (see, e.g., Greene, 1993, chapter 16; Hsiao, 1986, section 3.3). Since sample attrition is quite important in this data set (see Bielenski / Magvas / Parmentier, 1992) we account for it by adopting a straightforward extension of the standard random-effects estimator to the situation of an unbalanced panel design (unequal number of observations per person), assuming that attrition occurs at random (see, e.g., Hsiao, 1986: 194-197).

One complication when estimating this model arises from the well-known potential sample-selectivity bias in earnings equations. Within the observation period November 1990 to November 1992, about 75 percent of all males and 64 percent of all females included in the sample have been employed on average, while there has been a dramatic fall in the employment ratio both for males and females. The possibility that an individual's employment propensity is correlated with his or her earnings, given his or her observable characteristics, seems likely a priori. To account for the resulting potential sample-selectivity bias, we follow the usual two-stage procedure by including the inverse Mills Ratio as additional right-hand side variable in the earnings equation. As usual, this selectivity-bias correction term is obtained from pooled reduced-form probit employment equations (this standard procedure is described in Greene, 1993: 708-713, for example).

Since we do not want to exclude a priori the possibility that the effects of some or all of the explanatory variables in the earnings and employment equations differ between males and females, the sample is split by gender and these functions are estimated separately for males and females. Table 1 contains definitions of the variables and their sample means in the estimated earnings equations.

The number of individuals refers to East German residents (including Berlin-East) aged 16 to 65 years working in East Germany; commuters to West Germany are thus not included in the sample. We also exclude employees on (apprenticeship) training schemes from the sample. The number of observations refer to cases with valid information for all variables included in the earnings equation as well as in the employment equation used to calculate the sample-selectivity term.

Our data base contains information on an individual's monthly net wage in each wave of the panel, but does unfortunately not give information on the gross wage which would obviously be more relevant for the present analysis. To account for the effects of marital status and children on the wedge between the gross and net wage we include these variables as control variables in the estimated earnings equations. This is an admittedly rather rough way to acount for the subtleties of the tax system taken over from West Germany, but to impute gross wages from the information contained in our data base seems hardly feasible and would be, in any case, well beyond the scope of this paper.

Table 1 Definition of variables and sample means in earnings equations.

Variable name	Males	Females
Real net monthly wage	1325.25	1054.81
ln real net monthly wage	7.13	6.89
Household structure		
Number of children	0.63	0.68
Married	0.74	0.72
Age (in years)	42.21	41.53
Age squared / 100	19.52	18.95
Educational requirement for job (skilled) [1]		
No qualification	0.13	0.13
Highly skilled	0.09	0.02
Graduate degree	0.24	0.32
Short-time work	0.18	0.16
New firm	0.11	0.11
Firm size (less than 29 employees) [1]		
20 - 200 employees	0.35	0.40
200 - 2000 employees	0.36	0.29
more than 2000 employees	0.12	0.08
Industry (Metal manufacturing) [1]		
Agriculture	0.08	0.06
Mining, Energy	0.07	0.03
Construction	0.15	0.03
Other Manufacturing	0.12	0.11
Trade	0.07	0.15
Public Transport	0.10	0.05
Banking, Insurance	0.01	0.03
Other Services	0.17	0.44
Public Services	0.29	0.52
Region (Sachsen) [1]		
Mecklenburg-Vorpommern	0.11	0.13
Brandenburg	0.16	0.15
Sachsen-Anhalt	0.18	0.17
Thüringen	0.17	0.16
Berlin-East	0.07	0.08
Wave (November 1990) [1]		
March 1991	0.18	0.18
July 1991	0.16	0.17
November 1991	0.16	0.15
July 1992	0.14	0.14
November 1992	0.13	0.13
Inverse Mills Ratio	-0.35	-0.49
# Individuals [2]	4027	3147
# Observations [2]	11170	8775

Notes: 1) The base category is given in parantheses. 2) In the earnings equation, the number of individuals (observations) refers to those employed at the date of interview in November 1990 for whom information on all variables included in the estimation is available.

