



Diskussionspapiere
Discussion Papers

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Eastern Europe: Lessons From the GDR**

by
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Deutsches Institut für Wirtschaftsforschung

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No economic theory directly predicts what will happen to the wage distribution as socialist economies change to capitalist ones. In this paper we discuss the implications of human capital theory in this process and we support our discussion with evidence from the transformation in eastern Germany, the former GDR. While it is obvious that the relatively equal socialist wage structure will gradually become more unequal as the capitalist market begins to allocate labor efficiently, our discussion of theory and evidence suggests that there is a strong age-specific structure in the new wage inequality. In the formerly socialist economies, older workers will receive relatively little of the benefits of the change to free markets.

The discussion is structured as follows. First we make some informal applications of human capital theory to formerly socialist economies (FSE's), building on discussions such as Schwarze (1992). Then we describe specific evidence from eastern Germany. Finally we contrast the GDR's experience with that of other FSE's. Since the GDR's transition to free markets is by far the fastest, its experience can serve as an indicator of the future of other FSE's.

I. Human Capital Theory in FSE's

According to standard human capital theory (Mincer, 1974), the wage is determined by the qualities of the worker. Supposing that a worker has schooling and training S , general work experience E , and firm-specific experience F , his human capital is given by some function H (which is increasing in all arguments):

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$$H = H(S, E, F)$$

Human capital measures the ability of the worker to produce valuable output for a firm; since the value of output determines the wage, the wage is directly proportional to human capital:

$$w = r_h H$$

It is possible to calculate the monetary return to an investment in human capital by simply measuring the change in the wage per unit change in human capital.

Human capital theory is based on the idea of free and efficient labor markets, and it is an open question how applicable it is to socialist economies. Our presumption is that socialist labor markets did not allocate labor efficiently. Specifically, there are two senses in which socialist labor markets were inefficient:

- the wage did not perfectly reflect the marginal productivity of the worker; therefore it was poorly related to a worker's true human capital
- schooling, experience and other formal qualifications also did not perfectly reflect the marginal productivity of the worker; therefore they too were poorly related to the true human capital

These will be discussed in turn.

Wage inequality was low under socialism. While it is possible that this was true because the underlying distribution of ability and human capital was relatively equal, this seems unlikely. Rather, wage equality was a political decision whose ideological benefits apparently outweighed the efficiency costs of labor misallocation (at least in the minds of the decision-makers). In terms of the equations above, we simply say that the wage under socialism is not equal to the return on human capital:

$$w \neq r_h H$$

The practical import of this is that a human capital regression of wages on various measurements of training and experience will not explain much of the wage variance.

Human capital itself was misallocated under socialism. The system of schooling and training was state-run and therefore as unlikely to have produced the social-welfare-maximizing amount of education in each type of economic activity. The management and

production methods of the GDR economy were inefficient relative to the object of maximizing profits and hence social welfare, meaning that GDR workers have too much experience at doing certain tasks (bribing suppliers to speed up deliveries, giving the appearance of working when there is in fact nothing to do) and too little experience at doing others (finding the right job, selecting from several competitive bids). In terms of human capital theory, we can express the inefficiencies in human capital allocation as follows. First, let the function $H(S,E,F)$ relating schooling and experience to human capital depend on the market structure (socialism or capitalism). Let $H_w = H_w(S_w, E_w, F_w)$ be the human capital produced by schooling and experience in a western, free market economy, and let $H_e = H_e(S_e, E_e, F_e)$ be the human capital produced in an eastern, socialist economy. In general, we can say

$$H_w(S_w, E_w, F_w) > H_e(S_e, E_e, F_e) > H_w(S_e, E_e, F_e)$$

The first inequality says that when the two systems are in equilibrium, the western system will produce more human capital than the eastern system. This is because the west's production and management systems are better at maximizing social welfare, and because western training, education and experience systems are relatively better at providing the right match between the needs of firms and the abilities of workers. The second inequality stems from the hypothesis that eastern human capital, applied in western production and management systems, is of very little value. The schooling components of socialist human capital may be of some value, but firm and work experience must surely be worthless.

