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The Pattern of Convergence of Eastern German Labor Markets to Western Standards Post-Unification[†]

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Keywords: German Labor Market, German Unification, Returns to Human Capital

JEL Classification Codes: J21, J31, J64, O12, R11

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I. Introduction

The unification of Germany in 1989 necessitated the fusion of two very different education programs, labor markets, and monetary systems. The East German education system was highly regulated and mandatory. As a result, average education levels were higher in East Germany than in West Germany pre-unification. In westernized nations, higher education is typically coupled with higher earnings. This was not the case in eastern Germany (the states formerly a part of East Germany) in 1992. Further, it is commonly held that returns to education increase in transitional economies with the acquisition of a free-market economy (Chase, 1997; Campos and Coricelli, 2002; Munich, Svejnar, and Terell, 2002). In particular, Bird, Schwarz, and Wagner (1994) found rising returns to education in the eastern German states during the initial transitioning years of 1989 until 1991. There is little subsequent research on the convergence of returns to education in the eastern states to western standards after unification. Therefore, the first question this paper addresses is to what extent the returns to schooling in the eastern states have converged returns to schooling in the western states.

Next, a transitional economy usually must undergo a restructuring of its labor force. As expected, unemployment in the eastern German states rose by approximately 35 percent between 1989 and 1992 (Hunt, 2003), while eastern output decreased by more than 65 percent (Sander & Schmidt, 1993). When output eventually began to rise, again, it was expected that eastern levels of employment would increase and begin to converge to western levels. The second question of this study is to what extent eastern levels of employment have converged to western levels.

Lastly, as is typical of communist countries, the German Democratic Republic (GDR) had little wage differentiation pre-unification, regardless of a workers education or occupation. Therefore, upon unification, the development of a free market economy necessitated comprehensive adjustments to the wage structure in the eastern states. Due to political pressures to adopt the Deutschmark in the eastern states, wages in the former east grew rapidly in the early 1990s, easily outpacing growth in productivity. The last question of this study is how much have eastern wages converged to western wages from 1992-2003.

Results show relatively steady increases in returns to an additional year of schooling for easterners and only slight fluctuations in returns to education for westerners. For unemployment and average hourly wages, results reveal two distinct periods. In unemployment, there is an initial period from 1992 until 1995, in which unemployment rates converge to western standards for men and diverge from western standards for women. In the following period form 1995 until 2003, unemployment rates for eastern men diverge from western standards while rates for females converge to western standards. Wages increase rapidly for both men and women for an initial period of 1992 to 1997, followed by a period from 1997 until 2003 of stagnation. Despite steady convergence in returns to an additional year of school for easterners and periods of convergence in unemployment and average hourly wages for eastern men and women, eastern levels remain far below western levels in 2003.

II. Germany: Pre- and Post-Unification

Believing that education is a primary unit of socialization, East Germany depended on its education system to instill socialist values in its youth. The education system (and the curriculum) was strictly regulated by the Socialist Unity Party of Germany (SED) out of a fear that any autonomy would lead to dissent (Pritchard, 1999). The SED feared that a failed education system would create unproductive and restless members of society. Thus, when problems arose, the SED was quick to make changes. This led to an education system that was progressive by nature.

In contrast, most West Germans were against changes in the education system and attempted to re-create a system similar to that of the Weimar Republic. This system consisted of a compulsory eight years of schooling, followed by civil service, an apprenticeship, or further schooling. The primary difference between East German and West German education systems was that the West offered students freedom of choice, and it encouraged innovative thought. It also sought to limit federal control and left regulation of education to the individual states (Hahn, 1998).

In 1992, the average eastern male had completed a full year more of schooling compared to men in the western states (see Table 1). Similarly, eastern women obtained an average of 1.15 years more than western women. A gap in the average years of education obtained by people in the eastern states from people in the western states remained even in 2003. While the gap fell to about a difference of a half of year for men, eastern women still had obtained more than 1 year more of education in the eastern states than in the western

Table 1. Average Years of Education by Region.

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Western men	11.57	11.62	11.62	11.66	11.70	11.74	11.75	11.80	11.98	12.04	12.09	12.13
Eastern men	12.58	12.59	12.60	12.58	12.59	12.59	12.61	12.57	12.59	12.62	12.66	12.71
Difference	1.01	0.97	0.97	0.92	0.89	0.85	0.86	0.77	0.61	0.58	0.57	0.58
Western women	11.10	11.18	11.21	11.20	11.27	11.31	11.29	11.40	11.55	11.60	11.67	11.64
Eastern women	12.25	12.28	12.34	12.32	12.32	12.33	12.39	12.44	12.44	12.46	12.52	12.71
Difference	1.15	1.10	1.12	1.12	1.06	1.02	1.10	1.04	0.90	0.86	0.85	1.07

states in 2003. Eastern wages remained well below western levels over the same time period.[1]

Following unification, the labor market in the eastern German states underwent a mandatory restructuring. Jobs were re-allocated, firms were privatized, wages were de-regulated, and the massive labor hoarding customary under the communist regime was reduced. The question becomes, what is the optimal speed of that transition? (Blanchard, Boycko, Dabrowski, Dornbusch, Layard, and Schleifer, 1993; Blanchard, Dornbusch, Krugman, Layard, and Summers, 1991; Blanchard, 1997; Hunt, 2003).

Due to political forces, the German Economic and Monetary Social Union (GEMSU) of 1 July 1990 introduced the DM to the eastern states. This resulted in high wage growth for easterners that was not on par with eastern productivity. As a consequence of high wages unmatched by high levels of output and revenue, 35 percent of eastern Germany became unemployed (Sander and Schmidt, 1993). With initial help of the western states, however, eastern Germany was able to increase per capita GDP from 31 percent of western German levels in 1991 to 57 percent in 1996 (Funke and Rahn, 2000).

