What attracts human capital? Understanding the skill composition of internal migration flows in Germany

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Abstract

By examining destination choice patterns of heterogenous labor, this paper tries to explain the skill composition of internal migration flows in Germany. Using a nested logit model of destination choice, this study only finds weak evidence in favor of the Roy selection model according to which high-skilled migrants prefer regions with higher returns to skill. By contrast, a migrant's average skill level strongly increases with mean wages in the destination region. Other factors such as unemployment differentials or regional disparities of amenities and disamenities only weakly affect the skill composition of internal migration in Germany. A simulation confirms that a wage convergence between Eastern and Western Germany is the most effective means of attracting human capital to Eastern Germany.

Keywords: destination choice, Roy selection model, human capital, Eastern Germany

JEL classification: R23, J61, C35

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1 Introduction

What attracts human capital? According to the New Theory of Economic Growth, the answer to this question is highly relevant for regional economic growth (Lucas, 1988; Romer, 1990; Krugman, 1991). One of the main arguments of this literature is that regions with a high human capital endowment experience faster growth due to positive externalities such as an efficient information flow and networks that convey both formal and tacit knowledge (Camagni, 1995; Maillat, 1998). Thus, a large pool of qualified workers facilitates innovative activties within the region and attracts new firms to the location. Several studies have shown that the human capital endowment of the region is positively linked to its future economic growth (Rauch, 1993; Simon, 1998). Thus, there may be dynamic gains from inward migration of skilled individuals if such migrants foster technological change and regional economic growth. It follows that labor migration may lead to a cumulative process that reinforces instead of alleviates regional economic disparities (Nijkamp and Poot, 1997). For this reason, understanding what drives the skill composition of internal migration flows is an important first step for understanding the consequences of heterogeneous migration flows for regional disparities. Given the concerns regarding a brain drain from Eastern to Western Germany[1] that may actually reinforce regional disparities, understanding which factors determine the destination choice of different skill groups is of particular interest in the German context. Therefore, the aim of this paper is to identify major forces behind the skill composition of internal migration flows in Germany by estimating a model of destination choice. While numerous studies confirm increasing migration propensities with higher skill levels (e.g. Molho, 1987; Hughes and McCormick, 1989; Antolin und Bover, 1997; Tervo, 2000), there has been much less micro-level research on the role of educational attainment in the destination choice of internal migrants.

One important exception is the strand of research that goes back to Borjas (1987) and Borjas et al. (1992) who applied the Roy model (Roy, 1951) to the international and subsequently to the internal migration decision. Accordingly, migrants maximize their income by choosing destination regions that provide a favorable income distribution for their skill level. It follows that high-skilled individuals have incentives to move to regions that reward their human capital investments, whereas less skilled individuals tend to move to regions with less income inequality in order to reduce the penalty from lacking these skills. Chiswick (2000) and Brücker and Trübswetter (2004) argue that these predictions may be modified when introducing migration cost that are negatively related to the skill level. This may be a reasonable assumption, if high-skilled individuals are more likely to be reimbursed for migration cost by their new employer. Also, migration cost may be lower due to geographically broader social networks that may

[1] Most recent studies suggest that east-west migrants tend to be disproportionately high-skilled (Schwarze, 1996; Hunt, 2000; Burda and Hunt, 2001), while Burda (1993) cannot unambiguously confirm these findings.

reduce information cost or psychological cost associated with migration. As a consequence, the skill-level of internal migration flows might be increasing with migration distance.

Another strand of literature stresses the role of regional amenities for the destination choices of migrants. Each location offers a set of location-specific amenities such as natural amenities (e.g. climate), urban scale amenities (e.g. the variety and type of regional consumption goods) and differences in certain public goods (e.g. school quality) as well as disamenities (e.g. pollution, crime rates). Shaw (1975) already suggests that regional amenities may become more important in the migration process with increasing wealth in a society. Similarly, Brueckner et al. (1999) argue that the marginal valuation of amenities increases with income level. To the extent that education raises earning capacities, this also suggests that the valuation of local amenities and the aversion to local disamenities may be positively related to human capital. In particular, recent research suggests that high-income or educated individuals tend to consume a disproportionate share of urban scale related amenities such as the variety of consumption goods and activities (Brueckner et al., 1999; Glaeser et al., 2001). Consistent with these notions, Adamson et al. (2004) find that returns to education fall with urban scale and interpret this as evidence that more educated individuals disproportionately appreciate urban scale amenities such that they accept lower compensated wages. Accordingly, regional amenities may translate into utility differences across skill groups and offer another explanation for the skill composition of internal migration flows.

The existing literature offers a variety of factors that may determine the skill composition of internal migration flows. Yet, there only have been few studies that examine the relevance of all of these factors in determining the destination choices of heterogenous skill-groups. One recent exception is the study by Hunt and Mueller (2004) who estimate a nested logit model of destination choice for migrants in the US and Canada. Their findings confirm the theoretical notions of the Roy model that high-skilled individuals tend to move to regions with high skill premia. Moreover, they also find evidence for lower migration cost and higher amenity valuations among high-skilled migrants. In the European context, Ritsilä and Ovaskainen (2001) and Ritsilä and Haapanen (2003) address the question of the skill composition of internal migration flows in Finland and find that high-skilled individuals tend to move to high-density urban areas. This may, however, be due to a mixture of higher urban wage premia, job opportunities and urban scale amenities. Therefore, these studies do not help in disentangling the factors behind the skill composition of migration flows in Europe. This paper tries to fill this gap by looking at forces behind the skill composition of internal migration flows in Germany. Moreover, this paper makes two additional contributions to the literature on the skill composition of internal migration flows.

First of all, preceding papers of destination choice typically do not control for unobserved time-constant factors at the regional level that may bias estimation results. Based on the IAB employment subsample 1975-2001 (IAB-R01), I use a pooled sample of mobility events between 1995 and 2001. This allows for including dummies for all origin and destination regions which should avoid biases from omitting time-constant region-specific factors (Train, 2002). Secondly, the skill composition of internal migration flows may partially reflect differences in mobility patterns between voluntary and involuntary movers. Clearly, these groups may have different motives for migration which should affect their destination choices. Voluntary job moves are typically career-oriented and aim at better job matches and higher wages. Also, preferences for certain regional amenities may motivate individuals to voluntarily move to another region. By contrast, involuntary mobility is associated with previous or expected job losses. Thus, involuntary moves are more likely to be concerned with job opportunities than with higher wage levels or preferences for certain regional amenities. To the extent that involuntary and voluntary mobility are not equally distributed across skill groups, such differences may have obscured the findings of previous studies. This paper tries to diminish this problem by distinguishing between employed and unemployed migrants.

Using a partially degenerate two-level nested logit model that distinguishes between the decision to stay and move to one of the destination regions, this paper only finds weak evidence in favor of the extended Roy model. Regional variation in returns to skill does not seem to be a major factor in determining the skill composition of internal migration flows in Germany. By contrast, the mean wage level, local job-finding conditions and some regional amenities contribute to spatial sorting processes. Moreover, the degree of voluntariness is found to significantly affect destination choices and thus the composition of internal migration flows. Simulating mobility patterns for a hypothetic economic convergence between Eastern and Western Germany demonstrates how heterogeneous destination choice patterns affect the skill composition of migration across the former border. Wage convergence is found to be the most effective means of attracting an increasing share of high-skilled migrants to Eastern Germany while converging unemployment levels stop the current net loss of population in Eastern Germany without increasing the share of high skilled west-east migrants. Moreover, this study also finds some reluctance on the part of West Germans to move to Eastern Germany beyond what is explicable with economic disparities between both parts of Germany. Mobility patterns in Germany seem to be affected by a border that has long vanished physically, but that still seems to exist in people's minds.

The research outline of the paper is as follows. The next section elaborates on the theoretical model, while section 3 and 4 introduce the data set and show some descriptive evidence regarding the skill composition of internal migration flows in Germany. Section 5 introduces the econometric specification. Section 6 discusses major findings. Section 7 simulates mobility patterns in case of an economic convergence between Western and Eastern Germany. Section 8 concludes.

2 A theory of sorting

Consider a framework in which movements between k regions are based on utility maximization. Individual i faces the problem of evaluating the utility of living and working in all alternative locations. For simplicity, I assume that an individual always lives and works in the same region, i.e. there is no commuting between the two regions. Moreover, assume that the utility for individual i of living and working in a particular region may be written as:

$$U_{ik} = U(W_{ik}, S_{ik}, A_{ik}, P_{ik}) \tag{1}$$

where P_{ik}, S_{ik}, W_{ik} and A_{ik} denote observed region-specific characteristics that yield different utility levels for heterogenous individuals.

W_{ik} refers to the log wage paid to individual i in region k. Assuming θ to resemble normally distributed skills within the population, I decompose this wage according to the extended Roy selection model developed by Borjas et al. (1992):

$$W_{ik}(\theta) = \mu_k + \eta_k[\theta_i - E(\theta)] \tag{2}$$

where μ_k is the log mean wage level in the region and η_k reflects differences in the returns to skill across regions. In particular, the skill level determines the wage W_{ik} up to a factor of proportionality, $\eta_k > 0$. This specification implicitly assumes that an individual ranks equally in the skill distribution across all regions. More importantly, this specification implies that individuals with a positive skill differential have higher wages the higher the returns to skill η_k in an area. Consequently, skilled individuals should prefer destinations with high skill premia while low-skilled individuals with a negative skill differential should rather avoid such regions in order to minimize the penalty from lacking relevant skills. In other words, the extended Roy model by Borjas et al. (1992) suggests that individuals select themselves into regions with a favorable wage distribution for their particular skill-level. In addition, one may also expect some selection processes by previous job status. From a search-theoretic perspective, previously employed individuals should seek an improvement to their current wage level which should exceed the reservation wage level of the unemployed job seekers. Thus, previously employed individuals might have stronger preferences for regions with higher wage levels than unemployed individuals.

