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Decomposing Male Inequality Change in East Germany During Transition

By Ira N. Gang and Myeong-Su Yun*

Abstract

This paper studies the cause of the changes in male wage inequality in East Germany during its transition from a socialist to a market-oriented economic system. We are interested in how much of the change in the dispersion of wages can be explained by the changes in the characteristics of workers and how much can be explained by the changes in returns to the characteristics of workers.

JEL Classification: D 30, J 30

1. Introduction

During the course of East Germany's economic transition, there was an apparently substantial widening in wage dispersion. Various inequality measures indicate that the wage inequality increased between 25 % and 61 % relative to the level in 1990 (Gang / Yun, 2002).[1] This paper studies the causes of the changes in wage inequality measured in terms of variance of log-wages, asking what factors explain the change in wage dispersion. We are interested in how much of the change in the dispersion of wages can be explained by the changes in the characteristics of workers and how much can be explained by the changes in returns to characteristics of workers.

There is a small literature on inequality change in East Germany. Franz / Steiner (2000) and Burda / Hunt (2001) address changes in distribution of hourlywages from 1990 – 1997, finding that inequality increases. Some papers

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[1] Gang / Yun (2002) examines the Gini coefficient, the coefficient of variation, the Theil index, the log-wage differentials between top and bottom 10 % and the variance of log-wages.

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(e.g., Abraham / Houseman (1995), Hunt (2002), Krueger / Pischke (1995)) discuss the effects of the transition in terms of wage inequality and the gender wage gap. Biewen (2000) extensively analyzes income inequality changes (based on net monthly household income), finding increased inequality in East Germany after unification. Gang / Yun (2002) analyze both wage growth and the changes in wage dispersion in a unified framework, making comparisons between East and West Germany from 1990 – 2000. Generally, all of these papers find a widening dispersion of household income and wages.

In this paper, we employ a newly developed Blinder-Oaxaca type inequality decomposition method for analyzing the change in wage inequality since East Germany's unification with West Germany. Our inequality decomposition method (see Yun, 2002) allows us to find not only the gross contribution of each factor to the changes in wage inequality, but also the price and quantitative effects of each factor by utilizing information contained in the earnings equations. The standard Blinder-Oaxaca (Blinder, 1973; Oaxaca, 1973) decomposition explains wage differentials in terms of differences in individual characteristics (characteristics effect) and differences in the coefficients of the wage equations (coefficients effect). The methodological innovation introduced by Yun (2002), which is based on Oaxaca's decomposition methodology, allows us to derive these types of effects for changes in wage dispersion, and overcomes some difficulties in the earlier methodologies proposed by Juhn / Murphy / Pierce (1993) and Fields (2001). We employ the 1990 through 2000 waves of the German Socioeconomic Panel (GSOEP), a comprehensive panel of household and individual data.[2] Collection in East Germany began in May 1990. We restrict our sample to men aged between 20 and 60 who are not in school or in formal occupational training, with real before tax wages (in 1995 DM) less than 100 DM per hour. We exclude the self-employed, those on maternity leave, in agriculture, and who were originally in the sample but moved from East to West Germany. For each wave, we perform our analysis on all men meeting these criteria (unbalanced sample).

Figure 1 presents the East German male mean hourly wage rates and the variance of log-wages for each year from 1990 to 2000, normalized to 1990 = 1.00 for comparison purposes.[3] The growth in mean wages stands out, especially the doubling of mean wages from 1990 to 1994. Wage inequality measured by the variance of log-wages increases from 1990 to 2000 by 58.1 %. It is interesting that most of the increase in wage inequality occurred between the first two years (1990 to 1991), while the wage growth was achieved from

[2] We use the international version of the GSOEP, which is a 95 % sample of the German version. For a full description, see http://www.diw.de/soep/soep.htm

[3] The inequality measures are constructed using population weights provided in the GSOEP data.

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1. Mean hourly wage rates in terms of 1995 constant German Marks.
2. Population weights given in the GSOEP data are used for calculation.
3. Standardized measures, 1990=1.00.

