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# Changes in Occupational Demand Structure and their Impact on Individual Wages

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# Changes in Occupational Demand Structure and their Impact on Individual Wages

by

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## Abstract

This paper estimates wage losses arising due to changes in the structure of demand for occupations. The data on occupational changes made for the sake of adjustment to the changes in the demand structure come from the German reunification of 1990. Endogenous occupational changes are instrumented by the post-reunification demand properties of the occupation of the apprenticeship completed in the GDR. The IV computation reveals a negative wage effect of nearly 35 log points in 1991/92. This effect is persistent over time: after almost 10 years after reunification the negative wage effect associated with occupational changes due to the relocation of individual human capital across occupations is more than 20 log points.

JEL-Classification: J24, J62, I21, P21.

Keywords: Human capital, wage premium, occupational change, natural experiment.

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# 1 Introduction

An occupational change is a usual phenomenon of a modern economy. E.g. [Miller \(1984\)](#) and [Witte and Kalleberg \(1995\)](#) claim that a successful career planning is unthinkable without one or several occupational changes. Compared to a job change, an occupational change is related to more risks, such as substantial losses of occupation-specific human capital (see e.g. [Kambourov and Manovskii, 2007](#)). Thus, under stable economic conditions an occupational change is likely to occur when a potential improvement of wage profile can be anticipated beforehand. Moreover, estimated changes in individual wages associated with an occupational change are upward biased due to the selectivity of the group of occupational movers. In the current paper I propose an instrument to solve the endogeneity problem of occupational changes that is based on the evidence from German reunification of 1990. The unification of East and West Germany was an unprecedented phenomenon that has constituted an enormous challenge for both political and economic systems. The fall of the Berlin Wall is a symbol for the failure of the socialist society that has triggered a comprehensive process of democratization and integration of East Germany to West-German economy. The new economic conditions brought by “the wind of change” have started the process of multidimensional adjustments of employment, wage and occupational structure.<sup>1</sup> The lessons of German reunification are interesting not only as an example of a transition from planned to market economy. It also constitutes a unique example to study how a fundamental shock to the occupational structure influences individual wages and how long can a “recovery” from the shock last. Thus, the phenomenon of reunification offers a challenging experimental environment which is especially attractive for empirical studies.

The research question of the current paper is the wage effects of occupational changes of East Germans after reunification. In a socialist system of the GDR, the decisions about the occupational structure were integrated into the overall state planning process. Thus, the formation of individual preferences were to some extent state-assisted, or at least not totally voluntary in the common economic sense. After 1990, the West-German institutions were transferred to the East-German labor market. Moreover, there was a wave of firm closures in East Germany due to their low or negative profitability. Generally, the integration process demanded reallocation of resources, including the overall adjustment of occupational structure accompanied by a migration wave to West Germany.<sup>2</sup> Under such critical economic conditions and permanent threat of unemployment, many occupational changes were superimposed by the overall changes in the occupational structure of the East-German economy. Thus, even if the data does not contain enough information to clearly identify these occupational changes as voluntary or involuntary, they can be at least qualified as imposed. Such an occupational change can theoretically still lead to better wage perspective or to an improvement of non-pecuniary aspects of the job – e.g. working time, overall flexibility, job stability, intrinsic motivation etc.

Occupational changes that are imposed by the labor market conditions rather than by a strategic career planning may result in higher wage penalties. Under stable economic conditions, most occupational changes occur in the beginning of the professional career and cause the highest wage growth, since young workers face lower costs of unemployment or non-employment

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<sup>1</sup>A detailed documentation of the transition process in East Germany can be found in [Akerlof et al. \(1991\)](#), [Sinn and Sinn \(1992\)](#) and [Burda \(2006\)](#). The evolution of wage and efficiency wages in particular was analyzed by [Akerlof et al. \(1991\)](#), [Topel and Ward \(1992\)](#), [Burda and Hunt \(2001\)](#), [Riphahn et al. \(2001\)](#).

<sup>2</sup>The migration studies by [Akerlof et al. \(1991\)](#) and, in particular, [Burda and Hunt \(2001\)](#) also show that the migrants to West Germany exhibit positive selectivity with respect to their labor market characteristics.

when changing job or occupation.<sup>3</sup> This also implies that an older worker may change the occupation being forced by economic conditions and take higher wage losses into account in order to avoid unemployment. From the standpoint of the human capital theory, occupational changes that occur later in the working life are associated with higher human capital losses. The massive wave of the occupational changes after reunification in Germany has influenced all age groups, meaning that a high proportion of the human capital accumulated in the East-German society was not used under the new economic conditions. The question is then whether the new economic perspectives in East Germany were good enough to overweight the average negative wage impacts of sudden career breaks.

For the analysis I employ the data from the German Qualification and Career Survey (QCS) to address the wage loss of male medium-skilled workers in East Germany due to occupational changes. In order to identify the causal effect on wages I use the properties of the post-reunification demand for the occupation of the first apprenticeship completed in the GDR as an instrument for an occupational change. The analysis is conducted for the two subsequent waves of the QCS – 1991/92 and 1998/99. When running a wage regression using OLS, an occupational change is associated with 9% lower wages in 1991/92, and less than 4% lower wages in 1998/99. However, the IV estimation shows that an occupational change produces a significantly more negative effect on wages – more than 35 log points in 1991/92. Surprisingly, this effect does not disappear over time due to upswing of the East-German economy. Even by 1998/99 the negative effect on wages amounts to more than 20 log points. Such negative results may be explained by high selectivity of the group of the occupational changers in East Germany, but it also shows that the shifts in the demand for occupacionals stemming from a fundamental reallocation of human capital cannot be easily compensated for.

Post-unification occupational mobility in East Germany is an underexplored research field, although reunification of Germany constitutes a unique experiment of transformation of legislation and institutions. One of the rare studies on labor mobility using post-reunification changes in legislation is provided by [Prantl and Spitz-Oener \(2009\)](#). The authors look at the changes in entry regulations into self-employment to address the negative effect of regulations on occupational mobility. [Hunt \(2001\)](#) evaluates the evolution of post-unification wages in East Germany with respect to the voluntary/involuntary *job* changes as well as migration to the West. She documents an insignificant effect of an involuntary job change on the wages of East Germans, whereas both voluntary changes and moves to the West make the employees better off. However, consequences of an *occupational* change can have a more striking effect on wages than those of a job change, as the theoretical model of [Neal \(1999\)](#) predicts.