[1] Houthakker (1959) and Schultz (1961) present original studies revealing the returns to schooling. Psacharopoulos (1985) reviews international returns to education until 1985. Kosters (1990) describes the impact of schooling on wages for the US from 1975 until 1990. For a more recent review, see Bils and

Like many communist states, East Germany had numerous laws that encouraged families to have children. For example, mothers were ensured of work after pregnancy and maternal leave, and there was adequate free childcare available. During the communist regime, over 80 percent of women participated in the labor market. Even in 2000, 72 percent of women in the former east were in the workforce, compared to 62 percent of westerners (Kreckel, Schenk, 1998; Bonin, Euwals, 2001).

Lastly, as is typical of communist countries, the German Democratic Republic (GDR) had little wage differentiation. Therefore, upon unification, the development of a free market economy necessitated comprehensive adjustments to the wage structure in the eastern states. Unlike classical transitioning economies, eastern German officials had to deal with political pressures stemming from the threat of a massive westward migration. Therefore, in contrast to the advice given by economists, the political measures in both the eastern and western states resulted in a rapid currency reform for the eastern states, which had harmful effects on the new wage structure. Specifically, wages were set too high for the eastern German economy to sustain (Sinn, 2002; Lange and Pugh, 1998a; Akerlof, Dornbusch, Guitian, Hessenius, Rose, and Yellen, 1991; Hasse, 1993). According to Lange and Pugh (1998b), market forces allowed prices to adjust freely in the product market, but wages were distorted and regulated in the labor market. This created extraordinarily high wages relative to productivity levels in the eastern states. In 1992, wages were estimated to be nearly 200 percent of 1989 levels, while productivity was only about 150 percent of the 1989 level (Sander and Schmidt, 1993).

Klenow (2000).

The initial wage explosion slowed considerably after mid 1995. It is commonly held that there were two phases of structural adjustments of eastern wages. First, wages grew excessively between 1989 and 1995. In the last couple years of this phase, growth rates of wages declined and finally stabilized around an annual rate of 5 percent growth (Franz and Steiner, 2000; Lange and Pugh, 1998b; Burda and Hunt, 2001). Numerous studies report the decomposition of wages for the period ranging from unification until 1997. These reveal a rise in returns to education for easterners, an absence of an impact of experience on wages, an increase of eastern wages, and a decrease in wage inequality between men and women in the eastern states (Hunt, 2002; Burda and Schmidt, 1997; Franz and Steiner, 2000). Only one paper by Gang and Yun (2002) explores changes in inequality and wage growth trends in eastern and western Germany between 1990 and 2000 but does not discuss the convergence to western standards. Their findings point to little change in western equality and a slight increase in eastern levels of equality. Wage growth trends are only examined for males and showed a positive correlation between firm size and earnings, as well as education and earnings. Little literature exists that compares explanatory variables between men and women, as well as differences in rates of convergence, after 1997.

III. The Data

The data comes from the public-use version of the German-Socio Economic Panel (GSOEP) data for the years 1992-2003. The GSOEP data are collected by the Deutsche Institut für Wirtschaft (DIW) and are a representative sample of German households and individuals. This data have been collected for the western states (states included in the

former West Germany) since 1984. From 1984 until 1990, the survey was composed of two sample groups: West Germans (sample A) and foreign nationals living in West Germany (sample B). In 1990, the eastern states were added to create a third sample (sample C). Much of the income data for eastern Germany for 1990 and 1991 are missing. Therefore, my analysis begins with 1992. One of the most prominent features of the data set is its large and stable size, which enables longitudinal analysis to account for compositional changes. A possible problem with the data is that using a longitudinal sample creates the possibility for attrition bias.[2]

The GSOEP contains some "generated variables," which are produced by researchers and staff affiliated with Cornell University and the DIW Berlin to fill in missing observations (Grabka, 2005). The analysis here includes the following variables: number of children in the respondent's household, marital status, industry of employment, employment status, annual hours worked, number of years of education, attainment of high school diploma or equivalent, and earned income. Each of these variables is summarized in Table 2.

Before discussing the variables in detail, it should be noted that this study is limited to citizens who are in the labor force. Therefore, I restrict the sample to individuals between 25 and 65 years of age. Additionally, the GSOEP contains each respondent's labor force status. Respondents who report being unemployed and not seeking work, retired, on maternity leave, involved in military or civil service, or enrolled in education and training are not included in this study. As usual, the labor force consists of individuals

[2] Studies concerning the attrition bias of the GSOEP point to problems with unsuccessful follow-up interviews (e.g. households moves, separation of households, etc.). Divorce, residing in East Berlin. and job

Table 2. Descriptive Statistics for the Labor Force.

	All (n=48,290)				West (n=31,428)		East (n=16,862)	
	Mean	Std Dev	Max	Min	Mean	Std Dev	Mean	Std. Dev.
Unemployed	0.090	0.286	1	0	0.060	0.240	0.150	0.350
Female	0.456	0.498	1	0	0.432	0.495	0.500	0.500
Age	42.971	10.083	65	25	42.688	10.272	43.49	9.697
Married	0.751	0.432	1	0	0.729	0.445	0.794	0.405
Children in household	0.771	0.986	6	0	0.768	1.018	0.776	0.924
Years of education	11.926	2.571	18	7	11.617	2.625	12.50	2.363
Living in an eastern state	0.349	0.477	1	0	0.000	0.000	1.000	0.000
Foreigner in western states	0.133	0.339	1	0	0.204	0.403	0.000	0.000
Less than diploma	0.160	0.366	1	0	0.223	0.416	0.042	0.200
High school diploma	0.641	0.480	1	0	0.568	0.495	0.777	0.416
More than diploma	0.198	0.398	1	0	0.207	0.405	0.181	0.385

who report working, working but not in the past seven days (e.g. on vacation), seasonal workers, and unemployed persons. The definition of unemployment used in this study is the definition used in the United States. This differs from the official German definition of being unemployed, which also considers anyone working less than 15 hours a week, but who desires full-time work.

Descriptive Statistics for the Labor Force Variables

Descriptive statistics for the labor force are listed in Table 2. The average unemployment rate for Germany, as a whole, was 9 percent from 1992 and 2003. The average unemployment rate for the eastern states, however, was more than twice that in the western states (15 versus 6 percent).