Source: IER-Labour Market Monitor, waves 1 - 6; own calculations.

Net monthly wages have been converted to real wages deflated by the average consumer price index as obtained from publications of the Federal Statistical Office.[2] The average monthly real wage in the observation period is about 1,300 DM for males and 1,050 DM for females. These wages refer to all the employed in the sample and are not standardized by working hours, information on which is only available in the first wave of the panel. We do, however, have information on whether or not an employee is on short-time work in each wave. In the East German transition process, short-time work has been a widely used means to assist the sharp reductions of employment. The number of short-time workers peaked in the second quarter of 1991 at nearly two million employees with an average working-time of only about 50 percent of standard hours (see Licht / Steiner, 1994). Since then, short-time work has been sharply reduced and reached a level of some two hundred thousand at the end of the observation period. We assume that in the observation period differences in working hours were mainly due to short-time work for which we include a dummy variable in the earnings equation.

Since labour force interruptions were relatively rare events in the former GDR -- working was more or less mandatory -- age should be a good proxy for labour market experience. Instead of including years of schooling or indicators for educational attainment as it is usual done in earnings functions based on human capital considerations, we use indicators for the skill requirements of an individual's job to account for specific human capital since this seems to us more relevant for answering the questions raised in the previous section. In the base category we include those with completed apprenticeship training ("Facharbeiter") or similar vocational qualification ("Teilfacharbeiter").

Following the discussion in section 2, we include firm characteristics (new firm, firm size) as well as industry and regional dummies as explanatory variables in the earnings equations to account for potential effects of industrial restructuring, collective bargaining and efficiency wage considerations on the wage structure. In addition, we also include a dummy for the public sector where wage determination is somewhat peculiar.

As explained above, we also include time dummies to account for the effect of changes in general labour market conditions and institutional regulations as far as they are not accounted for by the explanatory variables in the model.

4 Estimation Results

In Table 2 we report estimation results for the earnings functions for males and females from the random-effects model including the selectivity-correction term derived from the first-stage reduced-form probit employment equations in Table A1 in the appendix. Since these reduced-form equations are of little substantive interest in the present context, their main purpose being to derive the selectivity-correction terms, we do not comment on estimation results in Table A1 here.

[2] The price deflator series corresponding to the respective six waves in the period November 1990 to November 1992 is: 0.966, 1.041, 1.067, 1.180, 1.206, and 1.211 (see Statistisches Bundesamt, Zur wirtschaftlichen und sozialen Lage in den neuen Bundesländern, Wiesbaden; various issues).

Starting with the sample-selectivity term, the estimation results in Table 2 show that the error terms in the earnings and the employment equation are significantly correlated. Hence, theoretically, earnings equations estimated on a sample of employed individuals without controlling for sample-selectivity yield inconsistent parameter estimates of the earnings equations. However, as estimation results without the selectivity term (not reported here, but available from the authors on request) show, leaving out this term hardly changes estimation results; the only noticeable effect occurred for females where estimated coefficients on the variables age and age squared turned out somewhat higher in absolute terms.

Turning to the estimated time effects, we find that, ceteris paribus, real net monthly wages in November 1992 are about 17 (=exp(0.1525) - 1) percent higher for males and 26 (=exp(0.2327) - 1) percent higher for females than in November 1990. This large gender difference in the change of real wages may seem surprising at first sight, but could either be explained by a a self-selection argument if females with unfavourable market opportunities or a strong preference for home-time have had a high propensity to become unemployed or to withdraw from the labour market, whereas especially the latter option is not so easily available for men, except for early retirement. This propensity could either be related to observable factors included in the earnings equation, such as age and household structure, or unobserved factors related to an individual's employment propensity and correlated with earnings. However, in the latter case, we would have expected a somewhat stronger impact of the inclusion of the sample-selectivity term on the estimated coefficients in the earnings equation for females.