To my knowledge there were no causal empirical studies focusing on the magnitude and persistence of the wage effect due to changes in labor demand for particular occupational groups. The methodological novelty of the analysis presented here lies in the application of the post-transition *demand* properties for the occupation of apprenticeship obtained under the regime of planned economy as an instrument for the individual decision to change the occupation after reunification, i.e. to adjust the individual labor *supply*. Until now, the positive causal effect of a *voluntary* occupational change on individual wages was estimated using instruments such as military service, firm closures, newly emerged occupations, apprenticeship in industry/artisanry (see [Acemoglu and Pischke, 1998](#); [Fitzenberger and Spitz, 2004](#)). My paper contributes to the evidence on imposed occupational changes in a experimental research

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<sup>3</sup>See [Johnson \(1978\)](#), [McCall \(1990\)](#) for underlying theories and [Topel and Ward \(1992\)](#), [Neal \(1999\)](#) for supporting empirical arguments. The most similar study in terms of data and estimation design is [Fedorets \(2011\)](#); it also finds higher occupational mobility rates among the young.

design of a transition economy. It highlights the negative consequences of the shock in the occupational structure and addresses the time to overcome them.

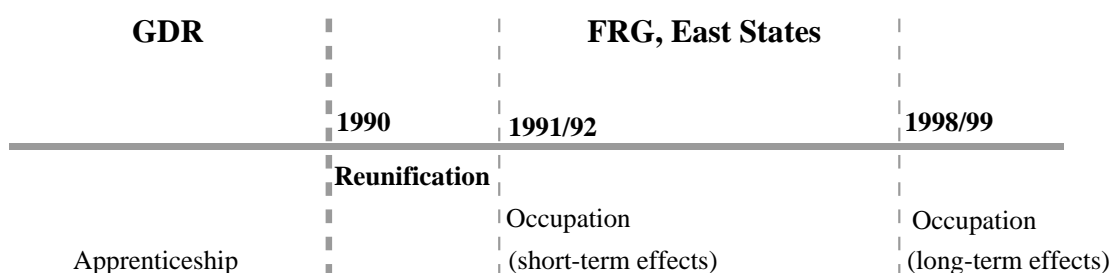
The paper begins with a brief introduction of the data set in Section 2. Section 3 contains the description of the identification strategy and the sample restrictions that contribute to the relative homogeneity of the analyzed sample. Section 4 describes the main variables of the wage regression. Section 5 contains the results of the regression analysis. Section 6 concludes.

## 2 Data

The empirical analysis employs the German Qualification and Career Survey (QCS). The survey is carried out by the Federal Institute for Vocational Education and Training (BiBB) together with the Institute for Employment Research (IAB). The questionnaire contains a large block of questions on education with the particular focus on vocational training, which makes the survey especially suitable for studies of the middle-skilled workers. Although QCS does not have a panel structure, information about the labor market history of the respondents can be obtained from the retrospective questions on education and employment history. For this study it is important that the survey contains information on occupations of the apprenticeship and the current employment as well as the year of graduation from the apprenticeship.

In order to study the consequences of occupational changes in East Germany after reunification in 1990, the waves of 1991/92 and 1998/99 are used. The sample of male East-Germans is restricted to those who completed their first apprenticeship before reunification, and were employed in the survey year. Thus, the result of 1991/92 will reveal short-time effects of an occupational change, whereas 1998/99 is used to obtain results on long-term effects. The rough scheme of the estimation idea is sketched in figure 1. Unfortunately, the next available QCS wave of 2005/06 does not contain any employees with the first apprenticeship obtained in the GDR after necessary sample restrictions.

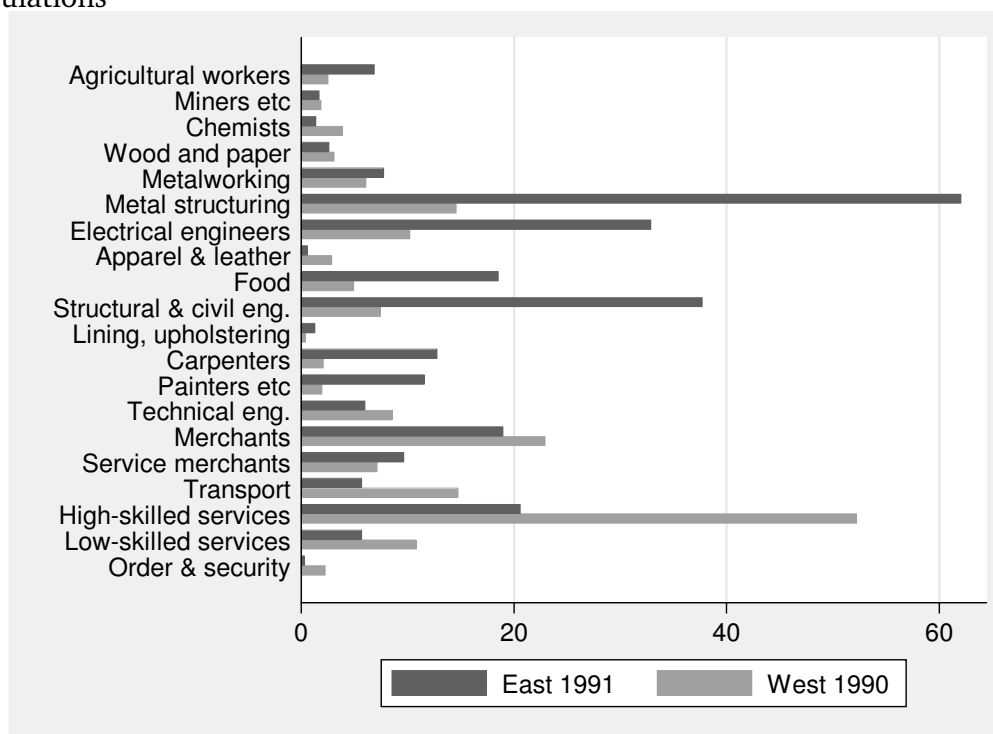
Figure 1: Schematic Representation of the Estimation Idea



## 3 Sample Restriction and Identification Strategy

As mentioned before, the current study focuses on the occupational mobility of East Germans after reunification, i.e. the analyzed sample contains only East Germans with the first apprenticeship completed in the GDR (before 1990), and who are employed in the respective survey year. I also exclude occupational movers whose tenure with current employer is too

Figure 2: Structure of the Apprenticeships Obtained before 1990 in the GDR and West-German Occupational Structure in 1990. Source: Official Statistics of the Federal Employment Office, own calculations



long, so that their occupational change is less likely to be associated with reunification.<sup>4</sup> The sample was further restricted to full-time workers of prime age (20-55) employed in so-called recognized occupations with vocational training as the highest level of completed education. This ensures rather homogenous preferences, career chances and, hence, labor market behavior of the respondents in the sample.