The two variables, marriage status and number of children in a household, are taken directly from survey questionnaires. In some cases, these variables were corrected for

loss have all been linked to a reduced rate of responding to follow-up waves of the survey. For more

Table 3. Unemployment by Gender, Region, and Number of Children.

	Western States		Eastern States	
Panel A: Females	Working	Unemployed	Working	Unemployed
No Children	93.47%	6.53%	81.87%	18.13%
	(7,239)	(506)	(3,392)	(751)
One Child	93.54%	6.46%	85.17%	14.83%
	(2,749)	(190)	(1,993)	(347)
Two Children	95.13%	4.87%	83.77%	16.23%
	(2,108)	(108)	(1,337)	(259)
Three or more	94.98%	5.02%	71.84%	28.16%
	(643)	(34)	(250)	(98)
Panel B: Males				
No Children	92.65%	7.35%	83.71%	16.29%
	(8,948)	(710)	(3,680)	(716)
One Child	96.21%	3.79%	92.64%	7.36%
	(3,451)	(136)	(1,902)	(151)
Two Children	96.71%	3.29%	93.82%	6.18%
	(3,203)	(109)	(1,504)	(99)
Three or more	94.20%	5.80%	86.68%	13.32%
	(1,219)	(75)	(332)	(51)

Notes: The number of observations for each cell is in parentheses.

inconsistencies.[3] All single, widowed, divorced, and separated persons were coded as being unmarried. Although roughly 75 percent of all workers and unemployed persons are married in Germany, there is a large regional difference with 80 percent of eastern households being married compared to 72 percent of households in the western states. Though the difference for the entire labor force is small, Table 2 shows working westerners have slightly fewer children on average per household than working easterners. A cross-tabulation on region and employment status by number of children (Table 3) reveals unemployment decreases as the number of children present in the household increases to two and increases with three or more children present in the household. This

information, see Frick & Haskins (2003).

Table 4. Percentage of Respondents with more than a High School Diploma by Region.

	Percent with more than High School Diploma			
Age	Easterners		Westerners	
25-30	18.91%	(1317)	15.10%	(n=3,483)
30-40	16.15%	(5016)	22.67%	(9776)
40-50	17.54%	(5428)	21.92%	(9053)
50-60	19.52%	(4349)	19.48%	(7443)
60-65	25.40%	(752)	19.01%	(1673)

Notes: The number of observations for each cell is in parentheses.

could be expected due to East German social policy during the communist period. The East German system gave pregnant women a twenty-six week paid leave of absence, and mothers could receive a partially paid leave of absence for up to one year following the birth of a child. Mothers also had generous vacation packages to assure proper care and upbringing of their children (Burant, 1998).

Since the German education system differs significantly from that of the United States, I used a GSOEP variable regarding education with respect to high school. Less than high school consists of intermediate secondary school (*Realschule*), lower secondary school (*Hauptschule*), other, and none. A high school diploma is considered the equivalent of having an upper secondary school degree (*Gymnasium*) or earning a certificate of aptitude (*Fachhochschulreife*). More than a high school diploma includes graduating from a school of health care (*Schule des Gesundheitswesens*), a specialized college of higher education (*Fachhochschule*), a college, a technical university (*Technische Universität*), or having had civil service training. Table 2 shows eastern Germans are far more likely to obtain a high school diploma or equivalent than western Germans (78 percent vs. 57 percent). In contrast, Table 4 shows western Germans, with the exception of those between 25 and 20, were more likely to obtain more than a high school diploma. This phenomenon

[3] For more information about the imputation of variables, see Grabka (2005).

Table 5. Educational Attainment by Region and Employment Status.

	Western States		Eastern States	
Educational Attainment	Employed	Unemployed	Employed	Unemployed
Less than High School Diploma	88.70% (6222)	11.30% (793)	66.90% (471)	33.10% (233)
High School Diploma or Equivalent	94.96% (16965)	5.04% (901)	84.62% (11091)	15.38% (2016)
More than Diploma	97.51% (6332)	2.49% (162)	92.69% (2828)	7.40% (223)

Notes: The number of observations for each cell is in parentheses.

Table 6. Unemployment by Region and Educational Status.

Educational Attainment	Western States	Eastern States
Less than High School Diploma	42.45% (793)	9.43% (233)
High School Diploma or Equivalent	48.23% (901)	81.55% (2016)
More than Diploma	8.67% (162)	9.02% (223)

Notes: The number of observations for each cell is in parentheses.

is not surprising given the value placed on a primary but not university education in the GDR. Education was a cornerstone for raising children with a proper socialist mentality, but too much education was discouraged. Therefore, university acceptance was limited for East Germans by the 1970s. Finally, Table 5 shows that increased education unambiguously leads to a decrease in unemployment, while Table 6 reveals the highly educated, unemployed eastern labor force.

Descriptive Statistics for the Employed

The subsample of employed individuals is limited to those working between 1560 and 3120 hours a year and earning between €2 and €100 per hour. Several additional variables available for only working respondents (e.g. average annual hours worked, tenure, and firm size) are listed in Table 7.

Table 7. Descriptive Statistics for the Employed.

	All (n=30,624)				West (n=20,243)		East (n=10,399)	
	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Mean	Std. Dev.
Female	0.334	0.472	0	1	0.285	0.451	0.429	0.495
Age	42.502	9.651	25	65	42.351	9.926	42.795	9.085
Married	0.742	0.437	0	1	0.712	0.453	0.800	0.400
Children in household	0.741	0.965	0	6	0.719	0.999	0.784	0.894
Years of Education	12.104	2.624	7	18	11.758	2.662	12.778	2.409
Less than diploma	0.139	0.346	0	1	0.199	0.399	0.023	0.149
High school diploma	0.643	0.479	0	1	0.577	0.494	0.770	0.421
More than diploma	0.218	0.413	0	1	0.224	0.417	0.207	0.405
Annual hours worked	2,220	316	1,561	3,118	2,193	308	2,275	323.74
Tenure with current firm	12.155	9.944	0	51.2	13.373	9.957	9.782	9.481
Hourly Wage (€)	13.88	6.71	2.01	98.39	15.76	6.84	10.22	4.62
Self-employed	0.022	0.146	0	1	0.023	0.149	0.020	0.138
Firm size 20 or less	0.206	0.405	0	1	0.178	0.382	0.261	0.439
Firm size 21 to 200	0.269	0.443	0	1	0.236	0.425	0.333	0.471
Firm size larger than 200	0.503	0.500	0	1	0.563	0.496	0.386	0.487