S_{ik} summarizes individual i's chances of finding and keeping a job in region k which may depend on an individual's occupation and skill level and the demand for these characteristics in region k. Thus, on the one hand, S_{id} captures the cost of searching for a job in region k. According to search theory, regions with higher job-finding rates should attract a higher level of search effort than regions with more unfavorable job-finding conditions (Arntz, 2005). General job-finding conditions, however, may be more important for unemployed job search than for employed job search. In particular, employed job search may rather be career-oriented such that job search is concentrated on specific sectors or occupations. Moreover, job-related contacts may be quite important for employed job search. By contrast, unemployed job search may be less restricted to the previous occupation or sector of activity. In this case, unemployed job seekers are likely to have a broader focus such that general job-finding conditions in a region should be more important. Apart from job-finding conditions, S_{id} also captures the risk of future unemployment periods in region k which may depend on the economic prospects in region k. Regions with unfavorable economic prospects should be less attractive to job searchers since such destination regions imply a lower expected lifetime income.

A_{ik} captures all unpriced region-specific factors that are a source of utility or disutility such as natural and urban-scale related amenities and disamenities. Consistent with the literature discussed in the introduction, I assume the utility derived from these regional characteristics to differ by skill level. Accordingly, preferences for amenities and aversions to disamenities are assumed to be stronger with increasing skill levels. Moreover, I hypothesize that employed migrants have higher amenity valuations than unemployed migrants since for employed individuals changing the job may actually be a means of moving to a particularly attractive region. Finally P_{ik} refers to the regional price level. The marginal disutility derived from high price levels may be expected to decrease with increasing wage levels. Since unemployed and less-skilled individuals should have lower earning capacities, these groups may be expected to avoid expensive regions.

In this framework, individual i moves from origin o to destination d if this migration path maximizes utility, i.e. if

$$U_{id} - C_{iod} > U_{ik} - C_{iok} \; \forall d \neq k \tag{3}$$

where C_{iok} denotes the migration cost from origin o to the destination region k. Thus, the utility of living and working in region d net of migration cost needs to exceed the utility of living and working in all other destination regions k net of migration cost. The migration cost component can be decomposed into several sub-components:

$$C_{iok} = C(m_{io}, d_{iok}, mp_{iok}). \tag{4}$$

Among these components, m_{io} refers to the fixed cost of leaving the origin region which may depend on a number of individual characteristics such as age, marital status and home ownership. By contrast, d_{iok} and mp_{iok} capture variable cost of migration that depend on the choice of destination region. Search cost or psychological cost of migration, for example, should be increasing with distance (d_{iok}). If high-skilled individuals have spatially broader social networks that reduce search cost and/or psychological cost of migration, d_{iok} should be lower for high-skilled individuals. Regarding differences in migration costs by job status, no clear predictions are suggested. While unemployed individuals may have fewer financial resources to bear moving costs, the willingness to move further distances in order to find employment may be more pronounced among this group. In addition to the discussed migration cost components, mp_{iok} captures migration cost that are associated with a specific migration path. In particular, moving from Western to Eastern Germany may be associated with some stigma effects if someone who has grown up in West Germany prefers a region simply for being located in Western Germany.

To sum up, this framework predicts complex sorting processes by skill level and job status that affect the composition of migration flows and that may be summarized as follows:

1. The proportion of high-skilled individuals following a particular migration path increases with the returns to skills, the level of amenities and the price level in region d. Moreover, if high-skilled individuals face lower migration cost, the average skill-level of a migration path increases with distance.

2. The proportion of previously employed individuals following a particular migration path increases with favorable wage conditions and the level of regional amenities while the proportion of unemployed migrants increases in destinations with favorable job-finding conditions.

3 Data

The analysis is based on the IAB employment subsample 1975-2001 - regional file (IAB-R01[2]). This register data set also contains spell information on a 2 % sample of the population working in jobs that are subject to social insurance payments. As a consequence, the sample does not represent individuals who are not subject to social insurance contributions such as self-employed individuals and life-time civil servants. The data contains spell information on periods for which the individual received unemployment compensation from the federal employment office (*Bundesagentur für Arbeit*) such as unemployment benefits UB (*Arbeitslosengeld*), unemployment assistance UA (*Arbeitslosenhilfe*) and maintenance payments during further training MP (*Unterhaltsgeld*). Thus, employment histories including periods of transfer receipt can be reconstructed on a daily basis.

For every employment spell, the IAB-R01 includes the micro-census region of the workplace. This is the central piece of information in order to identify mobility events, since for any observed job move it is possible to compare the previous to the current workplace location[3] According to

[2]See Hamann et al. (2004) for a detailed description of the IAB-R01.

[3]Since the exact date of migration between the two employment spells is unknown, it is not possible to distinguish between contracted migration after a successful job match and speculative migration. According to Molho (1986), contracted migration, i.e. mobility after a successful job match, is much more common in Europe than speculative migration.

the definition used in the analysis, a job move occurs if there has been a change in the employer[4] and the reason for ending the previous employment spell is denoted as "end of employment"[5]. Moreover, if the end of an employment spell indicates "end of employment", no job move is assumed if the next employment spell indicates the same employer and this new employment spell occurs within 90 days. This restriction ensures that recalls linked to seasonal work are not counted as job moves[6].

Having identified job moves, the next step involves defining the different circumstances under which these job moves occurred. One major difficulty arising in this context is that the IAB-R01 does not allow for identifying registered unemployment, but only contains information on the receipt of transfer payments. Since unemployment assistance (UA) is means-tested, it only applies to a selective group of individuals who lack other financial resources. As a consequence, it is not possible to distinguish between those who have left the labor force and those still unemployed but not receiving any unemployment compensation since both of these states are unobserved in the IAB-R01. Therefore, it is necessary to define proxies for unemployment (Fitzenberger and Wilke, 2004). For my purpose, I define the following three different states:

1. **Direct job change (DJC):** The job move occurs within 90 days after the last job ended and there has been no intermediate transfer receipt.

2. **Job change after unemployment (JCU):** This definition closely follows Lee and Wilke (2005). A job move is said to occur after an unemployment period if transfer receipt started within four weeks after the last employment spell ended and gaps between periods of transfer receipt are no longer than four (in the case of a suspension period six) weeks. The gap between the end of transfer receipt and the new job beginning does not exceed 90 days.

3. **Job change after all other states (REST):** This group consists of two sub-groups. It contains all those experiencing a job move without any intermediate transfer receipt but a gap of more than 90 days between both employment spells. Since it is unobserved what happened in between the two employment spells (e.g. self-employment, out-of labor force), this group is not included in DJC. The second group comprises those who receive intermediate transfer receipts, but do not fulfill the JCU definition, i.e. they experience

[4]Hunt (2005) suggests that high-skilled individuals face much lower migration cost than less skilled individuals because they are much more likely to be regionally mobile while staying with the same employer. I deliberately exclude this type of migration because these movements are largely determined by site locations of the employer and not by a decision-making process that considers all alternative locations.

[5]The data set includes an identifier for the employer which is not free of inconsistencies. Fortunately, additional information on the reason for ending the employment spell can be used to identify real job moves.

[6]Most seasonal work should be interrupted for less than 90 days. Still, some robustness checks will be necessary on this restriction in future research.

longer gaps such that it is unclear whether they are still unemployed, already out of labor force or self-employed.

In order to distinguish between employed and unemployed job changers, I will use only DJC and JCU for the subsequent analysis since the remaining job moves (REST) are a very heterogenous and unclear sample.

For each job move (i.e. DJC and JCU), I define the origin and destination region based on the workplace information of the employment spells. For two reasons, this approach introduces some measurement error. First of all, we do not observe moves that are not related to a new employment. While this problem should be less severe for the DJC who find a job within 90 days, JCU partially experience lengthy unemployment periods where the actual whereabouts of the individual is unknown. Thus, this drawback of the data should be kept in mind. Secondly, to the extent that individuals commute between different regions, the use of the workplace location induces some measurement error. Since I use the 16 federal states (*Bundesländer*) as the regional entities to define mobility at this stage, this is problematic because the boundaries of these administrative entities do not take into account any commuting linkages. Thus, the measurement error may actually be quite severe. In particular, this concerns the three metropolitan areas which are also federal states. Repeating the subsequent analyzes for a definition of 13 states which lump together the three metropolitan area states with their adjacent federal state did not, however, yield different results[7].

I restrict the sample to job moves occuring between 1995 and 2001. Furthermore, I restrict the sample to prime-age males aged 25 to 45 years and working in a full-time job in order to receive a relatively homogenous sample. I exclude women because they are more likely to be tied movers. Finally, I address the problem of inconsistencies in the education variable that have been discussed by Fitzenberger, Osikominu and Völter (2005) by using one of their proposed imputation rules in order to correct this variable[8].

Based on the definitions and sample restrictions discussed in the previous section, I observe 116,978 DJC and 85,066 JCU in the period from 1995 to 2001. Moreover, 72% of all individuals experience more than one job move within the seven year period[9].

[7]Alternatively, the planning districts (Raumordnungsregionen) should be used which are defined based on commuting linkages and should thus minimize the measurement errors. However, at this stage, the necessary data have not been accessible yet, but should be accessible soon.

[8]In fact, I use the imputation procedure IPI which basically assumes that educational degrees do not get lost and that missings may be overwritten by previous information on the education level if available.

[9]I compared all of the following empirical analyzes to an alternative sample that included one randomly chosen observation per individual, but results did not significantly differ.