Figure 1: Wage Growth and Changes in Male Wage Inequality (East Germany)

1990 to 1994. From 1991 to 2000 wage inequality fluctuates without much overall change.

Under socialism we would expect that the bias toward egalitarianism would have suppressed wage inequality. Our simple calculations show that among men wage dispersion as well as absolute wages have increased during the transition. In this paper, we will study the sources of the changes in wage inequality: Have the changes in workers' characteristics caused the increase in wage inequality?; Have the changes in returns in workers' characteristics due to the changes in the economic system caused the widening of wage inequality?

In the next section we outline our methodology. Section 3 discusses our decomposition results, and Section 4 concludes.

2. Explaining Changes in Inequality using Earnings Equation

We are interested in explaining the change in wage dispersion (inequality) in East Germany that has occurred since unification. Yun (2002) develops a

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new decomposition method for the changes in wage inequality measured in terms of variance of log-wages utilizing the information contained in the earnings equation.

Let wages be generated from the following regression equations (earnings equations)

$$(1) \qquad y_A = \beta_{0A} + \sum_{k=1}^{k=k-1} \beta_{kA} x_{kA} + e_A \qquad \text{and}$$
$$y_B = \beta_{0B} + \sum_{k=1}^{k=k-1} \beta_{kB} x_{kB} + e_B \ ,$$

where $y_t = \log(Y_t)$, and x_{kt}, e_t are the kth exogenous variable and residuals, respectively, and $t = A, B$.

A feature of the newly developed decomposition method for wage inequality is that it uses the information contained in the earnings equation, i.e., it utilizes the coefficients of the earnings equation. The method explains the changes in wage inequality in terms of characteristics effect, coefficients effect and residuals effect similar to the Blinder-Oaxaca decomposition for wage growth.

From equation (1), we find the following identity, $\sigma_y^2 = \sum_{k=1}^{K-1} \sigma_{\beta_k x_k, y} + \sigma_{e,y}$, where $\sigma_{e,y} = \sigma_e^2$ if OLS is used for estimation of the equation (1). Fields (2001) defines the relative factor inequality weight for a factor k using the OLS estimate of the coefficient of the earnings equation as

$$s_k = \frac{\sigma_{\beta_k x_k, y}}{\sigma_y^2} = \frac{\sigma_k \cdot \sigma_{x_k} \cdot \rho_{x_k, y}}{\sigma_y} \ ,$$

where σ_{x_k} is the standard deviation of x_k and $\rho_{x_k, y} = \frac{\sigma_{x_k, y}}{\sigma_{x_k} \sigma_y}$.

Fields applies the relative factor inequality weight to study changes in wage inequality over time. Fields' method, however, does not decompose the changes in wage inequality in terms of characteristics, coefficients and residuals effects. On the other hand, Juhn / Murphy / Pierce (1993) explain changes in wage inequality in terms of characteristics, coefficients and residuals effects, and study the changes only at aggregate level without identifying the role of each variable. Yun (2002) unifies the methods of Fields (2001) and Juhn / Murphy / Pierce (1993).

According to the unified method, the changes in the variance of log-wages may be decomposed as follows;

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$$
\begin{aligned}
\sigma^2_{y_A} - \sigma^2_{y_B} &= \sum_{k=1}^{k=K-1} \left(s_{ky_A} \cdot^2_{y_A} - s_{ky_B} \cdot \sigma^2_{y_B}\right) \\
&+ \sum_{k=1}^{k=K-1} \left(s_{ky^*} \cdot^2_{y^*} - s_{ky^*} \cdot \sigma^2_{y^*}\right) \\
&+ \left(s_{ky_A} \cdot^2_{y_A} - s_{ky_B} \cdot \sigma^2_{y_B}\right) \\
&= \sum_{k=1}^{k=K-1} \left(\beta_{kB} \cdot \sigma_{x_{kA}} \cdot \rho_{x_{kA}, y^*} \cdot \sigma_{y^*} - \beta_{kB} \cdot \sigma_{x_{kB}} \cdot \rho_{x_{kB}, y_B} \cdot \sigma_{y_B}\right) \\
&= \sum_{k=1}^{k=K-1} \left(\beta_{kA} \cdot \sigma_{x_{kA}} \cdot \rho_{x_{kA}, y_A} \cdot \sigma_{y_A} - \beta_{kB} \cdot \sigma_{x_{kA}} \cdot \rho_{x_{kA}, y^*} \cdot \sigma_{y^*}\right) \\
&+ \left(\sigma^2_{a_A} - \sigma^2_{e_B}\right) ,
\end{aligned}
\tag{2}
$$

where $y^* = \beta_{0B} + \sum_{k=1}^{k=K-1} \beta_{kB} x_{kA} + e_A$ and an index K represents error term.