The phenomenon of German reunification provides a unique experimental environment for the studies on occupational changes. However, it should be mentioned, that many East Germans have not only seized the occasion for occupational mobility, they also took advantage of the newly obtained geographic mobility and moved to West Germany (Burda and Hunt, 2001). Although it results in the loss of variation, I exclude all the respondents who have moved from East to West Germany after reunification since their preference structure essentially differs from those of the “stayers” which is associated with additional channels through which initial occupation of apprenticeship may affect the decision of an occupational change and, thus, individual wages.<sup>5</sup> Furthermore, the decision to move to West Germany, as well as the decision to change the occupation, is endogenous. This means that keeping both “migrants” and “non-migrants” would require an estimation strategy that can clearly disentangle the decisions to migrate and to change the occupation, which would set a grand challenge to the available data. Thus, the suggested estimation strategy takes account only of occupational changes for the East-German employees with vocational training degree who stay in East Germany.

The theoretical models on the post-unification resource reallocation (e.g., Burda, 2006) as

<sup>4</sup>Relaxing this restriction does not change the results much. However, for the clarity of the identification strategy I prefer to keep tenure with current employer restricted.

<sup>5</sup>Main descriptive statistics for the group of migrants from East to West can be found in appendix B.

well as sociological and economic studies on transition processes (Mayer et al., 1999; Sinn and Sinn, 1992) imply that in the adjustment process of the occupational structure of the GDR after reunification, the initial occupation of the employee should have played a crucial role in his decision to change the occupation. Following the classical idea of Angrist and Krueger (2001), the properties of the newly emerged *demand* for occupational groups can be used to instrument for the decision about an occupational change that is met on the labor *supply* side.

Indeed, when roughly comparing the distribution of occupations in West Germany in 1990 and the distribution of apprenticeship qualifications obtained in the GDR before 1990 across 20 broad occupational categories (figure 2), it becomes apparent that the occupational structures of the two economies were significantly different. Thus, the structure of labor supply in East Germany did not match the distribution over occupations in West Germany. The evidence from the following years illustrates that East-German economy was to the most extent the one that had to adjust to the new demand structure (see, e.g. Sinn and Sinn, 1992; Burda and Hunt, 2001).

Under the new economic conditions some occupations become underdemanded or even disappear, which initiates the flows from the underdemanded occupations into the non-employment, unemployment and employment in other occupations. Due to the data quality, I will further focus on the transitions to employment. To instrument the endogenous decision of an occupational change, I will use the post-reunification demand properties for the occupational group, in which the individual has obtained his apprenticeship in the GDR. In particular, the first instrumental variable is the size of the respective occupational group in West Germany in 1990; and the second instrument is the occupation-specific unemployment rate in East Germany in 1993.<sup>6</sup> The underlying mechanism of how the instrument should influence individual wages through the decision to change occupation after reunification can be described as follows. After reunification the occupational structure of East Germany has experienced dramatical changes, which led to high unemployment rates in some occupational groups (see figure 3). The demand for different occupational groups has adjusted according to the West-German occupational structure. Moreover, individuals could form new expectations of what perspectives their occupation of apprenticeship from the GDR have, based on the size of the respective occupational group in West Germany. In the subsection presenting the descriptive statistics it will be shown that having an apprenticeship in some particular occupational groups constitutes the main difference between the subsamples of occupational “movers” and “stayers”. As figures 4 and 5 in appendix A show, “movers” are overrepresented among agricultural workers, metalworking and metalstructuring occupations, as well as transportation. On the contrary, “stayers” are overrepresented among electrical, civil and structuring engineers, painters and food occupations. This evidence is also supported by the literature that documents the transition process and construction boom in East Germany on the whole (Sinn and Sinn, 1992; Burda and Hunt, 2001). Interestingly, mean wages within respective occupations in West Germany failed as an instrument. This support the hypothesis that the massive wave of occupational changes was driven not by rent-seeking under new economic conditions, but rather by the search of employment in order to escape from unemployment.

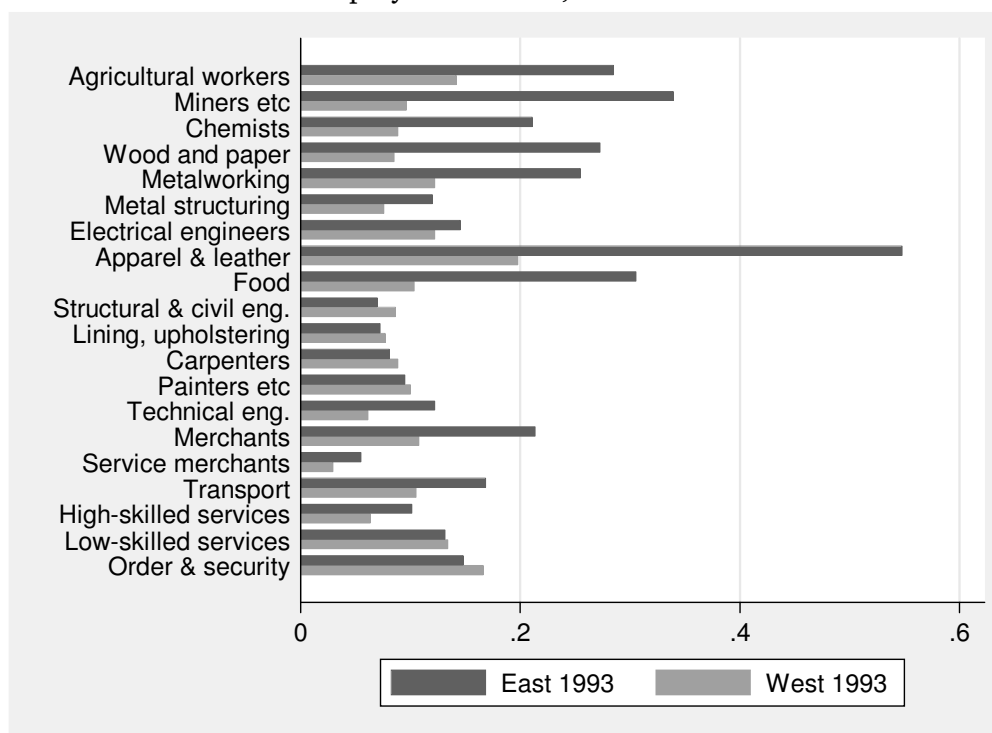
Thus, the initial occupation of the individuum may be used to instrument for an occupational change, if several conditions are fulfilled. First of all, the initial assignment of occupations in the GDR should be uncorrelated with the error term. Secondly, only the demand for the initial

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<sup>6</sup>Due to the gap in statistical provision after reunification, 1993 is the first year with reliable and comparable unemployment statistics in East Germany.