Table 2. Earnings function estimates (random-effects model)
Dependent variable: ln real net monthly wage

Variable [1]	Males Coeff.	| t |	Females Coeff.	| t |
Constant	6.7065	99.05	6.5716	68.16
Married	0.0755	5.62	- 0.0702	4.41
# Children	0.0214	4.17	0.0042	0.62
Age (in Years)	0.0141	3.98	0.0154	2.99
Age squared / 100	- 0.0150	3.36	- 0.0186	2.78
No qualification	- 0.0251	3.59	- 0.0517	6.14
Highly skilled	0.0892	9.85	0.0586	3.27
Graduate degree	0.1625	18.93	0.0953	11.75
Short-time work	- 0.1046	20.95	- 0.1188	19.35
New firm	0.0093	1.37	0.0256	3.31
20 - 200 employees	0.0103	1.47	0.0274	3.66
200 - 2000 employees	0.0298	3.81	0.0737	8.51
More than 2000 employees	0.0575	5.68	0.1054	8.46
Agriculture	- 0.0487	3.83	- 0.0225	1.06
Mining, energy	0.0481	3.37	0.0533	1.98
Construction	0.1041	10.31	0.0680	3.14
Other manufacturing	- 0.0128	1.32	- 0.0209	1.28
Trade	- 0.0127	0.99	- 0.0425	2.64
Public transport	0.0204	1.53	- 0.0169	0.67
Banking, insurance	0.0421	1.41	0.1251	5.14
Other services	0.0208	1.97	0.0116	0.76
Public services	- 0.0264	3.93	0.0525	6.99
Mecklenburg-Vorpommern	- 0.0126	0.76	0.0411	1.89
Brandenburg	0.0154	1.05	0.0075	0.37
Sachsen-Anhalt	- 0.0027	0.19	0.0135	0.69
Thüringen	- 0.0071	0.49	- 0.0098	0.49
Berlin-East	0.0653	3.36	0.1145	4.50
March 1991	- 0.0635	15.24	- 0.0740	15.96
July 1991	- 0.0012	0.25	- 0.0196	3.75
November 1991	- 0.0202	4.05	0.0305	5.54
July 1992	0.0542	9.49	0.1162	17.86
November 1992	0.1525	25.34	0.2327	34.76
Inverse Mills Ratio	0.0493	2.71	0.0834	4.77
S.e. of error components[2]				
σ_α	0.303		0.411	
σ_ε	0.164		0.176	
R^2	0.90		0.85	
# Individuals	4027		3147	
# Observations	11170		8775	

Notes: 1) For definition and sample means of the variables see Table 1. 2) The first component in the composite error term $\sigma_u = \sigma_\alpha + \sigma_\varepsilon$ refers to the time-invariant individual effect, the second component is a white-noise error term which varies both over time and between individuals.

Source: IER-Labour Market Monitor, waves 1 - 6; own calculations.

As mentioned above, marital status and the number of children should account for the effects of the tax system on the wedge between gross and net wages. Whereas for males the coefficients of these variables show the expected signs and are of reasonable magnitude, estimation results for females suggest that some intervening factors with respect to these variables are at work. One such factor could be that, on average, married females may in fact work fewer hours on average than singles whereas we have assumed that, except for institutionally regulated short-time work, there has been little variation in individual working hours within the observation period.

Following usual practice, the variable age as a proxy for general labour market experience is included by a linear and quadratic term in the earnings equations to allow for the typical concave age/earnings relationship. The estimated coefficients on age and age squared are relatively low both for males and females compared to most estimates for West Germany and other market economies. This result is compatible with previous research by Schwarze (1991), Krueger / Pischke (1992) and Geib et al. (1992) based on different data sources and estimation methods.