In summary, we identify three types of inefficiency: (1) Wage inefficiency, by which wages were not set relative to the level of human capital, (2) management and production inefficiency, which made the maximum human capital artificially low, and (3) human capital allocation inefficiency, caused by too much work experience in inefficient management and production systems. The second variety of inefficiency is frequently studied: it is observable in the fact that most socialist firms, when faced with free-market competition, go bankrupt (Akerlof et al., 1991). The first and third varieties have not yet been studied, as they are labor market phenomena for which data is hard to obtain. With the help of the data described

below, however, we hope to find empirical analogs to the two inequalities above, i.e. how much higher is western human capital than eastern human capital? And, when eastern workers are placed under western production and management systems, by how much is their human capital discounted?

The first question, statistically, asks whether the real money value of an hour's labor in a western economy exceeds that of a socialist economy. The second question has a slightly deeper econometric meaning: human capital regressions can identify the extent to which years of schooling or experience under socialism are evaluated, relative to free-market schooling and experience. One simply runs a regression using data on socialist workers employed in free-market firms; this gives an estimate of $H_w(S_e, E_e, F_e)$ which can be compared to $H_w(S_w, E_w, F_w)$. The parameters should indicate the difference in rates of return of the two schooling types.

All FSE labor markets are now making a transition from these inefficient wage and qualifications policies to western, more efficient ones. Human capital theory indicates that as formerly state-owned firms are privatized, and as new firms are founded, a larger and larger proportion of the workforce will be paid according to productivity, and will be placed in jobs on the basis of the "real" value of past experience and education. Wages will become less equal and eventually match the underlying productivity distribution. And the human capital acquired under socialism will be re-evaluated and most likely devaluated.

These predictions of the theory are plausible but they leave a number of questions open, most of which are immediately important for policy makers concerned about the social stress this transition will produce. The most obvious question is, how will the wage and human capital revaluation be distributed in the population? If certain groups will be systematically hurt by the changes, the likelihood that they will form a political force is greater than if the changes are randomly distributed. Second, how quickly do these labor market changes take place? Rapid devaluation of human capital would produce relatively more stress than a steady but gradually change. These questions are important but are not resolved by human capital theory alone. Empirical evidence is required.

II. Empirical Evidence From the GDR

We base our empirical investigation on a standard human capital regression approach:

$$\ln(Y) = b_0 + b_1S + b_2E + b_3E^2 + b_4F + u$$

where Y is wage income and u is an error term. Under the standard assumptions about u and proper measurement of the independent variables, an OLS regression suffices to consistently estimate the parameter vector $\underline{b}$.¹

The data we will use come from the eastern and western subsamples of the German Socio-Economic Panel.² Schwarze (1992) describes the data and the empirical procedures in more detail. Table 1 gives sample statistics and definitions of the variables we will use.

[Table 1 about here]

¹There are two objections to simple OLS. First, as will be seen, we concentrate on employed persons. In 1989 this was virtually everyone; but by 1991 unemployment had reduced the relevant population 15-30 percent. To obtain population measures of the return to human capital we would have to correct for selection. But we are content to condition our results on the employed sub-population; our interest is not so much in the population return to human capital as it is in the wage and employment practices of firms under the new and old situations. For these issues, straight OLS is appropriate.

Second, it could be objected that there is measurement error in the explanatory variables. Schooling, for example, is supposed to reflect the level of productive ability one has attained through formal education. Our schooling measure, however, is simply the number of years a worker has been in formal education and job training. Some years of formal education and job training may contribute a great deal to Schooling, others may not; but our measure treats all years the same. Therefore there is measurement error in the Schooling variable; and one could make similar arguments for the other variables as well. But in our view, the likelihood of significant bias from measurement error is too small to warrant a correction.

²The SOEP was started in West Germany in 1984 and expanded to the then-GDR in June 1990 (see Wagner, 1991). It is a repeated sample panel data set similar to the Michigan Panel Study of Income Dynamics. As of this writing, income data for several time periods are available: May 1990, October 1990, Spring 1991, and May 1989 (retrospectively in the May 1990 survey).