The GSOEP measures individual labor earnings from the previous year. This consists of wages and salary for all employment and self-employment, as well as bonuses, profit-sharing plans, and military service payments. All figures are listed in euros, adjusted to year 2000 prices to control for inflation.[4] The GSOEP also includes annual hours worked.[5] Using these variables, I generate an hourly wage variable by dividing the annual labor earnings by the annual hours worked. The average hourly wage for the period 1992-2003 was €10.22 for easterners and €15.76 for westerners. Table 8 reports average wages

[4] The Consumer Price Index can be found at http://laborsta.ilo.org/.
[5] For further detail regarding calculations of individual labor earnings and annual hours worked, see Lillard (2004).

Table 8. Average Hourly Wage by Gender and Region.

	Year											
Men	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Western	15.82	16.17	16.23	16.40	16.73	16.55 €	16.81 €	16.89 €	17.34 €	17.34 €	17.76 €	18.77 €
Eastern	7.80	8.68	9.56	9.99	10.33	10.44 €	10.52 €	10.81 €	11.04 €	11.14 €	11.74 €	12.24 €
Difference	8.02	7.49	6.67	6.41	6.40	6.11 €	6.29 €	6.08 €	6.30 €	6.20 €	6.02 €	6.53 €
Women												
Western	12.03	12.12	12.64	12.69	13.16	12.82 €	13.34 €	13.12 €	13.03 €	13.18 €	13.51 €	14.12 €
Eastern	7.01	8.22	9.32	9.76	10.54	10.42 €	10.64 €	10.82 €	10.93 €	10.91 €	11.26 €	11.72 €
Difference	5.02	3.90	3.32	2.93	2.62	2.40 €	2.70 €	2.30 €	2.10 €	2.27 €	2.25 €	2.40 €

Notes. Hourly Wages reported in €.

by region, sex, and year. This table shows the rapid initial catch up of the eastern states to western wage levels between 1992 and 1997, followed by stagnation.

Table 7 also reveals westerners are more likely to work for larger firms, while easterners are more likely to be employed by small to medium sized firms. For the purposes of this study, a small firm employs one to twenty workers, a medium sized firm employs between 21 and 200 workers, and a large firm employs more than 200 workers. A separate category exists for the self-employed. Table 9 shows that, with the exception of those self-employed, the average wage is positively correlated by the size of the firm.

Lastly, Table 7 shows that the average tenure with a firm was higher in the western states (13.37 years) than in the eastern states (9.78 years).[6] This is not surprising given the re-allocation of labor in the eastern states following unification. The majority of East German firms were state-owned, and approximately half of those jobs were disposed through the *Treuhandanstalt* (privatization agency) by the end of 1991 (Collier, 1991).

[6] For further information about the tenure variable, see Schupp (2004).

IV. Resuts

Returns to Education

Using the data for employed persons, a log-wage model is used to estimate yearly returns to education using ordinary least squares. The model takes into account personal characteristics (marital status, number of children living in the household, etc.), job characteristics (tenure with firm, firm size, etc.) and education. Education is measured in years of completed schooling. In order to allow the returns to education to vary across region and time, years of education are indicated with year dummy variables for both regions. The results from estimating yearly returns to education separately in the eastern and western states are reported in Table 9. The first model shows the estimated coefficients for the entire sample. The second two models limit the sample to working men and women, respectively. Because the estimation is based on a log-wage model, coefficients show both direction and magnitude, with the estimated coefficients reporting the percentage point increase in wages due to an extra year of schooling.

Starting in 1992, workers in former East Germany realized an average return to an additional year of education of just over 1 percentage point. In the same year, westerners received returns to education of 6.6 percentage points. The rate of return in the eastern states rose steadily between 1992 and 1997 so that an additional year of schooling in the eastern states was associated with 3.6 percentage points higher wages in 1997. After 1997, the increase slowed, leaving the average rate of return per year of schooling at only 4.4 percentage points in 2003. In comparison, between 1992 and 2003, the rates for westerners fluctuated between 6.6 and 7.2 percentage points. These results exhibit the initial speedy