Figure 3: Occupation-Specific Unemployment Rates, East and West Germany, 1993. Source: Official Statistics of the Federal Employment Office, own calculations



occupation influences the decision to change the occupation after reunification.

The crucial point in the discussion of the apprenticeship occupation as a valid instrument for an occupational change depends on the economic and political system of the GDR.<sup>7</sup> The German Democratic Republic was a socialist state established in the Soviet occupation zone after World War II. Under the political regime of socialism, the state directs the economy by setting up exact plans not only for the production and distribution of goods and services, but also for the allocation of available resources. Thus, the process of decision making is generally under control of a central planner, not single individuals. In contrast to the market economy, the social planner is responsible for forecasting future needs in particular occupations with respect to production and to guarantee that the youngsters choose the occupations that will fulfill the future plans. Although the occupational choice cannot be said to be completely involuntary, there existed various mechanisms that made the occupational choice far from voluntary in terms of Western economies.<sup>8</sup> The state started to influence the preferences of the youth for particular occupations very early. Already at school there existed occupational orientation, which was designed to direct the students' interest to particular occupations. The direct choice of the apprenticeship after school was restricted by existing quotas for the apprenticeship places in each occupation. Moreover, the chance to get a place in the occupation of particular interest was dependent on the family background and – to some extent – by the gender of the applicant. The important underlying reason for the distribution of the quotas was the policy of creating equal opportunities for men and women, as well for the working-class children.<sup>9</sup>

<sup>7</sup>For reference see e.g. Schmitt (1975).

<sup>8</sup>More arguments supporting the restricted voluntariness of the occupational choice in the GDR can be found in Uthmann (1991), Ulrich et al. (1991), Trappe and Rosenfeld (1998) and Solga and Konietzka (1999).

<sup>9</sup>For reference see, e.g. Trappe and Rosenfeld (1998) and Miethe (2007).



Moreover, the idea of full employment and related “anti-parasite” laws made it possible to coerce those secondary school graduates who did not enter any apprenticeship after a year since graduation into any occupation chosen by the local officials. Afterwards, occupational mobility was not desirable since a human capital reallocation would destroy at least some of the previous investments in training, which results in losses for the society (Huinink et al., 1995). Thus, the occupational mobility I observe in the data is very likely to be associated with the reunification-related adjustments.

The planned economy created in East Germany a unique experimental environment to study the resource allocation under restricted individual decision power. For research reasons it is also crucial that reunification of East and West Germany was not foreseeable; the political turn that caused the opening of the border came suddenly in 1989 and formal reunification of the two states was carried out within several months. Thus, the employees of the GDR did not generally sense the soon reunification, could not foresee the possible reallocation of the labor force and take any action in changing the occupation to the one that could become more promising in the unified Germany. Moreover, due to the fact that apprenticeships last several years, the choice of the apprenticeship group in the GDR was certainly not affected by the post-reunification changes.

Some additional words should be said in regard to the vocational training systems in the GDR and FRG and the recognition of the apprenticeship qualifications achieved in the GDR. The dual apprenticeship system is the dominating form of vocational training in Germany.<sup>10</sup> Its tradition roots in the middle ages and the formation of the system dates back to the 19th century, although the formal institutions were established in the 1960s.<sup>11</sup> Thus, the whole structure of the system is highly institutionalized in the economy and society, so that many researchers agree that it would be impossible to transfer the West-German dual apprenticeship system to other countries.<sup>12</sup> Even if the similarity of the apprenticeship system in the GDR and FRG cannot be conceded without sound scepticism, some essential facts besides the long pre-partition history speak for the general similarity of the apprenticeship systems.<sup>13</sup> First of all, the basic structure of the apprenticeship system in the GDR was overtaken by the FRG after reunification without deep institutional transformations.<sup>14</sup> The apprenticeship graduation certificates obtained in the GDR were accepted in the FRG by the Unification Treaty, Article 37.<sup>15</sup> The sample is wittingly restricted to the employees with jobs in the so-called recognized occupations, which are the most traditional and well-established occupations.

The introduced instrument picks up on the falling demand for particular occupational groups due to post-reunification economics adjustment. The main threat to the described identification strategy would be, if the underdemanded occupations were already on decline in the pre-reunification period. However, the statistical evidence points at a stable occupational structure in the GDR (see e.g. Ulrich et al., 1991).

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<sup>10</sup>For the detailed description of the dual apprenticeship system and its history see e.g. Timmermann (1993), Witte and Kalleberg (1995), Münch (1995) and Franz and Soskice (1995).

<sup>11</sup>See e.g. Mitter (1990), Bundesinstitut für Berufsbildung (2006).

<sup>12</sup>See e.g. Timmermann (1993), den Broeder (1995), Harhoff and Kane (1997), Korpi and Mertens (2003), Sharpe and Gibson (2005).

<sup>13</sup>Some information on challenges to the educational system after reunification may be found in Mitter (1992).

<sup>14</sup>Consult Ertl (2000) for the detailed information on the underlying legislation process, as well as the arguments for the similarity of the two systems. The transformation of qualifications after reunification is also discussed by Mayer et al. (1997).

<sup>15</sup>Moreover, Bonin and Zimmermann (2001) mention the high level of formal qualification of East-German workers.

## 4 Descriptive Statistics

Under the restrictions described above, 565 observations for 1991/92 and 625 observations for 1998/99 remain in the sample. Although the sample size is quite moderate, it is still possible to identify significant and robust tendencies concerning the average wage effect of an occupational change.

Table 1 shows the means of the variables for the subsamples of occupational movers and stayers both 1991/92 and 1998/99. Statistically, the t-tests show that the means of all variables for the two subsamples are same. However, the real log hourly wages for the occupation movers in 1991/92 is lower in comparison to the stayers; the difference in average log wages becomes even lower by 1998/99. The average tenure with current employers of occupational movers in 1991/92 is by 0.7 months higher those of the stayers, whereas in 1998/99 it is nearly 5 months lower. Accordingly, the overall average number of employers is somewhat higher for the occupational movers than for the stayers.