Table 1.
Variable Means and Definitions
All samples are of working males

<u>Worker Characteristics</u>	Means By Cross-Section:		
	GDR 1989	FRG 1990	FSE 1990
Wages (DM)	1241	3984	1814
Education (Years)	12	12	12
Work experience (Years)	22	22	21
Firm experience (Years)	14	13	12
College preparatory degree (percent)	17	14	18
Occupational certificates (percent):			
None	2	10	4
Specialist worker	63	68	62
Master worker	10	9	10
Engineer	14	4	13
University degree	11	9	11
Placement in jobs for which one is overqualified, by occupational certificates: (percent)			
All certificates combined	21	25	26
Specialist worker	25	30	31
Master worker	10	22	10
Engineer	7	25	15
University degree	18	11	27
Weekly work hours	43	40	41
White-collar employee (percent)	39	41	37
Large company (percent)	32	36	23
Married (percent)	81	70	80
Number of observations	1135	1800	754

Variable Descriptions:

Wages: Gross wage per month in DM. **Education:** combined years of schooling and official training programs. **Work experience:** Total years employed in the past. **Firm experience:** Years worked at that particular firm in the past. **College preparatory degree:** Equals 1 if the worker has obtained a *Hochschulreife* secondary school degree, i.e. one that enables him to attend a university or specialized post-secondary school. **Occupational certificates:** These certify particular levels of occupational training; they are here given in ascending order of qualification. **Job placement and qualification variables:** In the SOEP, workers were asked what the qualifications required for their jobs were; in these variables a worker receives a 1 if he is now working in a job for which he is overqualified. **Work hours:** hours worked by the individual in a typical week. **White-collar employee:** equals 1 if the worker has a white-collar job (*Angestellte*). **Large company:** Equals 1 if the worker's company has more than 2000 employees. **Married:** Equals 1 if the worker is married.

Source: Cross-sections from the SOEP, 1989-1991.

The variables are contained in three cross-sections. The first is the "old" GDR, which is data retrospective to 1989 obtained in the initial, May 1990 eastern SOEP.³ We will refer to this cross-section as the GDR sample. The second cross section also pertains to the territory of the GDR but was obtained in the early 1991 SOEP sampling. The wage values refer to a time period about nine months after the economic union of July 1, 1990. We will call this the FSE sample. Finally a third cross-section was drawn from the early 1990 sampling of the western German SOEP, and we will call this the FRG sample. By comparing the GDR sample to the FRG sample, we identify the inefficiencies in the old socialist economy.⁴ The FSE sample indicates how far the GDR labor market had progressed from socialism to capitalism in the first nine months after economic unification.

The data will be used to evaluate three empirical questions:

- How does the wage return to various elements of human capital differ in the GDR, the FSE and the FRG samples?
- How does misallocation of human capital affect the measured return to the wage in the standard human capital approach?
- How quickly is human capital and wage inefficiency being eliminated?

A. Returns to Human Capital

Table 2 reports the most important coefficients of wage regressions on the GDR, FRG and FSE samples.

[Table 2 about here]

Here we see immediately by comparing the GDR to the FRG (columns 1 and 2) that

³Independent cross-checks with archival GDR data from 1988 indicate that the retrospective data is very accurate. See Frick et al. (1991).

⁴It is tempting to treat the FRG sample as the "efficient" economy, but this would be wildly inaccurate. Note in Table 1 that there are more over-qualified workers in the FRG than in the old GDR. The BRD labor market is dominated by unionization and it is no surprise that it suffers from chronic unemployment and labor-shortage problems. At best we can call the BRD economy the "relatively more efficient" one. In any case it seems certain that the GDR's development from the old socialist economy will stop when the transformation into a BRD-style semi-socialist economy is complete.

the wage and human capital were not powerfully related in the old socialist system. The return to a year of schooling in the GDR was 4.4 percent, in the FRG it is 6.7 percent. Firm experience was half as valuable in the east as it is in the west (2 percent return vs. 4 percent). The work experience coefficients indicate a much flatter wage-age profile in the old GDR. On any measure of probable productivity, the wage and the productivity of the worker were not strongly related under socialism: the GDR R^2 is 0.39, fourteen points lower than the FRG R^2 of 0.53, indicating that human capital models, in general, have less explanatory power under socialism.

The third column indicates how the transition to capitalism is affecting the value of human capital, and it confirms our hypothesis about the second inequality: workers in the FSE now find that their schooling and firm experience have lost value. A year of schooling now represents a 4.1 percent increase in wages, a loss of 0.3 percent. The return to firm experience has been halved, while the return to overall work experience is unchanged. This evidence suggests that as the wage begins to correlate more strongly with productivity, socialist human capital is found to be relatively uncorrelated with the new standards of productivity: socialist human capital is less valuable in a market economy.