Table 9. log Wage-Regression of Returns to Education

	Sample					
Variable	All (n=30,642)		Women (n=10,227)		Men (n=20,415)	
Gender	-0.140	(33.39)**				
Foreigner	-0.044	(7.40)**	-0.028	(2.52)*	-0.048	(6.93)**
Age	0.023	(12.48)**	0.026	(7.80)**	0.023	(10.36)**
Age squared	0.000	(10.98)**	0.000	(7.23)**	0.000	(8.85)**
Married	0.031	(6.20)**	-0.005	-0.63	0.044	(6.84)**
Number of children living in	0.021	(9.17)**	-0.018	(3.63)**	0.025	(9.44)**
Tenure with firm	0.006	(24.70)**	0.007	(16.53)**	0.005	(16.62)**
Self employed	-0.224	(16.69)**	-0.290	(11.37)**	-0.203	(13.05)**
Firm size of 1 to 20 employees	-0.116	(20.76)**	-0.136	(14.11)**	-0.107	(15.80)**
Firm size of more than 200 employees	0.129	(27.87)**	0.143	(17.67)**	0.119	(21.19)**
Easterners rate of return						
1992	0.011	(9.35)**	0.021	(10.67)**	0.005	(3.83)**
1993	0.021	(18.60)**	0.033	(16.80)**	0.015	(10.54)**
1994	0.029	(25.66)**	0.041	(21.47)**	0.022	(15.63)**
1995	0.033	(29.01)**	0.045	(23.04)**	0.026	(18.62)**
1996	0.037	(32.40)**	0.050	(25.94)**	0.029	(20.34)**
1997	0.036	(31.75)**	0.048	(24.59)**	0.029	(20.70)**
1998	0.038	(33.23)**	0.052	(26.17)**	0.030	(21.12)**
1999	0.040	(34.21)**	0.051	(26.25)**	0.032	(22.16)**
2000	0.040	(35.46)**	0.051	(26.58)**	0.033	(23.56)**
2001	0.040	(35.29)**	0.051	(26.62)**	0.033	(23.31)**
2002	0.042	(36.92)**	0.053	(27.32)**	0.036	(24.93)**
2003	0.044	(38.25)**	0.053	(27.87)**	0.038	(26.01)**
Westerners rate of return						
1992	0.066	(63.05)**	0.068	(33.88)**	0.064	(52.85)**
1993	0.066	(64.09)**	0.068	(34.07)**	0.064	(53.89)**
1994	0.067	(64.99)**	0.071	(35.40)**	0.064	(54.17)**
1995	0.067	(65.43)**	0.070	(34.74)**	0.065	(55.03)**
1996	0.069	(67.12)**	0.073	(36.25)**	0.066	(55.93)**
1997	0.067	(65.87)**	0.070	(34.96)**	0.065	(55.24)**
1998	0.069	(67.72)**	0.074	(36.95)**	0.066	(56.24)**
1999	0.068	(66.87)**	0.071	(35.97)**	0.066	(55.87)**
2000	0.068	(68.30)**	0.069	(35.57)**	0.067	(57.83)**
2001	0.068	(68.36)**	0.069	(36.05)**	0.067	(57.66)**
2002	0.069	(68.89)**	0.070	(36.85)**	0.067	(57.78)**
2003	0.072	(71.94)**	0.074	(38.23)**	0.071	(60.63)**
Constant	1.231	(32.07)**	1.011	(14.78)**	1.262	(27.30)**
R-squared	0.467		0.379		0.474	
Observations	30,624		10,227		20,415	

Notes. Standard errors are reported next to the estimated coefficients. *, ** Statistically significant at the 5% and 1% level respectively. The dependent variable is the natural log of hourly wages from 1992 until 2003.

convergence of the eastern states to western levels of rates of return on additional years of schooling, followed by a period of less rapid convergence.

It is interesting to note the differences in returns to education between women and men. First, there is only a small difference between women and men in the western states. The average returns to each year of schooling for women range from 6.8 to 7.4 percentage points, while that of men varies between 6.4 and 7.1 percentage points. In contrast, returns by sex in the eastern states are notably distinct. In 1992, women realized returns for each year of schooling of approximately 2.1 percentage points, while men received an average rate of return of just 0.5 percentage points for each year of schooling. This inequality between men and women remained virtually unchanged 12 years later. In 2003, returns for each year of schooling for women reached 5.3 percentage points (a 3.2 percentage point increase over 1992) and 3.8 percentage points for men (3.3 percentage points higher than 1992). This implication is that rates of return in the eastern states moved toward the western rates in the early 1990s, but that the convergence was, in magnitude, the same for men and women.

Convergence in Unemployment Rates between Genders

The results from estimating unemployment in the eastern and western states are reported in Table 10. Both models in Table 10 are robust, linear probability models, in which the dependent variable equals 1 for unemployed individuals and 0 for employed individuals. The coefficient for the year represents the returns seen by easterners and

Table 10. Regression: Convergence of Unemployment Rate by Gender.

	Male Sample		Female Sample	
Foreigner	0.031	(5.32)**	0.042	(6.18)**
Age	-0.018	(11.23)**	-0.019	(10.02)**
Age squared	0.000	(13.37)**	0.000	(11.38)**
Married	-0.040	(8.31)**	-0.024	(4.85)**
Number of kids in household	0.004	(2.09)*	0.019	(7.92)**
No high school diploma	0.068	(10.40)**	0.029	(4.56)**
More than high school diploma	-0.037	(11.29)**	-0.061	(14.21)**
1993	0.008	(1.20)	0.007	(0.75)
1994	0.027	(3.64)**	0.023	(2.25)*
1995	0.021	(2.99)**	0.018	(1.83)
1996	0.030	(4.03)**	0.012	(1.29)
1997	0.045	(5.68)**	0.025	(2.53)*
1998	0.040	(5.14)**	0.021	(2.12)*
1999	0.028	(3.82)**	0.008	(0.90)
2000	0.029	(3.89)**	0.009	(0.95)
2001	0.021	(2.93)**	0.009	(0.91)
2002	0.024	(3.20)**	0.017	(1.71)
2003	0.032	(4.05)**	0.021	(2.13)*
Easterner in 1992	0.087	(7.43)**	0.144	(9.28)**
Easterner in 1993	0.091	(7.35)**	0.159	(9.86)**
Easterner in 1994	0.073	(5.71)**	0.152	(9.04)**
Easterner in 1995	0.055	(4.66)**	0.142	(8.73)**
Easterner in 1996	0.063	(4.88)**	0.146	(9.14)**
Easterner in 1997	0.066	(4.72)**	0.138	(8.50)**
Easterner in 1998	0.089	(6.12)**	0.138	(8.56)**
Easterner in 1999	0.083	(6.05)**	0.108	(7.34)**
Easterner in 2000	0.065	(4.96)**	0.111	(7.57)**
Easterner in 2001	0.082	(5.95)**	0.104	(7.10)**
Easterner in 2002	0.090	(6.28)**	0.100	(6.65)**
Easterner in 2003	0.092	(6.06)**	0.108	(6.77)**
Constant	0.322	(10.18)**	0.373	(9.53)**
R-squared	0.064		0.063	
Observations	26286		22004	