4 Background and descriptive evidence

In order to give some descriptive evidence regarding differences in destination choices by skill level and job status, I define four macro-regions (East, North, West and South) which can be seen in figure 1. There are strong disparities among the three western regions north, west and south in terms of unemployment rates. While the south is the most prosperous region with unemployment rates much below the country average, the north is struggling with much higher unemployment rates. The west ranges in between these two regions. Among the four regions, however, Eastern Germany is still lagging behind economically with unemployment rates more than twice the western rate. Moreover, eastern wages continue to be one-quarter below the western wage level despite a remarkable wage convergence during the 1990s. The observed downward trend in east-west migration from an initial peak in the early 1990s has mainly been attributed to this wage convergence (Hunt, 2000; Burda and Hunt, 2001). Wage dispersion continues to be less pronounced in eastern than in western states despite growing wage inequality in Eastern Germany during the 1990s. According to the Roy selection model, this should contribute to a positive selection of east-west migrants, especially during the early 1990s. Brücker and Trübswetter (2004) find evidence that east-west migrants are indeed positively selected with regard to unobserved abilities.

Figure 1: Four German Macro Regions

Having these regional disparities in mind, table 1 shows the mobility pattern by origin and educational attainment between these macro regions. Note that an interregional move can occur within the same macro-region since each of these regions consist of at least two states. I distinguish between less-skilled individuals (LS) that are either unskilled or have a vocational training and high-skilled individuals (HS) with a college or university degree[10].

First of all, note that for all origin regions, high-skilled individuals are much more likely to experience an interregional move than less-skilled individuals. This is consistent with the literature which typically finds migration propensities to increase with skill level. Less-skilled

[10]Among the less skilled individuals, only 10% have a high-school degree.

Table 1: **Mobility Pattern by origin and skill level, IAB-R01 1995-2001**

			Destination (in %)				
Origin	**Skill level**	**Obs.**	**Stay Home**	**East**	**North**	**West**	**South**
East	Less skilled	49,935	81.1	9.5	2.7	3.0	3.6
	High-skilled	4,862	65.3	15.8	4.2	8.2	6.5
North	Less skilled	26,550	79.5	3.8	9.6	5.2	1.9
	High-skilled	3,683	56.4	5.6	15.4	14.3	8.2
West	Less skilled	54,759	87.0	2.0	2.3	5.1	3.7
	High-skilled	10,010	69.7	3.3	4.7	11.7	10.7
South	Less skilled	44,343	89.9	2.5	0.9	4.1	3.1
	High-skilled	7.902	75.1	2.6	3.2	11.9	7.1

individuals in the east are however only slightly more likely to stay in their origin state than high-skilled individuals in the south. Moreover, destination choice patterns differ by skill level. While high-skilled individuals with southern origin are more than twice as likely to move to the west or the north than their less-skilled counterparts, the likelihood of moving to the east is similar across the skill groups. These differences across skill groups do not vanish after controlling for job status. Figure 2 displays destination choice patterns not only by skill level but also by job status. According to hotelling test statistics, differences across skill groups are highly significant. Moreover, there are also significant differences in destination choice pattern between direct job changers and skilled job changers after unemployment although these differences tend to be smaller than between skill groups.

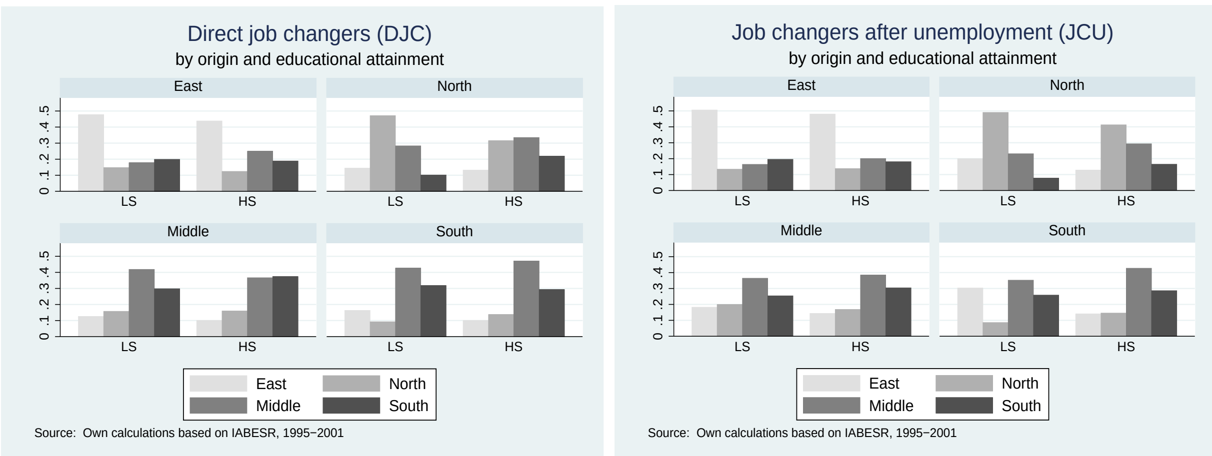

Figure 2: Destination Choice Pattern by skill level, origin and job status

These heterogeneous destination choice patterns determine the skill composition of a particular migration path. Table 2 shows the share of high-skilled migrants for migration flows between the four macro regions. On average, 17.1% of all migrants following a particular migration path are high-skilled. Migrants to the south or the west are more skilled than migrants leaving these regions. By contrast, migrants leaving the north and the east have a higher skill-level than the corresponding inward migrants. This suggests that the east and the north may loose a disproportionate share of human capital.

Table 2: **Share of high skilled migrants for migration flows between the four macro regions, IAB-R01 1995-2001**

	Destination				
Origin	**East**	**North**	**West**	**South**	**All**
East		13.2%	21.0%	15.0%	16.5%
North	12.5%		21.1%	29.6%	20.1%
West	13.8%	16.6%		22.0%	18.5%
South	8.9%	25.9%	22.0%		18.6%
All	11.8%	16.7%	21.4%	21.2%	17.1%

A higher skill-level among outward migrants than among inward migrants does however not necessarily imply that there is also a net outflow of high-skilled individuals or that the share of high-skilled individuals decreases in the east or the north due to these migration flows. Table 3 suggests, however, that both the east and the north are also net looser of human capital. In both regions, the net migration is negative for both less-skilled and high-skilled migrants. The employment change that is induced by these net flows, however, is larger for high-skilled than for less-skilled. As a consequence, both regions loose a disproportionate share of human capital to the west and to the south such that the share of high-skilled employees decreases in the east and the north while it increases in the west and the south.

In line with Büchel et al. (2001), the descriptive evidence thus points towards a continued brain drain from Eastern to Western Germany. Moreover, it also suggests that the north is even loosing a larger share of its high-skilled workforce. Since such a brain drain may reinforce regional disparities, it is important to understand what drives the skill composition of internal migration flows. The descriptive evidence suggests that destination choice patterns do not only vary by skill level but also by job status. The following econometric analysis examines destination choice patterns of heterogeneous labor in order to identify the factors that drive these observed sorting processes.

Table 3: **Net migration flows, induced net employment change by skill-level and share of high-skilled employees before (t0) and after (t1) migration, IAB-R01 1995-2001**

Region	Net migration		Net emp. change		Share of HS emp.	
	LS	HS	LS	HS	t0	t1
East	-499	-365	-0.5%	-2.3%	13.1%	12.9 %
North	-2,497	-777	-3.4%	-11.7%	8.2%	7.5%
West	2,147	763	1.3%	4.6%	9.0%	9.3%
South	849	378	0.6%	2.8%	8.9%	9.0%

Note: Employees by skill level are computed based on the IAB-R01 at the beginning of the observation period (01/01/1995).

5 Econometric specification

Following the well-known random utility approach to discrete choice problems (McFadden, 1981), the probability that individual i with origin o chooses destination d can be written as:

$$P_{iod} = P[V_{id} + \epsilon_{id} > V_{ik} + \epsilon_{ik}] \ \forall k \neq d \tag{5}$$

with $V_{ij} = U_{ij} - C_{ioj}$ denoting the observed utility component and ϵ_{ij} as the unknown stochastic part. Depending on the assumptions made about the error terms, a number of different models may be specified. In particular, assuming independent, identically extreme value distributed error terms between all destination choices yields the logit specification. This specification has been used by a number of recent destination choice studies (e.g. Davies et al., 2001; Schündeln, 2002). A simple logit representation of the above stochastic process is inappropriate, however, if there are unobserved components of utility that are correlated over destination choices. In this case, less restrictive models are necessary that allow for correlated errors such as the multinomial probit. Yet, estimating this model with many alternatives and a large number of observations comes with a large computational burden such that I leave this route for future research. Instead, I choose a nested logit specification which slightly relaxes the independence assumption of the logit specification by allowing for some correlation among nonorigin regions. This reflects the notion that choices that involve residential mobility are likely to be related due to some unobserved utility components. Thus, I use a partially degenerate nested logit model that distinguishes between two upper-level branches: staying (s) and migrating (m). At the lower-level, the branch m distinguishes between all destination regions while for the degenerate branch s, the origin region is the only choice. This model relaxes the independence assumption between the two branches, but still assumes independence between all nonorigin regions conditional on all observed factors, i.e. the Independence of Irrelevant Alternatives

(IIA) assumption has to hold.