Moreover, occupational movers in 1991/92 are slightly older than the stayers. This difference becomes negligible by 1998/99. Occupational movers tend to be higher qualified than the stayers, since they more often have a foreman certificate in their occupations. Both variables indicate that movers have more labor market experience and are likely to be on average more qualified than stayers, which implies positive selectivity of the movers. Consequently, I expect the OLS estimates of the association between individual wages and occupational change to be upward biased.

The distribution by the firm size and the state of residence (Bundesland) of those who have changed the occupation does not significantly differ from those of the occupational stayers in the sample.

The next block of table 1 presents the distributions of the apprenticeships obtained in the GDR over the occupational groups.<sup>16</sup> Although the sample size allows us to make only rough observations on the outflows from particular occupations, it is apparent that e.g. technical engineers, agricultural and metal structuring occupations have experienced more occupational changes, whereas for electricians, nutrition occupations, construction occupations, painters and varnishers occupational changes were less common.

Measured using the 2-digit occupational codes,<sup>17</sup> nearly 55% of the employees in the sample have changed the occupation by 1991/92. The fraction of the occupational movers has risen by 1998/99 only by additional 2 percentage points. According to own computations in Fedorets (2011), respective numbers for West Germany during the same period were nearly 15 percentage points lower in both 1991/92 and 1998/99. The mobility rates at a 3-digit level are respectively higher – 57% in 1991/92 and 62% in 1998/99 (see table 7 in appendix C). This high levels of mobility are very likely to be directly associated with reunification. The fact that most occupational changes took place a short time after reunification is in line with the findings of Hunt (2001) on *job* changes associated with the German reunification. Occupational mobility before reunification was unlikely due to its undesirability in the planned economy.

In total, the descriptive statistics show that the most tremendous differences between the subsamples of the occupational movers and stayers are associated with the occupational group of the apprenticeship.

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<sup>16</sup>A graphical illustration of the distribution of stayers and movers across broad occupational groups can be found in appendix A, figures 4 and 5.

<sup>17</sup>Based on the German KldB occupational classification in the version of 1988.

Table 1: Descriptive Statistic for the Samples of 1991/92  
and 1998/99

	1991/92		1998/99	
	Stayers (1)	Movers (2)	Stayers (3)	Movers (4)
N	257	308	267	358
Proportion of stayers and movers (2-digit level)	45.5%	54.5%	42.7%	57.3%
<i>Individual characteristics</i>				
Log real hourly wages	1.700 (0.372)	1.614 (0.351)	1.929 (0.298)	1.886 (0.356)
Age	32.61 (8.528)	35.80 (9.153)	38.94 (7.455)	38.87 (7.772)
Tenure, curr. employer	2.132 (1.148)	2.195 (1.167)	6.468 (3.067)	6.070 (2.981)
Number of employers	2.630 (0.952)	2.815 (0.956)	2.839 (0.962)	3.148 (0.845)
Foreman certificate	0.0973 (0.297)	0.153 (0.360)	0.116 (0.321)	0.140 (0.347)
<i>Distribution of workers across firms (column total=1)</i>				
Less than 5 employees	0.073	0.090	0.056	0.081
5 to 9 employees	0.195	0.136	0.206	0.145
10 to 49 employees	0.339	0.325	0.502	0.416
50 to 99 employees	0.148	0.140	0.105	0.137
100 to 499 employees	0.167	0.179	0.105	0.156
500 to 1000 employees	0.035	0.042	0.015	0.017
More than 1000	0.043	0.088	0.011	0.048
<i>Distribution of workers across federal states (Bundesland, column total=1)</i>				
East Berlin	0.109	0.082	0.097	0.082
Brandenburg	0.070	0.097	0.154	0.176
Mecklenburg-Vorpommern	0.187	0.156	0.112	0.103
Saxony	0.222	0.172	0.356	0.282
Saxony-Anhalt	0.163	0.201	0.176	0.201
Thuringia	0.249	0.292	0.105	0.156
<i>Distribution across the occupational groups of the apprenticeship (column total =1)</i>				
Agricultural occupations	0.028	0.055	0.010	0.096
Mining, mineral winning, stonery, material production	0.012	0.016	0.004	0.014
Chemical industry		0.013	0.004	
Wood and paper manufacturing, converting, printing	0.004	0.016	0.004	0.008
Metalworking occupations	0.012	0.117	0.030	0.076
Metal-structuring, engineering	0.156	0.331	0.187	0.310
Electrical engineering	0.195	0.084	0.221	0.085
Apparel industry, leather production and processing	0.004	0.006		0.009
Food industry	0.082	0.020	0.038	0.048
Structural and civil engineering	0.323	0.166	0.326	0.183
Lining, upholstering	0.020		0.015	

Carpenters	0.031	0.033	0.041	0.039
Painters, varnishers	0.066	0.026	0.071	0.017
Technical engineers	0.008	0.010	0.004	0.020
Merchants	0.008	0.003		0.008
Transport occupations	0.035	0.081	0.034	0.065
Organization, administration, high-skilled professionals	0.008	0.010		0.011
Cleaning, low-skilled healthcare services	0.004	0.013	0.007	0.008
Occupations of order and security	0.004		0.004	0.003

## 5 Econometric Model and Estimation Results

The estimation of the correlation between an occupational change and individual wages was performed separately for the two subsequent survey waves of 1991/92 and 1998/99:

$$\ln w_t = \alpha_t + \beta_t \cdot \text{Occ. change}_t + \gamma_t \cdot X_t + \epsilon_t, \quad t = 1991/92, 1998/99. \quad (1)$$

The main variable of interest is occupational change. The vector  $X$  contains such variables as tenure with the current employer, dummy for having a foreman certificate, age and age squared. Moreover, it includes the sets of dummies for the firm size and state of residence (Bundesland). The first stage for the 2SLS estimation is the following probit regression with  $\bar{L}_{1990,j}^W$  denoting the size (in thousands) of the respective 3-digit occupational group in West Germany in 1990 and  $u_{1993,j}^E$  denoting the 2-digit occupation-specific unemployment rate in East Germany in 1993.<sup>18</sup>

$$\text{Occ. change}_t = \alpha'_t + \beta'_t \cdot \bar{L}_{1990,j}^W + \beta''_t \cdot u_{1993,j}^E + \gamma'_t \cdot X_t + \epsilon'_t, \quad t = 1991/92, 1998/99. \quad (2)$$

Table 2 presents both OLS and IV estimation results for 1991/92 in three specifications. The first one (see columns (1) and (4)) is a “bare bones” specification that contains only exogenous variables, whereas the specification in columns (2) and (5) is extended by the common covariates listed above. The specification in columns (3) and (6) also contains broad 1-digit occupational groups of the current employment and is included in order to capture group-specific wage developments. The following table 3 displays the coefficients of the first stage IV regression estimation for 1991/92. Similarly, tables 4 and 5 contain the respective results for 1998/99.