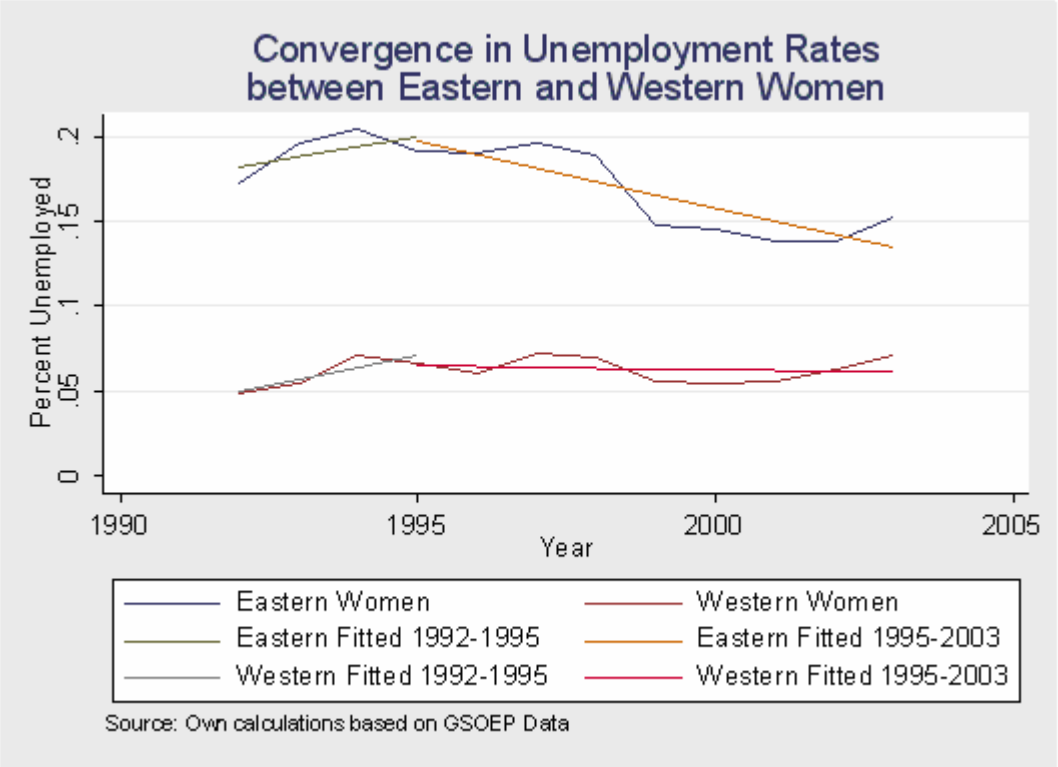
Notes. The dependent variable is the unemployment rate between 1992 and 2003 expressed as a percentage of the workforce that is unemployed. Also see the notes to Table 9.

westerners, and the coefficients for easterners represent the difference between western and eastern unemployment rates.

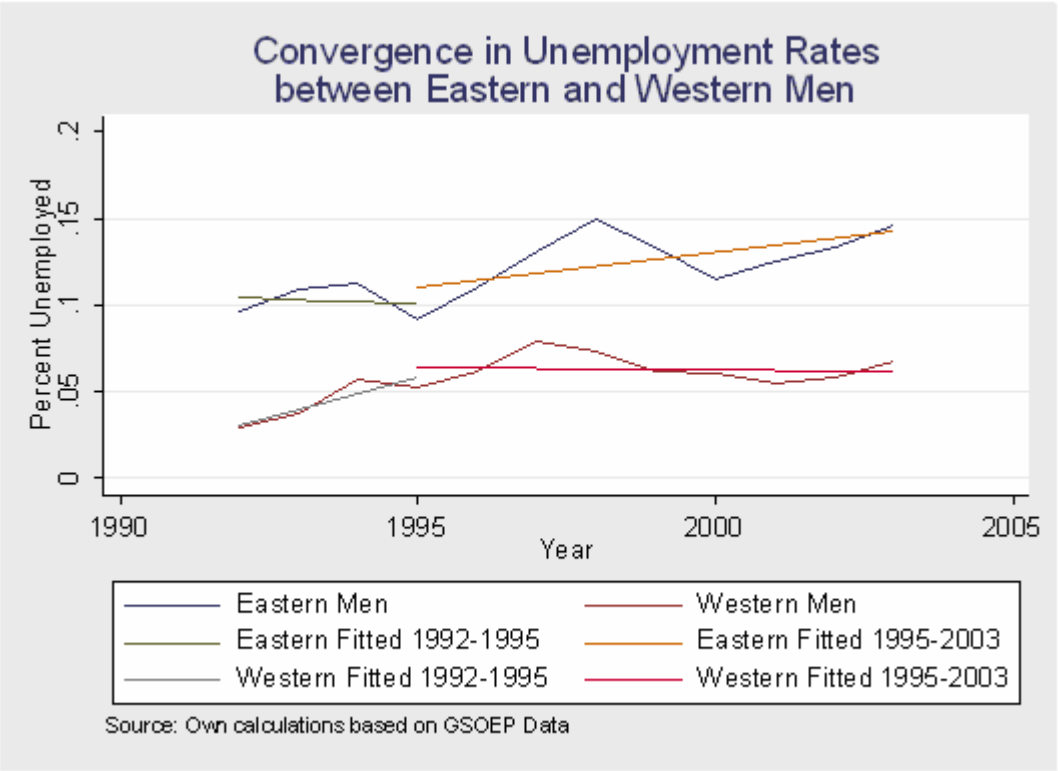
Unemployment for men in the western states fluctuated between approximately 1 percent and 4 percent. For men in the eastern states in 1992, the unemployment rate was 8.7 percentage points higher than it was for western men. By 1995, unemployment in the western states for men was only 5.5 percentage points above western levels. From 1995 to 2003, however, the unemployment rate for easterners increased to 9.2 percent higher than the unemployment rate for western men. The main result is that male unemployment rates fluctuate between the two regions. Except for a consistent narrowing of the gap in unemployment rates in the first half of the 1990s, there is little evidence of convergence in male unemployment rates.

For eastern women, the story is different. In 1992, eastern women were 14.4 percentage points more likely to be unemployed than western counterparts. Over the next twelve years, this gap in unemployment rates steadily fell to the point where eastern women were only about ten percentage points more likely to be unemployed compared to their western counterparts. This trend of convergence for women and divergence for men is pictured in Graphs 1 and 2. These graphs clearly elicit the convergence between eastern and western women and the lack of convergence between eastern and western men.