The nested logit model can be decomposed into the product of the marginal probability of choosing branch m or s (P_{il} with l = m,s) and the conditional probability of choosing alternative k conditional on choosing the branch ($P_{ik|l}$). This latter conditional probability for the non-degenerate branch m can be written as

$$P_{ik|m} = \frac{exp(\gamma' z_{ik})}{\sum_{k \in m} exp(\gamma' z_{ik})} \tag{6}$$

while $P_{io|s} = 1$ for the degenerate branch. γ is a parameter vector while z_{ik} are covariates that vary across non-origin regions. In particular, I want to test the predictions made by the extended Roy model by including the mean wage of the sector of activity individual i is working in and a returns to skill indicator[11]. According to the theoretical framework, higher regional mean wages should attract migrants irrespective of skill level. By contrast, high-skilled individuals should prefer regions with high returns to skill while less-skilled individuals should rather avoid such regions. Since I use the product of a returns to skill index[12] and the individual skill difference (see table 10 and 11 in the appendix for details) as an indicator of the interregional variation in the returns to skill for each individual, the expected effect for this covariate is positive across skill levels. In addition to these wage-related variables, I use regional unemployment rates and regional employment growth for individual i's skill group in order to capture regional job-finding conditions. Both lower unemployment rates and higher employment growth suggest better job-finding conditions and better economic prospects and should thus attract migrants, especially unemployed job seekers. Furthermore, I try to capture a number of non-priced factors that may attract migrants. I include regional child care facilities as an indicator of the availability of public goods. Hotel capacities are supposed to capture the general attractiveness of the region. In addition, as has been suggested by Herzog und Schlottmann (1993), I include population levels as a proxy for urban-scale related amenities such as the availability of consumer-oriented amenities. Moreover, as suggested by Ciccone and Hall (1996), I include a density measure, namely population density, in order to measure agglomeration effects[13]. While urban-scale amenities should be attractive for migrants, especially high-skilled ones, stronger agglomerations for a given urban scale may rather capture disamenities such as pollution or lack of housing space[14]. Thus, the sign of the density effect is likely to be

[11] Both mean sector wages and the returns to skill index are standardized in the sense that interregional differences reflect differences in labor prices rather than different compositions of the labor force. Table 10 in the appendix includes a short description of the methodology which is based on Hunt and Mueller (2002).

[12] This index refers to the regional wage variance normalized by the general wage variance across all region.

[13] Ciccone and Hall suggest employment density as a measure of agglomeration economies. Since employment densities and population densities are highly correlated, population densities should also be an appropriate measure.

[14] Positive agglomeration effects such as higher productivity levels due to closer proximity of workers and lower transportation cost, should mainly be captured by the regional wage distribution.

negative. In order to capture some specific source of disamenity, I also include regional crime rates. Moreover, regional land price differentials are used as a proxy for interregional cost of living differentials. All of these covariates are defined as relative measures between potential destination regions and the origin region of individual i. This reflects the notion that destination choices are typically made by comparing all destinations with the current region of residence[15]. Finally, several migration cost indicators such as a distance-related measure and dummies for crossing the former German border and moving between northern and southern Germany are included. Table 10 lists the exact definitions and data sources of all lower-level variables, while table 11 in the appendix gives some summary statistics on lower level covariates by skill level and previous job status.

The upper level marginal probability of migrating can be written as follows:

$$P_{im} = \frac{exp(\beta'_m w_i + \zeta_m iv_{im})}{1 + exp(\beta'_m w_i + \zeta_m iv_{im})}. \quad (7)$$

with

$$iv_{im} = ln[\sum_{k \in m} exp(\gamma' z_{ik})]. \quad (8)$$

iv_{im} refers to the inclusive value which links the upper with the lower model. In particular, $\zeta_m iv_{im}$ may be interpreted as the expected utility individual i derives from choosing among all nonorigin regions, i.e. from migrating. Moreover, the inclusive value parameter ζ_m reflects the degree of independence among all nonorigin regions . If $\zeta_m = 1$ cannot be rejected, the choice alternatives have to be considered fully independent such that a simple logit specification is a feasible approach. Since $\zeta_m = 1$ has been rejected for all estimations in the following section, the nested logit model turned out to be an appropriate choice.

β_m is a parameter vector that measures the effect of each characteristic w_i on the probability of migration. w_i consists of a number of individual-level characteristics that affect individual mobility decisions. In particular, these covariates encompass age, previous job status, previous sector of activity, previous type of occupation and previous wage income. Unfortunately, the IAB-R01 does not include important household characteristics such as home ownership and marital status which capture individual mobility cost. However, the data set allows for capturing the individual employment history (e.g. duration of previous unemployment spells, recall by previous employer, previous tenure, previous duration of all non-employment periods) which

[15] As a consequence, it is impossible to separate push from pull factors, i.e. this specification does not allow for separately identifying the effect of an improvement in the origin region from deteriorating conditions in the destination region. I tried to separate these two effects by adding origin-specific characteristics in the upper-level model which is described below. Yet, this specifications proved to be quite unstable. I therefore decided to stick to the more restrictive use of relative measures.

should at least reduce some of the unobserved heterogeneity among individuals. A long previous tenure, for example, should reflect some attachment to the region which should increase mobility cost. Moreover, by restricting the sample to prime age males and by separately estimating the model by skill-level and by job status, unobserved heterogeneity is further reduced. In order to capture differences in the propensity to be mobile across origin regions as has been shown in table 1, I include origin fixed effects. Appendix 12 contains summary statistics for all upper level covariates by sub-sample.

Note that the above nested logit specification is non-normalized, i.e. the utility of the lower level model has not been rescaled by the inverse of the inclusive value parameter (Daly, 1987). The normalized utility maximizing nested logit (McFadden, 1978) is typically being preferred for its consistency with utility maximization if $0 < \zeta_m < 1$. In particular, Koppelman and Wen (1989) and Hensher and Greene (2002) have shown that the non-normalized nested logit is not consistent with utility maximization if there are generic coefficients, i.e. coefficients that are common across branches. Since in my case, none of the above coefficients are common across the two branches, using the non-normalized nested logit (NNNL) specification is consistent with utility maximization unless ζ_m lies outside the interval $[0; 1]$ (Heiss, 2002). Since all estimated inclusive value parameters lie inside this interval, using the NNNL specification is a feasible approach.

Based on the decomposition into marginal and conditional probabilities, each nested logit model can be estimated sequentially by estimating the lower level model and the inclusive values before estimating the upper level model. This sequential estimation, however, is less efficient than simultaneous estimation by full information maximum likelihood (FIML). Moreover, due to the inclusive value estimate, the standard errors of the upper level model are biased downward (Amemiya, 1978). Thus, FIML is clearly preferable but comes at the cost of difficult numerical maximization since the log-likelihood function is not globally concave. Thus, for large samples, FIML is computationally burdensome. Since due to the large sample size, the loss in efficiency is of no major concern and the main focus of the paper is on lower level estimates for which both point estimates and standard errors are consistent, I decided to use the sequential estimation method[16]. When comparing sequential estimates with FIML estimates, both point estimates and standard errors were remarkably similar suggesting that sequential estimation is a suitable approach in this case. For all estimations, I impose standard errors that are robust to clustering at the regional level in order to avoid downward biased standard errors (Moulton, 1990).

One major caveat of the nested logit specification that has been discussed so far is that estimates are likely to be biased for a number of reasons. First of all, some of the regional covariates such as employment growth and population size may be endogenous due to a simul-

[16]Also, FIML estimation with the pooled sample was technically infeasible. Thus, I also decided to use sequential estimation in order for comparability reasons.

taneity issue. I therefore use lagged values for all covariates at the lower level z_{ik} for which such a simultaneity issue is likely to arise (see appendix 10). Even lagged values, however, can be endogenous due to the persistence of unobserved regional characteristics over time. For this reason, I include fixed effects for each destination region at the lower level of the model in order to avoid biases from omitting relevant destination-specific factors. Yet, biases may still arise from unobserved regional dynamics. Moreover, there may be unobserved characteristics of each migration path such as cultural proximity between origin and destination region which may bias estimation results. Since it is not possible to include fixed effects for each origin-destination pair, I only include fixed effects for movements across the former inner border and for movements between northern and southern Germany. Unobserved factors of other migration paths may still affect estimation results. To sum up, including lagged covariates, regional fixed effects for destination regions and fixed effects for some major migration path should clearly reduce potential biases compared to earlier studies that do not consider any fixed effects such as Hunt and Mueller (2004). Still, some sources of inconsistency remain and should be kept in mind when interpreting the results in the next section.

6 Estimation Results

Table 4 shows estimation results by skill level for the pooled sample of direct job changers and job changers after unemployment. It also includes estimates for the pooled sample of all individuals. Table 4 thus presents results that do not take account of the previous job status. Specification A does not include any destination-specific fixed effects nor any dummy variables for specific migration paths while specification B includes these additional covariates. Thus, lower level estimates for specification A are likely to be biased due to some unobserved time-constant factors that drive destination choice patterns. Indeed, comparing results for both specifications suggests that some parameter estimates are seriously biased. Parameter estimates for returns to skill, for example, seem to be upward biased for less skilled and downward biased for high-skilled individuals. This is not surprising because migration responds to noncompensating wage differentials but we only observe compensated wage differentials that reflect amenity valuations by different groups. If model A does not fully account for amenity variations and high-skilled individuals have higher amenity valuations than less skilled individuals, parameter estimates should be downward biased for high-skilled migrants. Destination-specific fixed effects, however, capture time-invariant interregional amenity variations (e.g. natural amenities). Therefore, I consider specification B to be much more reliable. This is also confirmed when testing the independence of irrelevant alternatives assumption. I run both Hausman tests and Small-Hsiao tests (Small-Hsiao, 1985) for excluding each of the 16 states, respectively. Table 4 shows how many of these 16 test statistics suggest the independence assumption to fail. While the Hausman test always suggests non-independent alternatives, the Small-Hsiao test confirms the iia assumption at least for model B in almost all cases. Still, even for model B the evidence in favor of the iia assumption is clearly mixed which suggests the need to compare these findings to less restrictive model specifications in future research. The following discussion refers to model B if not stated otherwise.