The first part of the estimation was performed using OLS. This revealed negative correlation between occupational change and wages. The estimates in table 2 indicate about 9% lower wages for those who have change the occupational up to 1991/92. This number falls to insignificant 4% or less to 1998/99, see table 4. The negative sign of these coefficients points at forced character of occupational mobility.

<sup>18</sup>Unfortunately, reliable data on occupation-specific unemployment rates in East Germany are not available until 1993. So, I use the earliest existent post-reunification data on unemployment as a proxy.

Table 2: Comparison of the Coefficients for OLS and IV Estimations in East Germany in 1991/92,  $N = 565$

Dependent variable:	OLS			IV		
ln wages	(1)	(2)	(3)	(4)	(5)	(6)
Occ. change 2-dig	-0.099*** (0.001)	-0.094*** (0.001)	-0.072** (0.040)	-0.396*** (0.004)	-0.349*** (0.005)	-0.358** (0.027)
Age	0.044*** (0.001)	0.039*** (0.001)	0.039*** (0.001)	0.049*** (0.000)	0.045*** (0.000)	0.043*** (0.001)
Age squared	-0.001*** (0.001)	-0.001*** (0.002)	-0.001*** (0.002)	-0.001*** (0.001)	-0.001*** (0.001)	-0.001*** (0.001)
Tenure, curr. employer		0.001 (0.924)	0.003 (0.838)		0.006 (0.676)	0.005 (0.723)
Foreman certificate		0.055 (0.224)	0.049 (0.281)		0.066 (0.166)	0.055 (0.246)
Firm size		Yes	Yes		Yes	Yes
Bundesland		Yes	Yes		Yes	Yes
Occ. groups			Yes			Yes
Constant	0.898***	0.890***	0.639***	0.922***	0.871***	0.689***
Adjusted $R^2$	0.034	0.169	0.180			
Angrist-Pischke (F-stat)				34.44	34.86	28.40
Sargan Test (p-value)				0.472	0.992	0.932

Standard errors in parentheses; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 3: First Stage of the IV Estimations in 1991/92

Dependent var: Occ. change (2-digit)	(4-fs)	(5-fs)	(6-fs)
Size of occ. group, West, in thousands	-0.001*** (0.004)	-0.001*** (0.003)	-0.001*** (0.001)
Unemployment rate in occ. group, East	2.828*** (0.000)	2.922*** (0.000)	2.480*** (0.004)
Age	0.044 (0.341)	0.064 (0.183)	0.045 (0.418)
Age squared	-0.000 (0.701)	-0.000 (0.455)	-0.000 (0.566)
Tenure, curr. employer		0.043 (0.395)	0.012 (0.834)
Foreman certificate		0.062 (0.736)	-0.050 (0.824)
Firm size		Yes	Yes
Bundesland		Yes	Yes
Occ. groups			Yes
Constant	-1.242	-1.753*	-1.545
Pseudo $R^2$	0.068	0.094	0.350

Standard errors in parentheses; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 4: Comparison of the Coefficients for OLS and IV Estimations in East Germany in 1998/99,  $N = 625$

Dependent variable:	OLS			IV		
ln wages	(1')	(2')	(3')	(4')	(5')	(6')
Occ. change 2-dig	-0.043 (0.114)	-0.044* (0.089)	-0.013 (0.681)	-0.271*** (0.003)	-0.257*** (0.002)	-0.219 (0.136)
Age	-0.003 (0.877)	-0.007 (0.691)	-0.010 (0.558)	-0.010 (0.623)	-0.013 (0.472)	-0.012 (0.490)
Age squared	0.000 (0.891)	0.000 (0.741)	0.000 (0.574)	0.000 (0.636)	0.000 (0.514)	0.000 (0.499)
Tenure, curr. employer		0.023*** (0.000)	0.025*** (0.000)		0.020*** (0.000)	0.021*** (0.000)
Foreman certificate		0.062* (0.098)	0.059 (0.120)		0.068* (0.084)	0.044 (0.263)
Firm size		Yes	Yes		Yes	Yes
Bundesland		Yes	Yes		Yes	Yes
Occ. groups			Yes			Yes
Constant	1.991***	1.776***	1.629***	2.255***	2.042***	1.844***
Adjusted $R^2$	-0.001	0.141	0.171			
Angrist-Pischke (F-stat)				68.39	68.50	28.77
Sargan test (p-value)				0.345	0.920	0.229

Standard errors in parentheses; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 5: First Stage of the IV Estimations in 1998/99

Dependent var: Occ. change (2-digit)	(4'-fs)	(5'-fs)	(6'-fs)
Size of occ. group, West, in thousands	-0.001** (0.020)	-0.001** (0.010)	-0.001 (0.158)
Unemployment rate in occ. group, East	4.931*** (0.000)	4.668*** (0.000)	3.027*** (0.001)
Age	-0.075 (0.301)	-0.076 (0.311)	-0.033 (0.705)
Age squared	0.001 (0.305)	0.001 (0.315)	0.000 (0.671)
Tenure, curr. employer		-0.030* (0.095)	-0.074*** (0.001)
Foreman certificate		0.080 (0.617)	-0.273 (0.180)
Firm size		Yes	Yes
Bundesland		Yes	Yes
Occ. groups			Yes
Constant	1.158	1.390	1.277
Pseudo $R^2$	0.077	0.110	0.361

Standard errors in parentheses; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

The first-stage estimations confirm that the occupation of the apprenticeship plays a significant role in the post-reunification individual decisions to change the occupations. The East-German occupation-specific unemployment rate is positively correlated with the decision to change occupation, which confirms that depressed economic conditions in an occupational group were likely to lead to an occupational change. The size of the respective West-German occupational group denotes the chances to find a new job in the old occupation, and is negatively correlated with occupational change, as expected. These general results of the first stage hold both for 1991/92 and 1998/99.

The IV estimation generally confirms the negative impact of an occupational change on wages both in 1991/92 and 1998/99. The F-statistics for the formal Angrist-Pischke test proves the validity of the applied instruments.<sup>19</sup> The Sargan test on the overidentifying restrictions does not reject that the instruments are uncorrelated with the error term. Similar coefficients for other controls in the OLS and IV regressions also confirm that the instrument affects through the channel associated with the occupational change imposed by the changes in the occupational structure.