The first, second and last terms of the equation (2) respectively represent the characteristics effect, coefficients effect and residuals effect. These are based on the information contained in the earnings equation (1).

3. Analysis – Empirical Results

We apply the unified inequality decomposition of Yun (2002) to analyze the coefficient and characteristics effects that lie behind the overall changes in wage inequality, using the variance of log-earnings as our inequality measure. In order to perform our wage inequality decompositions, we estimate wage equations for 1990 and 2000 using OLS.

Table 1 presents the sample means for the variables we use in our analysis. We restrict ourselves to basic variables for our wage analysis: experience, education, occupation, firm size and industry. Table 1 shows some changes in East Germany over the decade since the unification.

Education and experience increase slightly from 1990 to 2000. There is a stark change in occupation, with blue collar workers falling by 9 %, and scientist / managers and office / business / service job holders (presumably white-collar workers) increasing by about 4.5 % each. There is a marked movement to smaller firm sizes. There are also industrial shifts, the most notable being the decline in the transportation / postal industries, and, notably, an increase in the construction sector by 10 % from 1990 to 2000.

Table 2 reports the wage equation estimates for East German males. In both 1990 and 2000 experience is significant and follows a U-shape. Education adds to wages, with the return to an additional year of schooling increasing

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from 1990 to 2000. Occupation, firm size, and industry differentially affect wages, and the effects seem to vary from 1990 to 2000.

Table 1

Sample Means

	1990		2000	
Wages (constant 1995 DM)	8.292	(2.670)	18.080	(7.326)
Experience	20.846	(11.274)	22.407	(9.845)
Education (year)	12.258	(2.351)	12.554	(12.269)
Occupation				
Scientist / Manager*	0.192	(0.394)	0.233	(0.423)
Office / Business / Service	0.152	(0.359)	0.193	(0.394)
Blue Collar	0.655	(0.475)	0.574	(0.494)
Firm Size				
Size < 20 *	0.107	(0.309)	0.296	(0.457)
Size 20 – <200	0.206	(0.405)	0.415	(0.493)
Size 200 – <2000	0.347	(0.476)	0.129	(0.335)
Size 2000+	0.340	(0.474)	0.160	(0.367)
Industry				
Energy / Water / Mining	0.074	(0.262)	0.033	(0.179)
Chemicals / Synthetics	0.071	(0.257)	0.038	(0.192)
Iron / Mechanical	0.167	(0.373)	0.134	(0.341)
Electrical / Clothing	0.189	(0.392)	0.129	(0.335)
Construction	0.131	(0.337)	0.238	(0.426)
Sales	0.050	(0.219)	0.088	(0.283)
Transportation / Postal	0.130	(0.337)	0.071	(0.256)
Finance / Education / Health / Legal	0.114	(0.317)	0.150	(0.357)
Service	0.016	(0.125)	0.032	(0.175)
Public Administration*	0.058	(0.234)	0.088	(0.283)
Sample Size	1011		663	

Standard deviations are reported in parentheses.
* indicates a reference group in the regression analysis.