Looking at the results for the pooled sample of all individuals (column γ_{all}), we find most of the expected effects. First of all, migrants clearly prefer regions with higher mean wages. In fact, the mean wage in an individual's sector of activity turns out to be the strongest factor among all economic covariates. This is consistent with Burda and Hunt (2001) who find evidence that inter-state migration flows in Germany are mainly driven by wage differentials. In addition, separate estimations by skill level indicate that high-skilled individuals are more responsive to mean wage differentials with regard to their destination choices than their less skilled counterparts. In fact, the marginal effect is significantly larger for high-skilled as compared to less-skilled individuals at a 10% significance level (see table 5). As a consequence, wage differentials strongly affect the skill composition of migration flows. Concerning returns to skill, however, there is no convincing evidence irrespective of skill level in favor of a positive selection process as suggested by the extended Roy model[17]. The parameter estimate shows the expected positive sign, but is significant at a 10% level for less skilled individuals only. The corresponding negative marginal effect of an increase in the underlying returns to skill index[18] is insignificant though. One explanation for this finding may be that interregional differences in wage dispersion are much smaller in Germany than in the US with the exception of east-west disparities. East-West disparities in wage dispersion, however, go hand in hand with stark mean wage disparities between both parts of Germany. For any migrant crossing the former border, interregional differences in wage dispersion may thus be of minor importance compared to the strong east-west differences in mean wages. In this case, a selection based on interregional differences of skill premia may simply not be a major determinant of destination choices in Germany[19]. Instead, selection of high-skilled individuals is mainly based on mean wage differ-

[17]I experimented with a number of specifications. When using the regional mean wage across all sector and the returns to skill indicator, both covariates turned out to be positive and insignificant. When using mean wages in individuals i's sector of activity, there were strong an significant effects. Apparently, regional mean wages across all sectors do not capture the relevant wage differentials for mobility decisions. Instead, the sector wage level appears to be more relevant.

[18]Remember that the returns to skill indicator is the product of the returns to skill differential between destination region and origin region and the individual skill differential. Since this skill differential is on average negative for the less skilled sample, the positive parameter estimate implies that this group actually avoids regions with a higher returns to skill index.

[19]By contrast, Hunt and Mueller (2004) find strong evidence in favor of the Roy selection model in the U.S. context. Apart from a higher interregional variation of skill premia, these strong findings may also reflect certain specification issues. In particular, they do not use standard errors that are robust to clustering at the regional

entials. Apparently, high-skilled individuals have stronger preferences for higher mean wages, a result that is consistent with higher labor supply elasticities among high-skilled as compared to less-skilled individuals[20]. All this offers an explanation why selection based on mean wage differentials dominates any selection based on regional differentials in wage dispersion in the German context.

According to parameter estimates for the pooled sample of less and high skilled, regions with higher unemployment levels are less attractive destinations, while higher employment growth attracts migrants. Separate estimations by skill level suggest that primarily high-skilled migrants respond to employment growth conditions whereas unemployment rates primarily affect less-skilled migrants. Differences between the corresponding marginal effects for less and high-skilled are insignificant though. In fact, for almost all parameters, establishing significant differences across skill groups turns out to be difficult due to imprecise estimates for at least one group[21]. Thus, the findings should only be interpreted as a weak evidence that destination choices differ across skill groups with regard to job-finding conditions. Moreover, table 6 reveals that these differences partially reflect differences across job status groups.

As expected, the likelihood of moving to a region significantly decreases with distance for all skill levels. Moreover, consistent with the theoretical framework, migration cost associated with migration distance appear to be larger for less-skilled than for high-skilled job changers. For less-skilled job changers, the mean wage level of a destination region that is 100km further away has to be almost 4 Euro higher in order to keep the probability of moving to this region at a constant level. For high-skilled individuals, the mean wage level only has to increase by 1.3 Euro[22]. Since the corresponding marginal effects do not differ significantly (p-value of 0.14 in table 5), this may only be interpreted as (weak) evidence that migration cost are larger for less skilled individuals.

level. When using non-robust standard errors (not shown), I also get highly significant and positive effects of the returns to skill indicator for the pooled sample. For a more conservative specification, no such effect can be found.

[20]Based on the ZEW microsimulation model, I estimate labor supply elasticities by skill groups (see Arntz et al., 2005).

[21]Using non-robust standard errors yields significantly different parameter estimates across skill groups. Due to clustering at the regional level, I consider such estimates as unreliable, however.

[22]The ratio between two coefficients A and B denotes by how much A has to change if B increases in order to keep the probability of choosing this alternative constant.

Table 4: **Nested logit estimates by skill level using both DJC and JCU, IAB-R01 1995-2001**

	Model A			Model B		
Variable	γ_{all}	$\gamma_s{}^1$	$\gamma_{hs}{}^1$	γ_{all}	$\gamma_s{}^1$	$\gamma_{hs}{}^1$
Lower level model						
Mean sector wage	0.057	0.026	0.197**	0.208**	0.163**	0.319**
Returns to skill	0.365*	0.794**	-0.258**	0.243	0.440†	0.028
Unemployment rate	-0.010**	-0.019	-0.049**	-0.037*	-0.075**	-0.049
Sector employment growth	0.018**	0.017†	-0.002	0.019**	0.000	0.009†
Log(Distance)	-1.814**	-1.960**	-1.394**	-1.573**	-1.755**	-1.114**
Population size	0.012**	0.012**	0.013**	0.073**	0.102**	0.024
Population density	-0.021*	-0.025*	-0.018*	-0.168*	-0.243*	-0.282†
Crime Rate	-0.027*	-0.020	0.000	-0.002	0.004	-0.016
Hotel capacity	0.006**	0.006*	0.005*	-0.005*	-0.009**	0.004
Child care facilities	0.016**	0.014**	0.015**	0.010**	0.008†	0.019**
Land prices	0.363**	0.313**	0.407**	0.002	0.010	-0.062
South-North migration				-0.054	-0.103	0.092
North-South migration				-0.125	-0.186	-0.002
East-West migration				0.379	0.674	-0.717†
West-East migration				-1.484**	-1.600**	-1.080**
Destination fixed effects				*X*	*X*	*X*
LL (lower level)	-78441.3	-59519.7	-18483.7	-76438.2	-57978.7	-17878.0
N (Regional moves)	35,015	25, 216	8,296	35,015	26,719	8,296
IIA fails[2] (Hausman)	16/16	16/16	16/16	16/16	16/16	16/16
IIA fails[2] (Small-Hsiao)	14/16	15/16	5/16	3/16	1/16	1/16

Continued on next page...

... table 4 continued

	Model A			Model B		
Upper level model						
Age 25-30	0.060	0.057	0.149**	0.074*	0.066†	0.175**
Age 30-35	0.085**	0.069**	0.150**	0.097**	0.077**	0.167**
Age 40-45	-0.041**	-0.022	-0.108*	-0.032**	-0.016	-0.095†
Born in East Germany	0.641	0.753†	-0.183	0.558	0.647†	-0.072
2nd wage quintile	0.017	0.063	-0.301**	0.023	0.066	-0.287**
3rd wage quintile	0.104	0.155†	-0.118*	0.110	0.158†	-0.105*
4th wage quintile	0.324**	0.370**	0.149†	0.331**	0.374**	0.157†
5th wage quintile	0.640**	0.775**	0.413**	0.648**	0.778**	0.424**
Prev. average tenure	-0.068**	-0.070**	-0.045**	-0.066**	-0.069**	-0.039**
Mth. prev. non-employed	-0.016	-0.020*	-0.014	-0.014	-0.019*	-0.012
Prev. recall	-2.173**	-2.291**	-1.242**	-2.167**	-2.286**	-1.217**
Multiple job changes	0.070**	0.100*	-0.003	0.083**	0.108**	0.009
Other covariates[3]	*X*	*X*	*X*	*X*	*X*	*X*
ζ_m	0.265**	0.28**	0.174**	0.378**	0.357**	0.632**
LL (upper level)	-85036.5	-68909.7	-15684.6	-84909.1	-68831.8	-15643.0
N (Job changes)	202,044	175,587	26,457	202,044	175,587	26,457

Significance levels : † : 10% $*$: 5% $**$: 1%

[1]S: Less-skilled individuals; HS: High-skilled individuals.

[2]Number of regions (out of 16) for which iia fails at a significance level of 5%.

[3]Includes 13 sector of activity dummies, 9 types of occupation dummies, 16 origin region dummies. γ_{all} also includes an education dummy and a dummy for JCU. γ_s and γ_{hs} only include a dummy for JCU. Full estimation results are available from the author upon request.

[4]Note: Standard errors are robust to clustering at the state level

For the pooled sample of both skill groups, parameter estimates suggest that migrants prefer regions with higher population levels, but less population density. Contrary to the theoretical expectations, however, the urban scale effect of higher population levels is insignificant for high-skilled migrants while the agglomeration effect of higher population density seems to be a disamenity for both skill groups. Thus, there is no evidence that high-skilled individuals have stronger preferences for urban scale related amenities. Using 16 states as the relevant choice set for migrants may, however, not be the appropriate aggregation level to really capture urban scale related amenities. After all, whether a region offers a rich set of consumer amenities (e.g. theaters, shopping centers, museums) may actually depend on the urban scale at a more disaggregated level[23].

While specification A suggests that regions with higher hotel capacities per resident significantly attract migrants irrespective of skill level, specification B unexpectedly suggests that less skilled individuals tend to avoid such destinations. One likely explanation for this apparent contradiction is that in the latter specification, regional fixed effects already capture the average attractiveness of the region. Thus, while A mainly uses cross-sectional variation for identifying the effect, specification B uses the time variation for identification. Since eastern states experienced a strong expansion of hotel capacities between 1995 and 2001 while western states show only few time variation, specification B is likely to capture this drastic expansion which was paralleled by an economic decline in other sectors. Thus, this indicator probably captures the worsening economic conditions in the east for less-skilled individuals.

In line with the theoretical expectations, however, public goods such as the availability of child care facilities seem to attract migrants. Moreover, the marginal effect of an increase in available child care facilities is twice as large for high-skilled than for less-skilled job changers. Thus, although marginal effects do not differ significantly (p-value of 0.18), there is weak evidence that public goods are more important for destination choices of high-skilled job changers.