Estimation results in Table 2 indicate that there is some wage differentiation by skill level, although compared to western standards they seem quite modest. Compared to employees in semi-skilled jobs males without qualification earn, ceteris paribus, about 2.5 percent and females in this category earn about 5 percent less. Highly skilled male (female) employees earn about 9 (6) percent more than those in jobs without qualifcational requirement. The largest wage differential exists for male employees in a job requiring a graduate degree, whose wage is, ceteris paribus, about 18 percent higher than for the reference group.

Employees on short-time work earn, ceteris paribus, about 10 percent less than someone in full-time employment. Given the institutional regulations which in East Germany were, at least in the first phase of the transition process, considerably more generous than in West Germany, the wage effect of short-time work seems of reasonable magnitude.

Turning to the effects of firm and industry structure on wages, with respect to the "new firm" dummy we find only weak effects: for females the estimated effect implies that the wage premium for working in a new firm is about 2.5 percent, for males there is no statistically significant effect. Since there is really no reason for gender differences with respect to the "fair wage", the hypothesis referred to in section 2 is not supported by our estimation results. However, this result could also suggest that there is only a weak incentive for mobility between old and newly established firms, which could retard the future restructuring process in East German industry.

Although employment growth in Eastern Germany is concentrated on small and medium sized firms in construction, trade and services (see Harhoff / Stahl, 1994) wages are, ceteris paribus, significantly higher in larger firms. Wages of males working in firms with more than 2,000 employees are about 6 percent higher than in firms with less than 20 employees; for females this wage differential is more than 11 percent. An explanation for this firm-size effect could be in terms of the shirking hypothesis referred to in section 2. However, this explanation begs the question why the firm-size effect is much larger for females. We do not have a plausible explanation for this gender effect, which has also been detected by Bellmann (1992) in simple

cross-section estimates on the second wave of this data base, and therefore suspect that it is due to a selectivity effect which is not accounted for by our estimation procedure. Gender differences in wage differentials in the public sector, where a significant negative (positive) wage differential exists for males (females), are also hard to explain by collective bargaining or efficiency wage arguments.

The estimated industry effects are not compatible with any single explanation, such as pure demand-side or institutional explanations, i.e. the relative strength of union bargaining. First of all, estimated industry effects differ by gender, which is not easily explained by these theories. In particular, the wage premium in banking and insurance relative to metal manufacturing is much higher for females than for males, and for the former is still some 5 percent in public services where it is negative for males. Given the boom in the construction industry, the positive wage differential in this industry relative to manufacturing for both males and females is expected, whereas the negative differentials in trade come as a surprise (for males it is not significant, however). On the other hand, in view of the dramatic employment reductions which occurred in agriculture, the relatively small negative wage differential in this sector could indicate that most of the adjustment in this sector has already occurred. The positive wage differentials in mining and energy relative to metal manufacturing could be explained by less exposure to competition from West German and international firms in that industries.

Given the pecularities of the German centralized bargaining system it is not particularly surprising that, with the exception of East-Berlin, there is little wage differentiation by region (*Länder*). Since unification, East-Berlin forms one single labour market with West-Berlin and there is naturally a strong tendency for wages to catch-up with the western level earlier than in other parts of East Germany. Somewhat puzzling, however, is the result that this regional effect is much more pronounced for females than for males. Here, too, we can only appeal to a selecitivity effect which is not accounted for by our estimation procedure.

5 Conclusions

Our estimation results give a differentiated picture of the East German wage structure:

(i) After controlling for important explanatory variables, the autonomous wage increase for females exceeded that for males considerably. This could be due to a self-selectivity effect if only females with favourable market opportunities remained in employment. However, our estimation results on the basis of selectivity-corrected earnings equations cast some doubt on this explanation.

(ii) Experience/earnings profiles are very flat which suggests that human capital accumulated in the former GDR in the form of general labour market experience has been depreciated to a large extent. It will take a long time before we observe experience/earnings profiles as steep as for West Germany.