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Table 2

Regression Results of Earnings Equations

	1990		2000	
Constant	1.429*	(0.100)	1.944*	(0.122)
Experience	0.017*	(0.003)	0.015*	(0.006)
Exprience^2 / 100	-0.030*	(0.007)	-0.027*	(0.012)
Education (year)	0.039*	(0.005)	0.052*	(0.007)
Occupation				
Office / Business / Service	-0.120*	(0.033)	-0.128*	(0.043)
Blue Collar	-0.090*	(0.030)	-0.111*	(0.041)
Firm Size				
Firm Size 20 – <200	0.068*	(0.031)	0.142*	(0.029)
Firm Size 200 – <2000	0.086*	(0.029)	0.318*	(0.042)
Firm Size 2000+	0.118*	(0.030)	0.281*	(0.041)
Industry				
Energy / Water / Mining	0.064	(0.047)	0.140	(0.080)
Chemicals / Synthetics	-0.010	(0.047)	-0.051	(0.077)
Iron / Mechanical	0.009	(0.042)	0.045	(0.058)
Electrical / Clothing	-0.046	(0.041)	0.032	(0.060)
Construction	-0.005	(0.043)	0.047	(0.058)
Sales	-0.097	(0.050)	-0.132*	(0.060)
Transportation / Postal	0.004	(0.042)	-0.020	(0.063)
Finance / Education / Health / Legal	-0.063	(0.042)	0.005	(0.056)
Service	-0.256*	(0.074)	-0.142*	(0.082)
Adjusted R^2	0.223		0.306	
F Value	18.11		18.13	
Sample Size	1011		663	

1. Standard errors are reported in parentheses, and * means statistically significant at 5%.
2. Reference groups are scientist / manager for occupation, size less than 20 for firm size and public administration for industry.

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Table 3

Decomposition of Changes in Male Inequality (1990 – 2000)

	Earning Inequality[a)]				Decomposition[b)]			
	1990		2000		Characteristics Effect		Coefficients Effect	
Total	0.086	(100.0)	0.135	(100.0)	0.000	(0.6)	0.023	(46.6)
Human Capital	0.013	(14.7)	0.020	(14.9)	-0.001	(-1.0)	0.008	(16.2)
Experience	0.005	(6.0)	0.003	(2.1)	-0.001	(-2.5)	-0.001	(-2.2)
Experinece^2/100	-0.002	(-2.7)	-0.001	(-1.1)	0.000	(0.8)	0.001	(1.1)
Education	0.010	(11.4)	0.019	(13.8)	0.000	(0.6)	0.009	(17.3)
Occupation	0.004	(4.4)	0.005	(3.8)	-0.001	(-1.0)	0.002	(3.7)
Office / Business / Service	0.001	(1.1)	0.000	(0.0)	-0.000	(-0.8)	-0.001	(-1.1)
Blue Collar	0.003	(3.3)	0.005	(3.8)	-0.000	(-0.3)	0.002	(4.8)
Firm Size	0.002	(2.3)	0.015	(10.9)	0.000	(0.5)	0.013	(25.3)
Size 20 – < 200	-0.000	(-0.4)	0.000	(0.0)	0.001	(1.2)	-0.000	(-0.4)
Size 200 - < 2000	0.000	(0.2)	0.008	(6.0)	0.000	(0.8)	0.008	(15.4)
Size 2000+	0.002	(2.6)	0.007	(4.9)	-0.001	(-1.5)	0.005	(10.3)
Industry	0.002	(2.3)	0.004	(2.7)	0.001	(2.1)	0.001	(1.4)
Energy / Water / Mining	0.000	(0.5)	0.001	(0.9)	-0.000	(-0.2)	0.001	(1.8)
Chemicals / Synthetics	-0.000	(-0.0)	-0.000	(-0.0)	-0.000	(-0.0)	-0.000	(-0.1)
Iron / Mechanical	0.000	(0.1)	0.000	(0.1)	-0.000	(-0.1)	0.000	(0.1)
Electrical / Clothing	0.000	(0.4)	-0.001	(-0.1)	-0.000	(-0.0)	-0.000	(-0.8)
Construction	0.000	(0.0)	-0.000	(-0.5)	0.000	(0.0)	-0.001	(-1.4)
Sales	0.001	(0.7)	0.002	(1.7)	0.000	(0.6)	0.001	(2.8)
Transportation / Postal	-0.000	(-0.0)	0.000	(0.0)	0.000	(0.0)	0.000	(0.1)
Finance / Education / Health / Legal	-0.000	(-0.3)	0.000	(0.0)	-0.000	(-0.7)	0.001	(1.4)
Service	0.001	(1.0)	0.001	(0.6)	0.001	(2.5)	-0.001	(-2.5)
Residuals	0.065	(76.3)	0.092	(67.7)	0.026		(52.7)	

a) Shares of variance of log-wages in 1990 (0.086) and 2000 (0.135) are reported in parentheses.
b) Share of differences in variance of log-wages between 1990 and 2000 (0.050) are reported in parentheses.