Table 2.
Human Capital Regressions
Dependent variable is $\ln(Y)$

<u>Variable</u>	Coefficients by Samples		
	<u>GDR</u> <u>1989</u>	<u>FRG</u> <u>1990</u>	<u>FSE</u> <u>1990</u>
Constant	6.308*	4.839*	4.854*
Education	0.044*	0.067*	0.041*
Work Experience	0.012*	0.033*	0.013*
(Work Experience) ² / 10	-0.002*	-0.005*	-0.002*
Firm Experience	0.002*	0.004*	0.001
R ²	0.39	0.53	0.29
N	1134	1800	715

Notes:

"*" indicates $\Pr(b > 0 | \beta = 0) \leq 0.05$

Other variables in the regression include: work hours, civil service employment, firm size, white collar employment, tenured civil servant status, and whether married.

Source: SOEP, 1989-1991.

B. Misallocation of Human Capital

Clearly in the FSE old socialist human capital elements are being re-evaluated, indicating there has been some misallocation of human capital in the GDR. Human capital misallocations would be difficult to observe: one needs to know what the proper human capital for a given job is, and then whether the occupant of the job has it. But the SOEP data contain specific questions about the training required to perform one's job, and from these we can construct a binary measure indicating that an individual is working in a job for which he is over-qualified, i.e. possessed of too much human capital of the wrong kind. Qualifications ought to signal a worker's ability; in a free labor market, a worker found in a job for which he is formally overqualified is a worker whose true skills are less than his formal qualifications indicate. The signal is imperfect. That qualifications as signals are imperfect should be no surprise; even in the FRG sample some 25 percent of workers are overqualified (Table 1).

How can the binary indicator of overqualification affect a wage regression? We must assume that if schooling (which reflects the qualifications) and the overqualification indicator are both in the regression, the coefficient on overqualification will be negative: schooling indicates the worker should be making a wage of DM 1500, but he is employed below his official schooling level and is actually earning DM 1200. The over-qualification coefficient would be -0.20: being overqualified indicates a twenty percent loss of wages.

Table 3 presents regressions of log income on human capital and overqualification indicators. By comparing the average wage losses related to overqualification in the three samples, we can see how the different systems evaluate human capital as measured by these formal qualification levels. In the FSE (column 3), overqualification is associated with the greatest reduction in wage. Indeed when overqualification is accounted for, the devaluation of years of schooling reported in Table 2 is no longer apparent: here both the GDR and the FSE economies offer the same return to a year of schooling (4.5 percent). Given a certain level of training, if one can find a proper job, the return to that training is the same. The problem is that FSE workers are not necessarily placed in proper jobs and in the FSE, far more than in

the GDR or the FRG, improper placement results in reduced income. And in the FSE far more workers are so misplaced (Table 1). Thus the transition from socialism to capitalism can be very precisely measured, here, as a sharp reduction in the value of training. We can presume such specific devaluation effects are occurring for work and firm experience as well (even though we cannot measure them any more directly).

[Table 3 about here]

Table 3.
Human Capital Regressions Accounting For Misallocation
of Occupational Qualifications
 Dependent variable is $\ln(Y)$

<u>Variable</u>	Coefficients by Samples		
	<u>GDR</u> <u>1989</u>	<u>FRG</u> <u>1990</u>	<u>FSE</u> <u>1990</u>
Constant	6.307*	4.859*	4.767*
Education	0.045*	0.069*	0.045*
Work Experience	0.012*	0.033*	0.015*
(Work Experience) ² / 10	-0.002*	-0.005*	-0.002*
Firm Experience	0.002*	0.004*	0.000
Over-qualification Status, by Level of Qualification:			
Specialist Worker	-0.032*	-0.049*	-0.059*
Master Worker	-0.141*	-0.160*	-0.174*
Engineer	-0.017	-	-0.129
University Degree	-0.070*	-0.186*	-0.225*
R²	0.39	0.54	0.31
N	1134	1800	715

Notes:

*** indicates $\Pr(b > 0 | \beta = 0) \leq 0.05$

Other variables in the regression include: work hours, civil service employment, firm size, white collar employment, tenured civil servant status, and whether married.