Generally, the estimated IV coefficients for occupational change are much lower than their OLS counterparts, which indicates dramatic wage losses after accounting for sample selectivity. This supports the initial conjecture that imposed occupational changes in East Germany have led to severe interruptions in the individual wage profiles and have on average caused tremendous losses. Moreover, the coefficients imply positive selectivity of the group of occupational movers, which is in line with the theoretical and empirical findings on the selectivity of job and occupational changers (see e.g. [Hunt, 2001](#)).

Two years after reunification, in 1991/92, the negative effect of an occupational change amounts to more than 35 log points in all specifications. Although the OLS estimates indicate no significant wage losses in 1998/99, the IV estimates still point at significant negative effect of nearly 20 log points. These numbers show that the post-reunification fundamental changes of the occupational structure in East Germany can be evaluated as both tremendous and persistent.

It is important to mention that this tremendous wage cut is estimated in comparison to those who did not change the occupation. However, under economic transition non-employment and unemployment are more likely to be an alternative to an imposed occupational change. Thus, the wage cut following an occupational change is considered to be a more desirable alternative either in terms of pecuniary benefits, or because of a preference of employment. The latter is though characteristic to the socialist working morale, but it is hard to be quantitatively estimated in practice.

## 6 Conclusion

The aim of this analysis is to estimate the magnitude and the persistence of the individual wage effect associated with the adjustment of occupational structure to a negative demand shock. The employed data describes the overall adjustment of the occupational structure after reunification of 1990 in East Germany. The “wind of change” that has brought the political and economic freedom to East Germany is normally associated with the new chances that have opened for

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<sup>19</sup>The instruments were tested on their validity separately as well. In both estimations first-stage and second-stage estimates were similar, which points at the robustness of the results. F-statistics for the separate estimations are over 20.



East Germans. However, the overall economic evolution of the region in terms of wages and productivity is rather moderate, which is empirically well documented. Apart from the option of migration to West Germany, the question is what chances had middle-skilled employees under these new conditions? Reunification has caused broad reallocation of resources, including the adjustment of the occupational structure.

The wave of occupational changes from the occupations that were no longer demanded, has destroyed plenty of employee-occupation matches which has caused massive reallocation of human capital. Apart from the problematic of massive unemployment, application of early retirement schemes, emigration etc., the analysis presented in the current paper shows a significantly negative effect of an occupational change on wages. The IV estimation reports that an occupational change for middle-skilled employees has caused a wage loss of more than 35 log points in the short and one of more than 20 log points in the long run. The first stage estimation demonstrates that the decision to change occupation is positively correlated with the occupation-specific unemployment rate in East Germany, i.e. with the depression of the occupational group. At the same time, it is negatively correlated with the size of the respective occupational group in West Germany, i.e. with the chances to find a job in the initial occupation under the new demand structure. Interestingly, mean wages within occupation failed as an instrument. This evidence shows that the post-reunification wave of occupational changes was mainly driven by the search of employment in order to escape inactivity and not by rent-seeking motives.

Compared to a wage increase that accompanies an occupational change under stable economic conditions, my calculations show that a shock in the demand structure leads to a substantial wage decrease. Although the group of the occupational movers is positively selected, the wage decrease disappears very slowly. This illustrates the rigidity of occupation-specific human capital to fundamental adjustments and the persistence of the negative wage effect.

# A Distribution of Occupational Movers and Stayers across Broad Occupational Groups

Figure 4: Distribution of Movers and Stayers across Occupational Groups, 1991/92



Figure 5: Distribution of Movers and Stayers across Occupational Groups, 1998/99



## B Characteristics of Migrants from East to West in the QCS Data

Although the low number of observation does not allow to conduct a detailed analysis on the subsample of East Germans who has migrated to West Germany after reunification, it is informative to study the simple descriptive statistics of these subsamples (see table 6 below). On the whole the migrants from East to West have on average higher wages. Moreover, mean wages of migrants who have changed occupation is higher. Already this evidence points at the fact that migration to West Germany has allowed for strategic use of occupational changes as a career-boosting tool. Other characteristics of migrants are comparable with those of non-migrants.

Table 6: Descriptive Statistic for the Samples of Migrants in 1991/92 and 1998/99

	1991/92		1998/99	
	Migrants		Migrants	
	Stayers (1)	Movers (2)	Stayers (3)	Movers (4)
Log real hourly wages	2.070 (0.314)	2.195 (0.315)	2.131 (0.332)	2.163 (0.322)
Age	31.38 (9.032)	33.15 (9.121)	38.02 (7.760)	38.12 (7.875)
Tenure, curr. employer	2.475 (0.905)	2.385 (0.963)	7.442 (3.081)	6.515 (3.083)
Number of employers	2.725 (0.933)	3.000 (0.827)	2.977 (0.859)	3.147 (0.935)
Foreman certificate	0.025 (0.158)	0.128 (0.339)	0.070 (0.258)	0.132 (0.341)
N	62	60	54	77

## C Descriptive Statistics and Estimation Results for Occupational Changes at a 3-Digit Level

Table 7: Descriptive Statistic for the Samples of 1991/92 and 1998/99, Occupational Mobility at a 3-Digit Level

	1991/92		1998/99	
	Stayers (1)	Movers (2)	Stayers (3)	Movers (4)
N	232	333	240	385
Proportion of stayers and movers (3-digit level)	42.7%	57.3%	38.4%	61.6%
<i>Individual characteristics</i>				
Log real hourly wages	1.689 (0.368)	1.628 (0.358)	1.925 (0.298)	1.894 (0.354)
Age	32.61 (8.551)	35.56 (9.132)	38.88 (7.436)	38.96 (7.763)
Tenure, curr. employer	2.147 (1.138)	2.180 (1.173)	6.471 (3.120)	6.079 (2.960)
Number of employers	2.659 (0.967)	2.781 (0.949)	2.858 (0.962)	3.120 (0.861)
Foreman certificate	0.0991 (0.299)	0.147 (0.355)	0.121 (0.327)	0.134 (0.341)
<i>Distribution of workers across firms (column total=1)</i>				
Less than 5 employees	0.064	0.097	0.062	0.073
5 to 9 employees	0.198	0.138	0.212	0.141
10 to 49 employees	0.341	0.324	0.492	0.432
50 to 99 employees	0.159	0.132	0.100	0.139
100 to 499 employees	0.164	0.180	0.108	0.152
500 to 1000 employees	0.035	0.042	0.013	0.018
More than 1000	0.039	0.087	0.013	0.045
<i>Distribution of workers across federal states (Bundesland, column total=1)</i>				
East Berlin	0.095	0.094	0.096	0.082
Brandenburg	0.069	0.096	0.158	0.173
Mecklenburg-Vorpommern	0.181	0.162	0.121	0.100
Saxony	0.224	0.174	0.354	0.291
Saxony-Anhalt	0.159	0.201	0.163	0.202
Thuringia	0.272	0.273	0.108	0.152
<i>Distribution across the occupational groups of the apprenticeship (column total =1)</i>				
Agricultural occupations	0.033	0.052	0.012	0.083
Mining, mineral winning, stonery, material production	0.013	0.015	0.004	0.013
Chemical industry		0.012	0.004	
Wood and paper manufacturing, converting, printing		0.018		0.011
Metalworking occupations	0.013	0.108	0.017	0.081
Metal-structuring, engineering	0.147	0.324	0.171	0.312
Electrical engineering	0.164	0.114	0.217	0.100
Apparel industry, leather production and processing	0.004	0.006		0.008