Graph 1. Convergence in Unemployment Rates between Eastern and Western Women.



Graph 2. Convergence in Unemployment Rates Between Eastern and Western Men.



Convergence in Wages by Gender

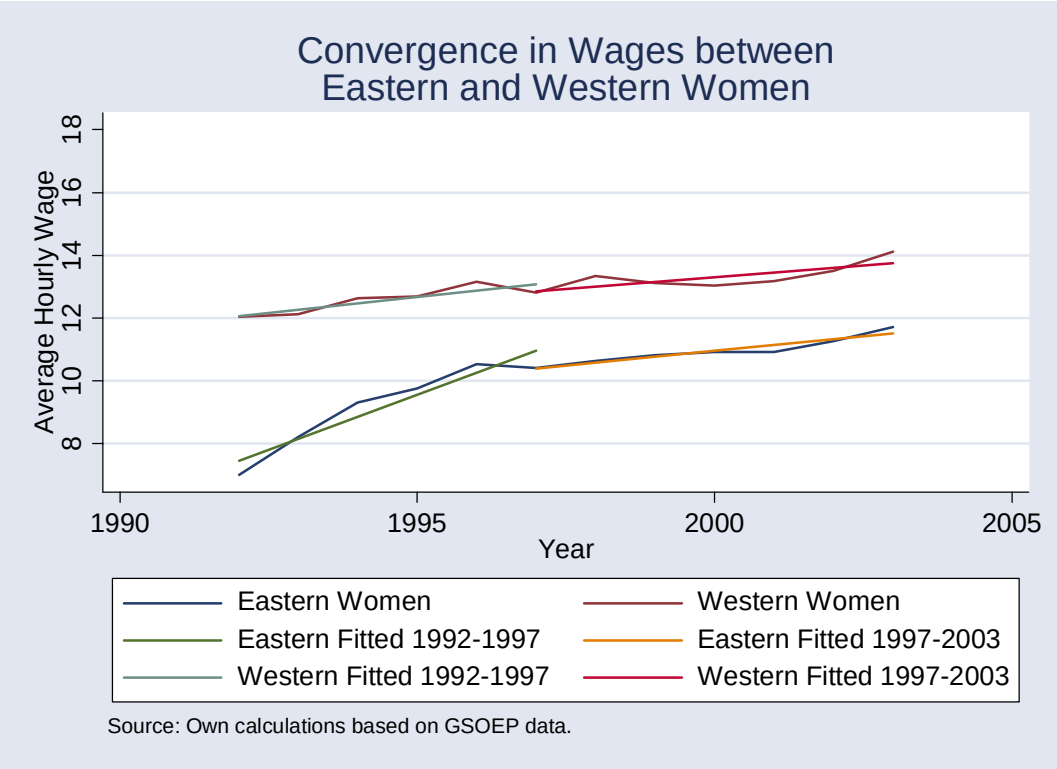
The results from estimating a log-wage model of the employed separately for men and women that allows for yearly wage differentiation by region are included in Table 11. I use dummy variables interacting year with region to allow for a separate estimate of wages for the eastern and western states each year. All coefficient estimates are measured against the average wage level in the western states in 1992. The increase in wages for eastern and western men and women is evident through the increasing coefficients. The results elicit two phases of convergence for eastern Germans to a western standard. These two phases align with existing studies; however, they extend the period of little eastern convergence to 2003. Between 1992 and 1996, both eastern men and women see dramatic increases in hourly wages. Eastern men see a 29.5 percent increase in hourly wages and a 25.1 percent increase relative to wage levels of western men. Eastern women obtain a 37.7 percent increase in hourly wages and a 28.4 percent increase relative to wages of western females. Not only is this trend statistically significant, but economically significant as well. Between 1996 and 2003, wage growth for men and women stagnates. Relative to wages for western men, wages for eastern men increase by only 0.4 percent. Eastern women actually see their wages fall by 1.5 percent relative to comparable western women. Despite the decrease in eastern women's wages in more recent years, this analysis suggests convergence for eastern women is occurring at a quicker pace than eastern men. Graphs 3 and 4 illustrate this fact.

Table 11. Wage Convergence by Gender.

	Male Sample		Female Sample	
	Coefficient	t-statistic	Coefficient	t-statistic
Foreigner	-0.103	(14.56)**	-0.089	(8.11)**
Age	0.028	(12.11)**	0.031	(8.99)**
Age Squared	0.000	(10.07)**	0.000	(8.36)**
Married	0.036	(5.26)**	-0.013	(1.60)*
Number of children	0.028	(10.14)**	-0.014	(2.50)*
Yearly Hours Worked	0.000	(9.55)**	0.000	(8.46)**
Tenure	0.002	(7.26)**	0.006	(13.03)**
Less than High School Diploma	-0.116	(15.93)**	-0.166	(14.75)**
More than High School Diploma	0.230	(33.60)**	0.159	(18.29)**
Large Firm	0.119	(22.70)**	0.152	(19.43)**
Small Firm	-0.094	(12.63)**	-0.140	(12.55)**
Independent	-0.182	(6.24)**	-0.241	(5.62)**
1993	0.008	(0.65)	0.003	(0.17)
1994	0.016	(1.32)	0.035	(1.73)
1995	0.026	(2.09)*	0.030	(1.40)
1996	0.044	(3.35)**	0.067	(3.18)**
1997	0.035	(2.71)**	0.034	(1.57)
1998	0.047	(3.62)**	0.073	(3.43)**
1999	0.043	(3.28)**	0.051	(2.35)*
2000	0.061	(4.62)**	0.038	(1.75)
2001	0.061	(4.61)**	0.044	(2.06)*
2002	0.070	(4.98)**	0.062	(2.77)**
2003	0.118	(8.29)**	0.104	(4.74)**
Easterner 1992	-0.689	(40.58)**	-0.580	(26.08)**
Easterner 1993	-0.580	(33.63)**	-0.422	(18.03)**
Easterner 1994	-0.496	(29.34)**	-0.340	(14.28)**
Easterner 1995	-0.457	(26.76)**	-0.293	(11.68)**
Easterner 1996	-0.438	(24.80)**	-0.254	(10.24)**
Easterner 1997	-0.418	(23.26)**	-0.245	(9.06)**
Easterner 1998	-0.426	(22.83)**	-0.241	(9.55)**
Easterner 1999	-0.398	(20.59)**	-0.221	(8.44)**
Easterner 2000	-0.432	(24.71)**	-0.228	(9.07)**
Easterner 2001	-0.435	(24.01)**	-0.234	(9.42)**
Easterner 2002	-0.419	(20.58)**	-0.240	(9.26)**
Easterner 2003	-0.433	(20.39)**	-0.269	(9.91)**
Constant	2.087	(40.26)**	1.997	(25.40)**
R-squared	.440		.334	
Number of Observations	20,415		10,227	