Source: SOEP, 1989-1991

C. Speed and Structure of Change

We also have the opportunity of analyzing how privatization affects the process of creating efficient labor allocation. Like all FSEs, the former GDR is now a patchwork of private and public firms, some of the private firms being new entrants and some being privatized versions of formerly state-owned companies. The SOEP asked respondents to describe their employers, and on the basis of the descriptions we are able to identify three classes of FSE businesses.⁵ The first type of firm we will call a Trust Firm, i.e. a firm still owned by the semi-governmental institution called The Trust (*Treuhandanstalt*). The Trust was called into being on July 1, 1990, when it became the holding company for the entire state-owned sector of the GDR. Its capital derives entirely from the FRG government, hence one can think of its firms as still state-owned. The Trust's primary purpose is to sell all of its holdings. Privatization has proceeded rapidly (unlike other FSEs), and we can identify firms sold by the Trust after July 1, 1990 as Privatized Firms. The third type of firm is one newly founded on the territory of the GDR after July 1, 1990, which we call New Firms. Table 4 shows wage regressions, including overqualification indicators, for FSE workers at these firm types, as compared to GDR workers and FRG workers.

The structure of human capital devaluation here is striking: new firms (column 4) pay the highest returns to schooling (8.8 percent) and offer no return to socialist work experience. Privatized firms (column 3) offer the second-highest schooling return and some return on work experience. Trust firms offer lower returns to schooling, no return on work experience, but some return on firm experience. That privatized firms offer no return to firm seniority, and that new firms offer no return to socialist work experience⁶ suggests that free markets are merciless to experience obtained under the old system. That schooling is still highly valued indicates that well-educated GDR workers will be relative winners as the economy comes to be

⁵See Schwarze (1992) for other identifiable firm types, and details on how firms were identified.

⁶In new firms there can be no firm experience.

dominated by private firms. The relative losers will be those for whom schooling is a small part of human capital: those with much firm and work experience, i.e. older workers.

[Table 4 about here]

Table 4.
Human Capital Regressions By Employer Type
 Dependent variable is $\ln(Y)$

Variable	GDR 1989	Subsamples of the FSE 1990 Cross-Section			FRG 1990
		Employer is:			
		The Trust	Privatized	New	
Constant	6.307*	4.630*	5.725*	6.226*	4.859*
Education	0.045*	0.053*	0.075*	0.088*	0.069*
Work Experience	0.012*	-0.000	0.005	0.000	0.033*
(Work Experience)^2 / 10	-0.002*	0.000	0.000	0.000	-0.005*
Firm Experience	0.002*	0.002	0.000	-	0.004*
Over-qualification Status, by Level of Qualification:					
Specialist Worker	-0.032*	-0.045	0.015	0.112	-0.049*
Master Worker	-0.141*	-0.510	-0.267	0.014	-0.160*
Engineer	-0.017	0.022	-	-0.318	-
University Degree	-0.070*	-0.365*	-0.350*	-0.502	-0.186*
R ²	0.39	0.19	0.25	0.06	54
N	1134	79	134	55	1800

Notes:

a) "*" indicates $\Pr(b > 0 | \beta = 0) \leq 0.05$

b) Other variables in the regression include: work hours, civil service employment, firm size, white collar employment, tenured civil servant status, and whether married.

c) Employer types are 1) **The Trust**, or *Treuhandanstalt*, the state-owned company that has managed all the formerly state-owned GDR firms as of July 1, 1990; 2) **Privatized**, all firms sold by the Trust after July 1, 1990 (some firms were privatized by the old GDR government before July 1, 1990, but they are not included here), c) **New** firms are those founded in the territory of the GDR after July 1, 1990.

Source: SOEP, 1989-1991.

The evidence also suggests that the speed with which the overall changes in human capital evaluations occur depends on the speed of the privatization process. We can see how rapidly the human capital changes were affecting welfare in the FSE of eastern Germany by examining simple descriptive characteristics of FSE workers in the different firm types. Table 5 shows the average wages, education, age and qualification indicators for the three firm types. The new firms are bidding high: average wages there (DM 2281) are over 20 percent⁷ higher than in Trust firms (DM 1881). High bidding allows the new firms to get better educated workers (about one extra year of schooling) and younger workers (about four years younger on average). In the course of their competitive bidding, the new firms pay less attention to the formal qualifications of the prospective employees: 36 percent of new-firm workers are formally overqualified, compared to 26 and 23 percent for privatized and Trust firms, respectively. Clearly the type of workers desired by new firms are not the typical workers the FSE of Eastern Germany has to offer: middle-aged workers with much socialist work experience.