Another factor that drives destination choice patterns is the former German border. Apparently, west-east migration comes with a strong disutility. Of course, this disutility may partially reflect economic disparities between both parts of Germany that are not captured by other covariates. Since there is no additional disutility of moving from the prospering south to the struggling north, however, the other covariates already seem to capture major economic disparities that affect destination choices. Therefore, the disutility of moving to Eastern Germany is likely to reflect some stigma effects that render it less attractive for someone who was born in West Germany to move to a region in Eastern Germany. This is consistent with migration intentions among West Germans in a study by Bücher et al. (2001). Accordingly, only one third of those who are willing to change residential location are also willing to move to Eastern Germany while more than 50% are willing to leave the country. Although these stated preferences may mainly capture economic motives, they are also likely to reflect some reluctance regarding west-east migration.

The lower part of table 4 shows estimates for the upper level choice between moving and staying at home. It includes the inclusive value iv_{im} which is calculated based on the lower level estimates

[23]This highlights the need to repeat the analyzes using a more disaggregated level of planning districts.

and which reflects the expected utility that an individual derives from migration. The corresponding parameter estimate ζ indicates whether pull factors are important in determining mobility decisions. Apparently, high-skilled individuals are more responsive to pull factors than less-skilled job changers. Apart from the inclusive value, there are a number of additional upper level covariates that significantly affect the mobility decision. Younger and previously well-earning job changers, for example, are more likely to be mobile while longer average tenure reduces the migration probability, probably due to the regional attachment that comes with a lengthy job tenure. Also, having been recalled previously dramatically reduces the migration likelihood since these individuals tend to be recalled locally again.

Table 5: **Marginal effects[a] (in percentage points) for model B in table** 4

Covariates	$\frac{\partial P_{ik\|m,all}}{\partial z_k}$	$\frac{\partial P_{ik\|m,ls}}{\partial z_k}$	$\frac{\partial P_{ik\|m,hs}}{\partial z_k}$	p-value[b]
Mean sector wage	1.17**	0.91**	1.79**	0.093
Returns to skill index	0.45	-0.63	0.35	0.483
Unemployment rate	-0.21*	-0.42**	-0.28	0.450
Sector employment growth	0.11**	0.00	0.05†	0.293
Log(Distance)	-8.87**	-9.84**	-6.27**	0.137
Population size	0.41**	0.57**	0.13	0.227
Population density	-0.95*	-1.36*	-1.58†	0.661
Crime Rate	-0.01	0.02	-0.09	0.279
Hotel capacity	-0.03†	-0.05**	0.02	0.186
Child care facilities	0.06*	0.05†	0.11**	0.184
Land prices	0.01	0.06	-0.35	0.279

Significance levels : $\dagger$: 10% $*$: 5% $**$: 1%

[a] Marginal effects and corresponding standard errors have been calculated as averages across all sample observations (see Train, 2002).

[b] P-values refer to test of difference between marginal effects for high- and less-skilled.

Table 6 shows separate estimation results for DJC and JCU by skill level as well as pooled estimates for less and high-skilled individuals. Comparing these disaggregated estimates to the previous results for the pooled sample of DJC and JCU allows for testing which of the previous differences across skills are robust to controlling for an individuals's job status. Contrary to the theoretical expectations, mean wage differentials have no stronger effect on employed than on unemployed migrants. Similarly, no significant differences across job status groups can be found for the effect of migration distance although point estimates suggest slightly higher migration cost associated with distance for JCU as compared to DJC. Thus, migration cost mainly seem to differ across skill-groups but not across job status groups. Other indicators such as population levels and populations density also indicate that differences rather exist across skills than across job status groups. By contrast, some findings also indicate differences across job status groups. While there has been no evidence in favor of the Roy selection model for the pooled sample of JCU and DJC, there is some evidence that less skilled JCU avoid regions with high returns to skill. Although differences across job status and skill level are insignificant, this weakly confirms the theoretical notion that avoiding regions with unfavorable wage distributions may be more important to less skilled JCU than to their previously employed counterparts. Moreover, JCU seem to be responsive to regional unemployment rates, while destination choices of DJC are significantly more responsive[24] to employment growth conditions. As hypothesized in section 4, search criteria seem to differ by job status. Apparently, generally favorable job-finding conditions, as reflected by low unemployment levels, are more important search criteria for unemployed job seekers. For DJC, employment growth conditions and thus prospects in their sector of activity appears to be more relevant for their destination choices. Since the proportion of less-skilled is much lower among DJC than among JCU, these differences across job-status groups also affect the skill composition of internal migration. Therefore, what appeared to be differences across skills in table 4 proved to be mainly differences across job status group.

Significant differences by job status can also be found regarding the regional variation in public goods and land prices. While for both of these factors, no differences across skill group could be detected for the pooled sample in table 4, table 6 and the corresponding marginal effects[25] suggest that child care facilities are a significantly more important determinant of destination choices for direct job changers than for JCU. This is consistent with the theoretical notion in section 4 that regional amenities such as the availability of certain public goods may be more relevant for destination choices of DJC than of JCU. Also, JCU and DJC significantly differ in their responses to regional price level variation. While JCU seem to significantly avoid regions with high price levels, DJC even prefer these regions. One explanation for this difference might be that moving to an expensive region immediately necessitates higher expenditures for living etc. which migrants may be less able to pay for after an unemployment period. On the other hand, higher price levels are likely to occur in amenity-rich regions. If wages are not fully compensating for regional amenity variation, differences in rents should reflect some of this variation. The fact that direct job changers prefer expensive regions while JCU rather avoid these regions may thus also be interpreted as some additional indication that direct job changers have higher amenity valuations than job changers after unemployment. According to estimates in table 4, however, no such differences can be found across skill-groups. If higher land prices attract employed migrants due to a higher level of amenities, there is no equivalent evidence that high-skilled individuals have higher amenity valuations than less-skilled migrants.

[24] Comparisons between sub-groups always refer to the marginal effects. For table 6 these are not shown but can be obtained from the author upon request.

[25] see previous footnote

Table 6: **Estimation results for nested logit model by educational attainment and previous job status (model B only)**

Variable	DJC			JCU		
	γ_{all}	γ_s	γ_{hs}	γ_{all}	γ_s	γ_{hs}
Lower level model						
Mean sector wage	0.216**	0.170**	0.309**	0.196**	0.162**	0.341**
Returns to skill	0.131	0.356	0.134	0.344†	0.425*	-0.251
Unemployment rate	-0.028	-0.050†	-0.040	-0.066*	-0.099**	-0.064
Sector employment growth	0.022**	0.014†	0.009†	0.004	-0.014	0.008
Log(Distance)	-1.525**	-1.726**	-1.081**	-1.704**	-1.825**	-1.240**
Population size	0.080**	0.110**	0.015	0.069*	0.088**	0.041
Population density	-0.228†	-0.215	-0.290	-0.147	-0.289**	-0.093
Crime Rate	-0.010	-0.002	-0.031	0.006	0.007	0.018
Hotel capacity	-0.005	-0.008*	0.003	-0.008**	-0.010**	0.007
Child care facilities	0.018**	0.015**	0.030**	0.000	0.001	-0.008
Land prices	0.042*	0.073*	-0.040	-0.066*	-0.071†	-0.124
South-North migration	0.008	-0.043	0.108	-0.161	-0.185	0.030
North-South migration	-0.087	-0.181	0.055	-0.179	-0.170	-0.195
East-West migration	0.203	0.531	-0.788*	0.709	0.918†	-0.518
West-East migration	-1.383**	-1.500**	-1.114**	-1.572**	-1.665**	-0.944*
Destination fixed effects				*X*	*X*	*X*
LL (lower level)	-49277.2	-34968.59	-13916.2	-26931.7	-22862.3	-3931.7
N (Regional moves)	22,861	16,342	6,519	12,154	10,377	1,777
IIA fails[1] (Hausman)	16/16	16/16	14/16	16/16	16/16	2/16

Continued on next page...

... table 6 continued

	Model A			Model B		
IIA fails[1] (Small-Hsiao)	1/16	1/16	1/16	0/16	2/16	0/16
Upper level model						
Age 25-30	0.070*	0.068*	0.141**	0.073	0.056†	0.305**
Age 30-35	0.084**	0.065**	0.136**	0.128**	0.095**	0.301**
Age 40-45	-0.062**	-0.030	-0.152**	0.005	0.009	0.030
Born in East Germany	0.455	0.560	-0.046	0.762†	0.822**	-0.083
2nd wage quintile	-0.006	0.058	-0.365**	0.045	0.059*	-0.092
3rd wage quintile	0.096	0.17*	-0.160**	0.114	0.123**	0.079
4th wage quintile	0.287**	0.355**	0.083	0.421**	0.399**	0.439**
5th wage quintile	0.597**	0.728**	0.360**	0.921**	0.976**	0.790**
Prev. average tenure	-0.066**	-0.069**	-0.044**	-0.049**	-0.057**	0.023
Mth. prev. non-employed	-0.020*	0.021*	-0.012	-0.007	-0.003	-0.030**
Prev. recall	-0.357**	0.333**	-0.510**	-3.228**	-3.226**	-3.067**
Multiple job changes	0.127**	0.171**	0.028	0.004	0.017	-0.053
Other covariates[2]	X	X	X	X	X	X
ζ_m	0.378**	0.340**	0.743**	0.342**	0.344**	0.311**
LL (upper level)	-53598.1	-40890.4	-12397.4	-30767.5	-27463.2	-3171.6
N (Job changes)	116,978	95,938	21,040	85,066	79,649	5,417

Significance levels : † : 10% $*$: 5% $**$: 1%

[1]Number of regions (out of 16) for which iia fails at a significance level of 5%.

[1]Includes 13 sector of activity dummies, 9 types of occupation dummies, 16 origin region dummies and an education dummy. Full estimation results are available from the author upon request.