(iii) So far, job-specific skills have been rewarded only modestly in the transition process. Females in jobs with high skill requirements are rewared less than males in comparable jobs. Hence, wage differentials for different skill levels may not

provide enough incentives to acquire the required skills which could hamper the restructuring process in East Germany.

(iv) Wages in newly established firms are, ceteris paribus, only slighly above those in incumbent firms. This, too, reduces incentives for mobility from old to newly established firms, which could retard the future restructuring process in East German industry.

(v) Wages increase with firm size, which is a result also found in studies for West Germany and other market economies. However, in East Germany this firm-size effect is, after controlling for other potential intervening factors, much larger for females which is not compatible with standard economic explanations.

(vi) Estimated industry wage differentials are not compatible with any single explanation, such as pure demand-side or institutional explanations, i.e. the relative strength of union bargaining. The wage differential is relatively high for males in the construction industry and for females in banking and insurance. Demand factors seem to play a role here, but the gender differences remain unexplained.

(vii) Except for East-Berlin, there is little regional differentiation in wages after controlling for other factors, which can be explained with the centralized system of collective bargaining taken over from West Germany and the special situation of East-Berlin which forms a single labour market with West-Berlin.

Appendix

The reduced-form probit employment equations summarized in the following table are used to construct the selectivity-correction terms (the Inverse Mills Ratio) in the earnings equations in Table 2. Estimation is by maximum likelihood on the pooled sample of all six waves. The set of explanatory variables in the two equations differ by the specification of the variables for age and the inclusion of indicators for the skill requirements of an individual's job in the earnings equations and level of education in the employment equations.

Table A1: Reduced-form probit employment equations - ML estimates

Variable [1]	Males Coeff.	|t|	Females Coeff.	|t|
Constant	1.3145	32.65	1.0679	31.05
Age < 20 years	- 1.0507	19.04	- 1.1946	23.79
20 < Age ≤ 30 years	- 0.4013	12.13	- 0.5343	21.42
Age > 50 years	- 1.0754	38.09	- 1.1223	45.97
# children	0.1202	7.51	- 0.0921	7.72
Married	0.3759	13.05	0.1060	4.91
Vocational training ("Teilfacharbeiter")	- 0.7769	16.73	- 0.5597	17.55
Apprenticeship training ("Facharbeiter")	- 0.2465	5.42	- 0.2430	6.02
Senior craftsman ("Meister")	0.0066	0.21	0.3560	6.23
Non-university graduate ("Fachschule")	0.1515	5.51	0.3862	17.25
University graduate	- 0.0915	3.10	0.3353	10.51
Mecklenburg-Vorpommern	- 0.1544	4.39	- 0.0476	1.59
Brandenburg	- 0.1369	4.40	- 0.0313	1.10
Sachsen-Anhalt	- 0.0754	2.47	- 0.0114	0.42
Thüringen	- 0.0807	2.59	- 0.1019	3.74
Berlin-East	- 0.0618	1.48	- 0.0613	1.73
March 1991	- 0.1252	3.72	- 0.1151	3.94
July 1991	- 0.2670	7.78	- 0.2633	8.88
November 1991	- 0.3164	9.34	- 0.2915	9.78
July 1992	- 0.3942	11.39	- 0.4136	13.57
November 1992	- 0.4734	13.53	- 0.4422	14.21
LR statistics: $\chi^2(20)$ [2]	4334.45		5159.36	
Pseudo R^2 (McFadden) [3]	0.18		0.16	
# Observations	21607		23956	

Notes: 1) For those variables not defined in Table 1 the base categories are: 30 ≤ Age ≤ 50 years and "no educational or vocational training" 2) The LR statistics is twice the difference of the log likelihood of the resticted and full model, respectively (degrees of freedom are in parantheses. 3) McFaddens Pseudo R^2 is a simple transformation of this statistics with a range between 0 and 1.

Source: see Table 1.

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