Food industry	0.091	0.018	0.042	0.045
Structural and civil engineering	0.341	0.165	0.350	0.178
Lining, upholstering	0.017	0.003	0.013	0.003
Carpenters	0.035	0.030	0.046	0.037
Painters, varnishers	0.073	0.024	0.075	0.018
Technical engineers	0.009	0.009	0.004	0.018
Merchants	0.004	0.006		0.008
Transport occupations	0.039	0.075	0.033	0.063
Organization, administration, high-skilled professionals	0.009	0.009		0.011
Cleaning, low-skilled healthcare services	0.004	0.012	0.008	0.008
Occupations of order and security	0.004		0.004	0.003

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Table 8: Comparison of the Coefficients for OLS and IV Estimations in East Germany in 1991/92; 3-Digit Level,  $N = 565$

Dependent variable: ln wages	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Occ. change 3-dig	-0.071** (0.022)	-0.069** (0.018)	-0.040 (0.235)	-0.383*** (0.009)	-0.329*** (0.009)	-0.309** (0.028)
Age	0.044*** (0.001)	0.039*** (0.001)	0.039*** (0.001)	0.049*** (0.000)	0.045*** (0.001)	0.043*** (0.001)
Age squared	-0.001*** (0.001)	-0.001*** (0.002)	-0.001*** (0.002)	-0.001*** (0.002)	-0.001*** (0.001)	-0.001*** (0.001)
Tenure, curr. employer		0.000 (0.973)	0.002 (0.864)		0.004 (0.788)	0.003 (0.831)
Foreman certificate		0.053 (0.242)	0.047 (0.300)		0.061 (0.201)	0.045 (0.341)
Firm size		Yes	Yes		Yes	Yes
Bundesland		Yes	Yes		Yes	Yes
Occ. groups			Yes			Yes
Constant	0.900***	0.893***	0.617***	0.953***	0.915***	0.703***
Adjusted $R^2$	0.025	0.161	0.175			
Angrist-Pischke F-stat				31.51	34.50	39.96
Sargan test (p-value)				0.211	0.554	0.400

Standard errors in parentheses; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 9: First Stage of the IV Estimations in 1991/92

Dependent var: Occ. change (3-digit)	(4'-fs)	(5'-fs)	(6'-fs)
Size of occ. group, West, in thousands	-0.001*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
Unemployment rate in occ. group, East	2.065*** (0.005)	2.117*** (0.005)	1.437* (0.090)
Age	0.040 (0.393)	0.063 (0.192)	0.052 (0.343)
Age squared	-0.000 (0.739)	-0.000 (0.448)	-0.001 (0.484)
Tenure, curr. employer		0.026 (0.601)	-0.011 (0.854)
Foreman certificate		0.044 (0.811)	-0.118 (0.591)
Firm size		Yes	Yes
Bundesland		Yes	Yes
Occ. groups			Yes
Constant	-0.846	-1.068	-0.942
Pseudo $R^2$	0.062	0.090	0.299

Standard errors in parentheses; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 10: Comparison of the Coefficients for OLS and IV Estimations in East Germany in 1998/99; 3-Digit Level,  $N = 625$

Dependent variable:	OLS			IV		
ln wages	(1)	(2)	(3)	(4)	(5)	(6)
Occ. change 3-dig	-0.033 (0.236)	-0.035 (0.177)	-0.000 (0.987)	-0.259*** (0.002)	-0.236*** (0.003)	-0.206 (0.110)
Age	-0.002 (0.893)	-0.007 (0.706)	-0.010 (0.563)	-0.009 (0.657)	-0.012 (0.512)	-0.012 (0.506)
Age squared	0.000 (0.906)	0.000 (0.756)	0.000 (0.579)	0.000 (0.665)	0.000 (0.552)	0.000 (0.514)
Tenure, curr. employer		0.023*** (0.000)	0.025*** (0.000)		0.020*** (0.000)	0.021*** (0.000)
Foreman certificate		0.061 (0.104)	0.060 (0.115)		0.062 (0.109)	0.041 (0.310)
Firm size		Yes	Yes		Yes	Yes
Bundesland		Yes	Yes		Yes	Yes
Occ. groups			Yes			Yes
Constant	1.979***	1.763***	1.616***	2.238***	2.003***	1.822***
Adjusted $R^2$	-0.003	0.139	0.171			
Angrist-Pischke (F-stat)				80.13	80.41	35.72
Sargan test (p-value)				0.559	0.816	0.573

Standard errors in parentheses; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table 11: First Stage of the IV Estimations in 1991/92

Dependent var: Occ. change (3-digit)	(4'-fs)	(5'-fs)	(6'-fs)
Size of occ. group, West, in thousands	-0.001*** (0.001)	-0.001*** (0.000)	-0.001*** (0.003)
Unemployment rate in occ. group, East	5.035*** (0.000)	4.822*** (0.000)	3.012*** (0.001)
Age	-0.073 (0.324)	-0.073 (0.339)	-0.028 (0.752)
Age squared	0.001 (0.321)	0.001 (0.337)	0.000 (0.717)
Tenure, curr. employer		-0.028 (0.130)	-0.068*** (0.002)
Foreman certificate		0.032 (0.847)	-0.363* (0.071)
Firm size		Yes	Yes
Bundesland		Yes	Yes
Occ. groups			Yes
Constant	1.258	1.374	1.222
Pseudo $R^2$	0.086	0.115	0.314

Standard errors in parentheses; \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$



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