[4]Note: Standard errors are robust to clustering at the state level

To sum up, the findings confirm some of the hypotheses developed in section 4 while others have to be rejected. As expected, the proportion of high-skilled following a particular migration path clearly increases with migration cost that are related to distance. Moreover, this finding is robust when controlling for previous job status. On the other hand, no clear evidence in favor of the Roy selection could be detected. If at all, there is some evidence of selection for less-skilled individuals that have been unemployed previously. By contrast, the average skill level of a particular migration path strongly increases with the mean wage level in the destination region even when controlling for job status. Lower unemployment rates and higher employment growth, on the other hand, attract an increasing share of high-skilled migrants. The above findings suggest, however, that these effects mainly operate through different destination choice patterns of unemployed and employed migrants. Regional variation in amenities does not have a clear effect on different skill levels since higher amenity valuations among high-skilled as compared to low-skilled individuals can neither be rejected nor clearly confirmed. Consistent with the theoretical framework, however, differences in amenity valuations can be detected across job status groups. Finally, there is one additional difference across job status groups that is worth mentioning. While preceding estimates of ζ_m imply a higher responsiveness to pull factors among high-skilled individuals, table 6 suggests that this higher responsiveness completely accrues to high-skilled direct job changers while pull factors have a similar effect on all other sub-groups.

7 Simulation Results

The preceding section has shown that destination choice patterns and the impact of pull factors on the mobility decision differ across sub-groups. This section simulates how these differences affect the skill composition of migration flows in case of an economic convergence between Western and Eastern Germany. For this purpose, I simulate mobility patterns in case of an economic convergence based on specification B in table 4. I simulate mobility patterns by using the observed wage level, returns to skill, unemployment rate and employment growth for all western states while adjusting the corresponding values for eastern states according to the following formula:

$$z_e^s = z_e + (\frac{1}{N_w}\sum_{k\in w} z_w - \frac{1}{N_e}\sum_{k\in e} z_e) \tag{9}$$

where e denotes all eastern and w denotes all western states. This simulation results in higher mean wage levels, an increasing wage variation, lower unemployment rates, increasing employment growth for high-skilled and slightly decreasing employment growth for low-skilled individuals[26] in Eastern Germany. Moreover, this mean convergence maintains regional disparities within Eastern Germany. Table 13 in the appendix shows observed and simulated values for Eastern Germany.

[26]For the period under observation, employment growth for individuals with only a high-school degree is even slightly higher in eastern than in western states, while for all other skill-groups converging conditions mean increasing employment growth.

Table 7: **Predicted mobility patterns by skill level, IAB-R01 1995-2001**

			Destination (in %)				
Origin	**Skill level**	**Obs.**	**Stay Home**	**East**	**North**	**Middle**	**South**
East	Less skilled	49,935	81.1	11.2	2.6	2.5	2.7
	High-skilled	4,862	65.3	17.8	4.3	6.7	5.9
North	Less skilled	26,550	79.6	3.5	9.5	5.5	1.9
	High-skilled	3,683	57.0	5.2	13.7	16.1	8.1
West	Less skilled	54,759	87.0	1.4	2.4	5.3	4.0
	High-skilled	10,010	69.7	2.6	5.3	11.9	10.6
South	Less skilled	44,343	89.4	1.8	0.9	4.2	3.7
	High-skilled	7.902	75.1	2.5	3.2	11.7	7.6

Table 7 shows the predicted mobility pattern based on specification B in table 4 for less-skilled and high-skilled individuals. Note that the predicted mobility pattern strongly resembles the observed pattern in table 1 which suggests some explanatory power of the econometric model. Table 8 shows percentage point differences between the predicted and the simulated mobility pattern in case of an economic convergence. Due to a much higher responsiveness to pull factors among high-skilled employed than among other sub-groups, the migration probability for high-skilled individuals strongly increases in western states and strongly decreases in eastern states compared to much weaker reactions for their less-skilled counterparts. More importantly, an economic convergence attracts migrants of all skill levels and from all regions to Eastern Germany. Pull factors are again much stronger for high-skilled than for less skilled individuals though. The probability of moving to the eastern states even more than triples for high-skilled individuals, but less than doubles for less-skilled individuals.

Table 8: **Simulated change in mobility patterns by skill level in case of an economic convergence between Western and Eastern Germany, IAB-R01 1995-2001**

			Destination (pp change)				
Origin	**Skill level**	**Obs.**	**Stay Home**	**East**	**North**	**Middle**	**South**
East	Less skilled	49,935	1.47	1.89	-1.13	-1.07	-1.16
	High-skilled	4,862	5.59	5.38	-2.79	-4.33	-3.84
North	Less skilled	26,550	-1.04	2.76	-1.59	-0.06	-0.06
	High-skilled	3,683	-4.19	10.36	-2.43	-2.46	-1.28
West	Less skilled	54,759	-0.47	1.26	0.28	-0.59	-0.47
	High-skilled	10,010	-2.77	6.14	-0.24	-1.70	-1.43
South	Less skilled	44,343	-0.60	1.26	-0.04	-0.35	-0.26
	High-skilled	7.902	-2.97	5.66	-0.39	-1.43	-0.88

As a consequence, economic convergence affects the net migration between both parts of Germany and also changes the skill composition of west-east and east-west flows. Table 9 shows the changing net migration and the changing proportion of high-skilled east-west and west-east migrants in case of an economic convergence. Moreover, it identifies the main sources of this change by looking at these indicators in case of an isolated convergence of mean wages, wage dispersion, unemployment rates and employment growth.

Table 9: **Net migration by skill-level, induced net employment change and share of high-skilled migrants between Eastern and Western Germany for various scenarios, IAB-R01 1995-2001**

	Net migration		**Net emp. change**		**Share of HS migrants**	
	LS	**HS**	**LS**	**HS**	**east-west**	**west-east**
Observed	-499	-365	-0.5 %	-2.33 %	16.5 %	11.8 %
Predicted	-614	-323	-0.6 %	-2.1 %	17.3 %	13.1 %
Isolated convergence of						
Mean wages	691	678	0.7 %	4.34 %	11.2 %	21.6 %
Skill premia	-1,404	-276	-1.4 %	-1.77 %	15.5 %	15.1 %
Unemployment rates	1,793	83	1.7 %	0.5 %	17.7 %	13.0 %
Employment growth	-1,188	-241	-1.1 %	-1.5 %	15.6 %	15.0 %
Full convergence	3,701	1,287	3.6 %	8.2 %	11.3 %	20.9 %

Note: Employees by skill level are computed based on the IAB-R01 at the beginning of the observation period (01/01/1995).

As suggested by the findings in the previous section, the increasing skill-level of west-east migration in case of a full economic convergence is mainly driven by increasing wage levels in eastern states whereas increasing skill premia or higher employment growth only weakly increase the skill-level of west-east flows. Moreover, consistent with the extended Roy selection model, increasing skill premia further reduce the number of less-skilled west-east migrants such that the net outflow even increases. By contrast, converging wage levels not only strongly increase the share of high-skilled west-east migrants, but also substantially raise net migration as has also been suggested by Burda and Hunt (2001). In case of full convergence, it is mainly lower unemployment levels that further raises the number of net migrants, but leaves the share of high-skilled migrants almost unchanged. Thus, while both lower unemployment levels and higher mean wages stop the net migration from eastern to western states, converging wage levels turn out to be the more effective means of attracting human capital to Eastern Germany.

8 Conclusion

The economic prospects of origin and destination regions as well as the equilibrating role of internal migration critically hinge on the skill composition of internal migration flows. Given the legitimate concerns regarding a brain drain from Eastern to Western Germany, understanding what drives the skill composition of migration flows is of particular concern if maintaining the viability of the eastern economy is an announced policy objective. By looking at destination choice patterns of heterogenous labor, this study has identified major determinants of the skill composition of internal migration in Germany. As a contribution to the literature, this study has also shown that this skill composition is partially driven by different destination choice patterns of employed direct job changers and job changers after an unemployment period. Using a partially degenerate nested logit analysis, this paper derives the following conclusions:

- The skill composition of internal migration in Germany is mainly determined by interregional mean wage differentials. High-skilled individuals are significantly more responsive to interregional variation in mean wages than their less skilled counterparts, a result that can be explained by higher labor supply elasticities of high-skilled individuals. By contrast, there is only weak evidence in favor of a Roy selection, a result that may be due to the fact that interregional differences in skill premia in Germany are less pronounced than in the U.S..

- While unemployed migrants avoid regions with high unemployment rates, no such effect can be found for employed migrants. This is consistent with the theoretical expectations that unemployed job search has a broader focus than employed job search such that general job-finding conditions are particularly important. These differences across job status groups also affect the skill composition of internal migration flows.

- Higher amenity valuations for high-skilled as compared to less-skilled migrants cannot be unambigously confirmed. By contrast, there is some evidence consistent with theory that voluntary movers have higher amenity valuations than involuntary movers. These destination choice patterns only marginally affect the skill composition of internal migration flows.

- As expected, the proportion of high-skilled migrants increases with migration distance suggesting lower migration cost for this skill group than for less-skilled migrants. These lower migration cost may, for example, reflect lower information cost for high-skilled individuals.

- Even 10-15 years after re-unification the former border between Western and Eastern Germany affects migration patterns. West Germans seem to be reluctant to move to eastern states beyond what is explicable by economic disparities. These stigma effects contribute to a relatively low level of west-east migration.

- Employed, high-skilled individuals are much more responsive to pull factors than all other sub-groups including high-skilled unemployed. Thus, improving destination conditions disproportionately mobilizes this group which affects the skill composition of internal migration.