[Table 5 about here]

⁷Statistically significantly different from zero at 10 percent.

Table 5.
Averages of Selected Worker Characteristics By Employer Type

<u>Characteristic</u>	<u>The Trust</u>	<u>Privatized</u>	<u>New</u>
Wage (DM)	1881	1776	2281
Years of Education	12	12	13
Age in Years	37	39	33
Percent Overqualified	23	26	36

Source: SOEP 1990 FSE sample.

III. Contrasting the GDR Experience With Other FSE's

The GDR is fortunate to be unified with a western economy, whose government is willing to support a high-wage policy. The re-allocations and re-evaluations now occurring in post-wall eastern Germany involve an upward movement of the wage for workers whose human capital is generally in low supply. It will not involve a decline in wages for workers whose human capital is less valuable. These workers are largely being supported by subsidies to their firms; by guaranteed-employment clauses in sale contracts of the Trust; and by explicit make-work programs. Unions have negotiated contracts that will put east and west German wages on par within a few years. It would seem that the ultimate fate of a worker endowed with low human capital will not be a low wage but rather unemployment.

Of course because of the German unemployment support system there will not be so great a loss in income. Such a support system is, however, expensive and is simply not an option for eastern Europe's other FSEs. It is far more likely that the allocation process there will take the form of an upward movement of wages for those with high human capital and a downward movement for those with low human capital. In a relative sense, the less-endowed worker will be worse off in both the GDR and other FSE's; but in the GDR he will not be worse off absolutely, while in other FSEs there will be a real loss of income.

Which employees will bear the brunt of this relative and perhaps absolute income loss? For this question the experience of the GDR is directly applicable to other FSEs. Table 6 reports the results of the following thought experiment: suppose all socialist experience were worthless, and all socialist schooling and training were 100 percent applicable in western production and management systems. The human capital of an eastern worker in the western market would then be $H_w(S_e, 0, 0)$. We have an estimate of the H_w function: it is the wage regression on the FRG sample (Table 2, column 2). If one fits this regression to schooling and experience data of FSE workers, and sets the experience parameters to zero in all cases, one obtains a fitted-value of income that indicates the expected income of eastern workers in a western system. We constructed such fitted value incomes for our sample of former-GDR workers. Table 6 indicates that young workers (ages 16 to 29) can expect incomes about 78

percent as high as similarly-schooled westerners, and older workers can expect incomes about 60 percent as high. Younger workers lose about 22 percent of their human capital in the transition to free markets, while older workers lose more than 40 percent of theirs.

[Table 6 about here]

Table 6.
Estimated Discounting of Human Capital By Age

<u>Age of Eastern Worker</u>	<u>Average Income Relative to A Similarly-Schooled Westerner</u>
16 to 29	78 %
30 to 39	63 %
40 to 49	58 %
50 and above	59 %

Notes: The figures are fitted values obtained by applying the parameters of the FRG wage regression of Table 2 to independent variables of a sample of GDR workers. It is assumed that the GDR workers' work and firm experience values are zero, i.e. the experience obtained under socialism is worthless, while schooling is 100 percent transferrable.

Source: SOEP, 1989-1991

Socialist qualification, schooling and experience are probably similar in all the FSE countries, and such age-dependent developments will probably be the same everywhere as free market systems evolve. All the FSEs can expect, therefore, a similar devaluation of qualifications and work experience; and they can expect a desire on the part of newer firms to hire younger workers so as to recoup as much of their training expenses as possible. Both trends indicate that it is the older worker who will face income losses in the FSEs. The new allocative efficiency is relatively good for the young, but relatively bad for the old.⁸ How the political system will respond to the tensions this situation will inevitably cause is anyone's guess.

⁸In the GDR, this statement is true only for workers up to retirement age. Pensioners in the GDR received a very favorable translation of their GDR pensions into DM and can be considered among the "winners" of unification. Currently older workers will not gain as much; their pensions will be calculated on the basis of their GDR work history which, we predict, will never be very lucrative.

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