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Table 3 shows our inequality decomposition results from 1990 to 2000. The first part of the table shows us how much each factor contributes to inequality in that year, while the second part decomposes the inequality change. From 1990 to 2000 wage inequality measured by the variance of log-wages has increased by 58.1 % (from 0.086 to 0.135). In total, the characteristics, coefficients and residuals effects are, respectively, 0.6 %, 46.6 % and 52.7 %. This means that wage inequality in 2000 was higher than in 1990 due to differences in the coefficients of the earnings equation by 46.6% and due to differences in the distribution of residuals by 52.7 %. However, the effect of differences in the characteristics of wage / salary earners on increasing wage inequality was negligible (0.6%). In other words, the changes in individual characteristics, such as education, age, and industrial and occupational composition, contributed to increasing wage inequality by 0.6 %; the changes in wage structure (changes in coefficients) between 1990 and 2000 contributed to widening wage inequality by 46.6 %; the remaining 52.7 % of the inequality change between the two time periods is the residuals effect.

From Table 3 it is easy to see the sources of the changes in wage inequality. The factors (variables) used in the decomposition may be grouped as human capital (education and experience), occupation, firm size and industry.[4] During the transition, the residuals played a major role in wage inequality change. Judging from the gross effects of factors (that is, the sum of the coefficients and characteristics effects), factors related to education and firm size have played major roles in widening wage inequality while only a few factors contributed to narrowing wage inequality. When the gross effects are further decomposed into characteristics and coefficients effects, the fact that the characteristics effect is negligible for virtually every factor stands out. Indeed, the coefficients effect is almost equal to the gross effect. As the East German economy increased its market orientation, the returns to schooling increased. The increase in the returns to schooling and increasing wage inequality may point to the fact that the East German economies not only experienced the transition to market oriented economies, but also skill-biased technological changes (see Juhn / Murphy / Pierce, 1993, for the effects of skill-biased technological changes on inequality).[5] Another interesting finding is that the large firm size premium became substantial, while there has been a shift into smaller firm sizes. It is also noted that though the industrial wage premium changes

[4] The effects of categorical variables (e.g., industry) or very closely related variables (e.g., experience and experience squared in hundreds) are computed by aggregating the effects of each variable.

[5] Interestingly, the changes in returns to experience do not explain much of the change in wage inequality. The increases in the returns to observed skills (measured by experience and schooling), in addition to unobserved skills, are major components of a skill-biased technological change explanation of the widening wage inequality during last two or three decades in the United States.

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during the transition, it does not contribute much to the changes in wage inequality.

4. Conclusion

In this paper we examine changes in male wage inequality in East Germany after the fall of the Berlin Wall. We investigate inequality changes, and decompose these changes using the Yun (2002) decomposition. This new and simple decomposition method synthesizes the methods proposed by Juhn / Murphy / Pierce (1993) and Fields (2001). Unlike the earlier methods, the decomposition we employ allows us to produce not only aggregate coefficient and characteristics effects estimates, but we can also distinguish these effects for each variable or groups of variables.

From 1990 to 2000 wages doubled and wage inequality increased substantially, as expected for economies in transition from a socialist to a market oriented system. Using the variance of log-wages, inequality increases by 58.1 percent over the decade. The inequality change is explained almost exclusively by the coefficients effect and the residuals effect. Changes in the wage structure increased inequality, while the characteristics effect had little impact on the wage inequality. The effects of individual factors vary. For example, among the changes in the wage structure (coefficients effect), returns to education and firm size premium contribute to the increasing wage inequality substantially, while industrial and occupational wage premia affect wage inequality only a little. Our analysis is thus able to provide a breakdown of the causes of the changes in male wage inequality during East Germany's economic transition.

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