These findings suggest only one effective route to attracting an increasing share of human capital to Eastern Germany: a wage convergence between western and eastern states. A simulation demonstrates that only a higher wages strongly attract high-skilled migrants to eastern states, while higher skill premia or higher employment growth only weakly increases the skill level of west-east migration. By contrast, converging unemployment levels stops the net loss of population, but leaves the skill composition of west-east migrants almost unchanged. Other routes to attracting high-skilled migrants such as investing in regional amenities proved rather ineffective. From a policy perspective, rising wage levels in Eastern Germany during the 1990s thus have been an effective means of preventing a stronger brain drain, but they did so at the cost of higher unemployment levels which mainly boosted east-west migration of less-skilled individuals. Since the continued loss of human capital at the end of the 1990s is likely to be detrimental to the future viability of Eastern Germany, some policy actions are required. Given the detrimental effect of rising wage levels on unemployment levels and outward migration, increasing mean wages can only be justified on the grounds of increasing labor productivity. In order to increase the eastern productivity level, Burda and Hunt (2001) recommend continued investments in infrastructure and a phasing out of distortions due to capital subsidies that favor certain sectors. In addition, they propose cutbacks of public work schemes that crowd out private employment and thus reduce productivity levels. If these measures help in closing the productivity gap between Eastern and Western Germany, the findings of this study support such policy action as a means of attracting human capital to Eastern Germany and to stop the continued net outward migration.

The study also points at a number of upcoming research tasks. First of all, urban scale related factors and other regional amenities are likely to vary spatially at a larger scale than the 16 German states. Therefore, the analysis will be repeated at a higher level of spatial disaggregation. Secondly, using a nested logit approach is restrictive due to its reliance on the iia assumption. Since the evidence regarding the appropriateness of this assumption is mixed, the findings need to be compared to less restrictive specifications such as a multinomial probit. Finally, due to data restrictions, the analysis leaves out a highly mobile and important labor segment, namely university graduates. Future research should examine destination choice patterns of this important segment because they strongly affect the skill composition of internal migration flows.

9 Appendix

Table 10: Definition and data source of lower-level covariates z_{ik} at the level of the Laender

Variable	Definition	1 yr Lag	Data Source[a]
Covariates with area and individual variation			
Mean sector wage[b]	Standardized mean wage in individual i's sector of activity l ($l = 1..13$)	No	A
Returns to skill[b,c]	Standardized returns to skill index times individual i's standardized skill differential	No	A
Sector employment growth[d]	Biennial employment growth in individual i's skill group	Yes	B
Covariates with area variation			
Unemployment rate	Average yearly unemployment rate	Yes	C
Log(Distance)	Log of average distance between all county capitals of any two regions	-	D
Population size	Number of residents in 100,000	Yes	E
Population density	Number of residents (in 100) per km^2	Yes	E
Crime Rate	Total offenses per 100 residents	No	F
Hotel capacity	Number of hotel beds per 1000 residents	No	E
Child care facilities	Places in day care for children and youth per 1,000 residents	No	E
Land prices	Land prices in 100 Euro per m^2	No	E

[a] A - German Microcensus 1995-2001
B - Own calculation based on IAB-R01 1993-2001 C - State Department for Employment
D - Own calculations based on known grid position of county capitals
E - Federal Statistical Office
F - European Regional Crime Database, Entorf und Spengler (2005)

[b] The mean sector wage and the standardized returns to skill index have been calculated by mainly following a methodology introduced by Mueller and Hunt (2002). Accordingly, the regional wage distribution reflects interregional differences in both skill prices and skill mix. Thus, they propose controlling for interregional differences in skill mix in order to estimate key parameters of the regional wage distribution. The standardized mean sector wage is calculated as the expected wage of the standardized wage distribution in region k. For this purpose, I first estimate a Mincerian-type wage equation for prime age males in each region k using OLS and including skills, experience, nationality, occupation type and sector of activity. I then calculate average values of all covariates for the entire sample of prime age males by sector of activity. Using these average values, I predict the standardized wage distribution for each of 13 sectors in each region k based on the estimated coefficients for k. This procedure thus controls for interregional differences in skill and experience levels and thus yields region-specific wage estimates for a standardized distribution of skills. Similarly, a region-specific returns to skills variance is estimated based on the predicted standardized wage distribution for region k. This regional returns to skills variance is divided by the returns to skills variance which is estimated across all regions using the same standardized skill distribution. Since both estimates are computed with the same sample and skill distribution, the skill mix is held constant and the ratio η_k only reflects interregional differences in returns to skills. If $\eta_k < 1 (> 1)$, the returns to skill variance in k is less than (greater than) the returns to skill variance across all regions.

[c] The standardized skill differential is calculated as $S_i = (S_i - \bar{S})/Var(S)$ with S_i as i's years of schooling and $\bar{S}$ and $Var(S)$ as the mean and the variance of schooling years in the sample (see table 12.

[d] I distinguish between employment growth for high-skilled and less-skilled individuals.

Table 11: Sample averages for lower level covariates[a] $z_{ik} = z_i d - z_i o$ by sample type[b]

Covariates	DJC and JCU		DJC		JCU	
			LS	**HS**	**LS**	**HS**
	z_{io}	z_{id}	z_{ik}	z_{ik}	z_{ik}	z_{ik}
Mean sector wage	8.34	8.47	0.136	0.063	0.171	0.107
Returns to skill index[c]	1.02	1.03	0.012	0.003	0.010	0.014
Returns to skill	0.36	0.36	-0.004	0.006	-0.003	0.030
Unemployment rate	12.25	11.75	-0.533	-0.242	-0.625	-0.494
Sector employment growth	0.88	1.17	0.249	0.334	0.289	0.429
Log(Distance)	n/a	5.39	5.37	5.503	5.35	5.453
Population size	71.83	75.55	3.883	1.554	4.648	4.643
Population density	6.00	5.82	-0.288	-0.138	0.070	-0.822
Crime Rate	8.54	8.39	-0.196	-0.095	-0.116	-0.244
Hotel capacity	28.78	29.02	0.446	0.489	-0.323	0.783
Child care facilities	40.67	40.31	-0.431	0.106	-0.569	-0.267
Land prices	0.87	0.89	0.010	0.007	-0.012	-0.037
Number of regional moves	35,015		16,342	6,519	10,377	1,777

[a] For the estimation, relative measures between destination (d) and origin region (o) are used. In order to give an impression on the magnitudes of underlying variables, the table displays destination and origin values for the entire sample and the relative measures only for the four sub-samples.

[b] DJC - Direct job changers; JCU - Job changers after unemployment; S - Skilled; HS - High-skilled

[c] The returns to skill index, i.e. the standardized returns to skill variance in region k, is not included as a covariate, but is multiplied with the standardized skill differential (see table 12) to yield the returns to skill indicator used in the estimation.

Table 12: Sample averages for upper level covariates w_{ik} by sample type

	DJC		JCU	
Covariates	**LS**	**HS**	**LS**	**HS**
Migrant	0.17	0.31	0.13	0.33
Standardized skill differential[b]	-0.30	2.21	-0.38	2.19
Age				
25-30	0.29	0.15	0.27	0.13
30-35	0.29	0.37	0.27	0.32
30-35	Reference			
40-45	0.19	0.20	0.22	0.26
Wage quintile in previous job[a]				
1st	Reference			
2nd	0.25	0.08	0.31	0.18
3rd	0.16	0.09	0.17	0.15
4th	0.10	0.19	0.07	0.17
5th	0.07	0.39	0.02	0.19
Employment history and other covariates				
Born in East Germany	0.21	0.13	0.33	0.22
Multiple job changes[c]	0.73	0.71	0.85	0.73
Prev. average tenure (yrs.)	2.91	2.44	1.74	1.76
Months prev. non-employed	1.04	0.76	2.24	1.97
Prev. recall by employer	0.01	0.01	0.18	0.03
Previous sector of activity				
Agriculture/fishing	Reference			
Primary industry	0.06	0.05	0.06	0.04
Invest. goods/engineering	0.08	0.08	0.05	0.07
Invest. goods/vehicles	0.07	0.11	0.04	0.07
Cons. goods/ food process.	0.07	0.04	0.07	0.04
Construction	0.17	0.05	0.37	0.10
Wholesale trade	0.08	0.07	0.05	0.07
Retail	0.07	0.03	0.05	0.04
Transport/Communication	0.10	0.03	0.06	0.03
Financial services	0.17	0.32	0.09	0.22
Domestic services	0.05	0.02	0.04	0.03
Social services	0.04	0.15	0.05	0.22
Public authorities	0.01	0.02	0.02	0.04
Previous type of occupation				
Agricultural work	Reference			
Blue-collar work	0.51	0.05	0.66	0.12
Salesmen	0.07	0.06	0.04	0.06
Technical work	0.06	0.35	0.03	0.29
Clerical work	0.06	0.11	0.03	0.10
White-collar work	0.05	0.26	0.02	0.16
Health-related/Teaching/Consulting	0.02	0.12	0.01	0.18
Other service jobs	0.20	0.05	0.16	0.07

[a] The wage quintile is based on the wage distribution of all full time employees observed in the IAB-R01 on January 1st of each year.

[b] The standardized skill differential is not included separately as a covariate, but is multiplied by the returns to skill index (see table 11).

[c] Indicator whether an individual contributes two or more observations (i.e. job changes) to the sample.

[d] The duration of the previous spell refers to the previous job tenure for DJC and to the unemployment period for JCU.

Table 13: Observed and simulated average unemployment, mean wage level, return to schooling and employment growth for Eastern Germany[a]

Indicator	Simulated	Observed
Mean wage in agriculture	8.70	6.17
Mean wage in primary ind.	9.37	6.63
Mean wage in inv. good/engineering	9.38	6.66
Mean wage in inv. goods ind./vehicles	10.43	7.43
Mean wage in cons. goods/food process.	8.26	6.01
Mean wage in construction	8.24	6.21
Mean wage in wholesale trade	8.65	6.34
Mean wage in retail	8.04	5.97
Mean wage in transport/communication	8.15	6.58
Mean wage in financial services	10.27	7.20
Mean wage in domestic services	6.62	5.413
Mean wage in social services	9.03	7.14
Mean wage in public authorities	9.02	6.87
Returns to skill index	1.11	0.83
Unemployment rate	10.25	17.67
Emp. growth for unskilled jobs	-4.48	-4.11
Emp. growth for skilled jobs	-0.43	-2.59
Emp. growth for high-skilled jobs	8.10	3.34

a The simulated mean values correspond to the observed mean values for western states.

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