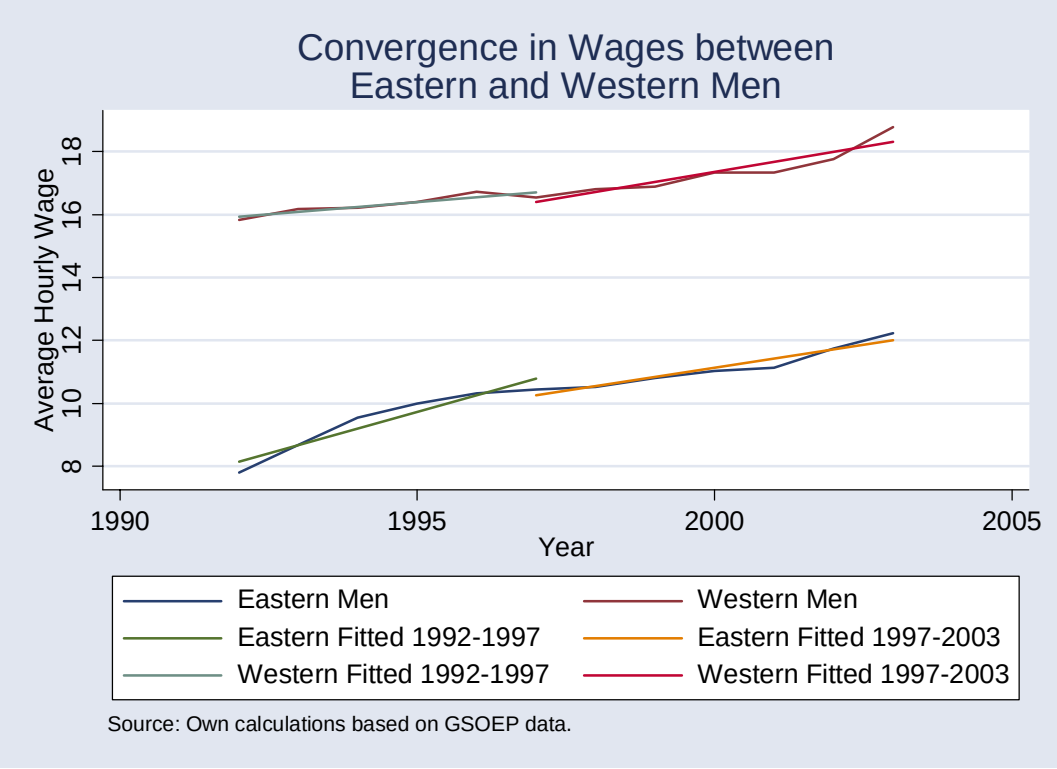
Notes. The dependent variable is the natural log of hourly wages between 1992 and 2003. Also see the notes to Table 9.

Graph 3. Convergence in Wages between Eastern and Western Women.



Source: Own calculations based on GSOEP data.

Graph 4. Convergence in Wages between Eastern and Western Men.



Source: Own calculations based on GSOEP data.

VI. Conclusions

It is reasonable to have expected returns to education to increase in eastern Germany following unification, as similar changes have been observed in a number of other transitional economies (Munich, Svejnar & Terell, 2002; Chase, 1997). Starting with Houthakker (1959) and Schultz (1961), several studies have exhibited the significant impact education has on an individual's earnings in a free-market economy.[7] Bird, Schwarze, and Wagner (1994) showed returns to work experience with the GDR had insignificant effects on eastern wages between 1989 and 1991 but education obtained during the socialist time period did have a slight positive impact on wage. This study uses the same data (plus more recent waves). There is little research on German returns to education between 1991 and 2003. The results of the paper fill in this gap and support the results of studies of returns to education in other transitional economies. Findings support the expectation that rates of return to education in the eastern states have moved closer to western levels with the extension of the western education system to the eastern states.

Next, this study examines the convergence of unemployment rates between genders in the eastern and the western states. It appears this has gone through two periods: 1992 until 1995 and 1995 until 2003 (see Graphs 1 and 2). As expected, in the first period, unemployment unambiguously rose in the eastern states, while western states witnessed no drastic changes. In the next period, unemployment fell for women but increased for men. This is related to an increase in real wages at a pace too rapid to sustain. The reason for this increase in real wages was to slow the westward migration that occurred after the fall of the Berlin Wall.

[7] For a review of more recent studies, see Blundell, Dearden, Meghir, & Sianesi (1999); Brunello and Comi (2000); Ammermüller, Kuckulenz, Lauer, and Zwick (2005).

Lastly, this paper investigates the convergence of eastern wages to western standards separately for women and men. Burda and Wyplosz (1992) explain that an initial wage increase would be expected to abate massive westward migration in the years following unification. Their study suggested wages would rise to an equilibrium, where migration would decrease to nominal levels. I find wages do rise quickly until 1997, at which time they appear to be at some sort of a steady state. I also find wages for women are rising at a faster pace than wages for men. In conjunction with falling unemployment rates for women, further research is needed to analyze trends in women's labor market participation. This study also suggests that there has not been much movement from the steady state, which began in 1997. It was about this time when transfers from the western states ended, and aid programs were finished. The problem is that the western firms purchased eastern firms during the privatization period. This has made it difficult for the eastern economy to be self-sustaining at levels on par with the western states.

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