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What Attracts Human Capital? Understanding the Skill Composition of Interregional Job Matches in Germany

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Non–technical Summary

According to the New Theory of Economic Growth, a large pool of qualified workers facilitates innovative activities within a region and fosters its future economic growth. This means that there may be gains from inward migration of skilled individuals which reinforce rather than alleviate regional economic disparities. It is therefore important to develop a more profound understanding of how the destination choices of different skill groups drive the skill composition of internal migration flows in order to explain regional disparities in income and economic growth. Given the brain drain from eastern to western Germany, this question is particularly relevant in the German context.

This paper examines the destination choice patterns of heterogenous job movers in order to identify the determinants of the skill composition of internal job matching flows in Germany. Recent European studies suggest that high-skilled individuals often relocate to high-density urban regions. The studies, however, do not clarify whether this is due to a mixture of higher urban wage premia, job opportunities or consumer amenities. This paper tries to fill this gap by investigating to what extent pecuniary and non-pecuniary factors may explain migration flows of heterogenous individuals in Germany.

The estimates suggest that spatial job matching patterns by high-skilled individuals are mainly driven by interregional income differentials, while interregional job matches by less-skilled individuals are much more affected by regional differentials in job opportunities. Regional differentials in amenities (e.g. availability of public goods such as child care infrastructure) weakly contribute to spatial sorting processes in Germany due to higher amenity valuations of job-to-job movers than job movers after unemployment. Thus, differences in destination choices by skill level are partly driven by different spatial patterns of job-to-job matches and job matches after unemployment.

The findings show that rising wage levels in eastern Germany during the 1990s have been an effective means of preventing a stronger brain drain. However, the cost of rising wages has been higher unemployment levels, the main effect of which has been to boost the east-west migration of less-skilled individuals. A simulated economic convergence between eastern and western Germany shows that higher wage levels are the most effective means of attracting human capital to eastern Germany, but that the net loss of population can only be reversed by a combination of higher wage levels and lower unemployment rates. If maintaining the future viability of eastern Germany is a pronounced policy objective, the findings in this paper thus advocate policies that foster wage convergence without further increasing eastern unemployment levels.

What attracts human capital? Understanding the skill composition of interregional job matches in Germany

Melanie Arntz*

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Abstract

By examining the destination choice patterns of heterogenous labor, this paper tries to explain the skill composition of internal job matching flows in Germany. Estimates from a nested logit model of destination choice suggest that spatial job matching patterns by high-skilled individuals are mainly driven by interregional income differentials, while interregional job matches by less-skilled individuals are much more affected by regional differentials in job opportunities. Regional differentials in non-pecuniary assets slightly contribute to spatial sorting processes in Germany. Such differences in destination choices by skill level are partly modified by different spatial patterns of job-to-job matches and job matches after unemployment. Simulating job matching patterns in a scenario of economic convergence between eastern and western Germany demonstrates that wage convergence is the most effective means of attracting human capital to eastern Germany.

Keywords: interregional job matches, destination choice, human capital

JEL classification: R23, J61, C35

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1 Introduction

According to the New Theory of Economic Growth (Lucas, 1988; Romer, 1990; Krugman, 1991), a large pool of qualified workers within a region facilitates innovative activities and fosters regional economic growth due to positive externalities such as efficient information flows and networks that convey both formal and tacit knowledge (Camagni, 1995; Maillat, 1998). Consistent with this idea, Rauch (1993) and Simon (1998) find evidence that regions with a high human capital endowment experience faster economic growth. This means that there may be gains from inward migration of skilled individuals which reinforce rather than alleviate regional economic disparities (Nijkamp and Poot, 1997). An important first step in understanding regional disparities is therefore to consider how the destination choices of different skill groups drive the skill composition of internal migration flows. Given the concerns regarding a brain drain from eastern to western Germany[1] that may reinforce regional disparities[2], this question is particularly relevant in the German context. The aim of this paper is therefore to identify major determinants of the skill composition of internal migration flows in Germany. More specifically, this study considers migration within a job-changing context by analyzing the destination choices of job movers[3]. Viewing migrants as one particular subset of job changers is a natural starting point when examining labor migration. The drawback of extending the analysis beyond labor migration to total migration is that this approach would conflate different migration motives. Restricting the analysis to the destination choices of job changers thus ensures a relatively homogeneous sample in terms of migration motives. Moreover, employment-motivated migration should also be the driving force behind the (re-)allocation of human capital. This study thus examines the factors that determine the spatial pattern of job matches of different skill groups in Germany.

So far, there has been relatively little research on the role of education in destination choice. 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 internal migration decisions in the US. According to this approach, migrants maximize their income by choosing a destination region that provides the most 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

[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.

[2] According to Burda and Hunt (2001), the eastern wage level continues to be three-quarters of the western level despite a remarkable wage convergence in the early 1990s. More importantly, the eastern unemployment level is around twice the western.

[3] As a consequence, the study only explains the probability of moving to region k conditional on changing the job (see Bartel, 1979 for a discussion). Extending the analysis to endogenously model the probability of changing jobs is not feasible with the data used and is thus left to future research.

regions with less income inequality in order to reduce the penalty attached to their lack of these skills. Chiswick (2000) and Brücker and Trübswetter (2004) argue that these predictions may be modified when introducing migration costs that are negatively related to the skill level. This may be a reasonable assumption, if high-skilled individuals are more likely to be compensated for their migration costs by their new employer. Migration costs may also be lower due to geographically broader social networks that may reduce the information or psychological costs associated with migration. As a consequence, the skill-level of internal migration flows might increase with migration distance.

Hunt and Mueller (2004) have recently modelled the destination decision as a utility-maximizing instead of an income-maximizing decision. This approach stresses the role of non-pecuniary returns from moving to a particular region. Every location offers a set of natural (e.g. climate), consumer (e.g. the variety of consumption goods and activities) and public goods amenities (e.g. school quality, infrastructure), but also comes with disamenities (e.g. pollution, crime rates). Shaw (1975) has also suggested that such non-pecuniary aspects may become more important in the migration process with increasing wealth in a society. Similarly, Brückner 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 this case, non-pecuniary factors may translate into utility differences across skill groups and offer another explanation for the skill composition of internal migration flows. In particular, recent research suggests that high-income or educated individuals tend to consume a disproportionate share of consumer amenities (Brueckner et al., 1999; Glaeser et al., 2001). Consistent with these notions, Hunt and Mueller (2004) find evidence in favor of higher amenity valuations among high-skilled migrants in the US and Canada. Based on a nested logit model of destination choice, their findings also confirm lower migration costs for high-skilled migrants and the implications of the Roy model that high-skilled individuals tend to move to regions with high skill premia. 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 relocate to high-density urban areas. Since this may be due to a mixture of higher urban wage premia, job opportunities and consumer amenities, 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 both pecuniary and non-pecuniary forces behind the skill composition of internal job matching flows in Germany. If amenity valuations differ by skill-level, including relevant non-pecuniary factors in a model of destination choice is important in order to reduce potential biases of the impact of regional income differentials. Preceding papers have tended to address this problem by including some amenity indicators

such as regional climate differentials (Hunt and Mueller, 2004) which should reduce but not eliminate biases from omitting time-constant region-specific factors. Based on a sample of job movements between 1995 and 2001 from the IAB employment subsample 1975-2001 (IAB-R01), this paper thus also contributes to the literature by including destination and origin fixed effects. This should avoid biases arising from the omission of time-constant region-specific factors (Train, 2002). Another contribution which this paper makes to the literature is that the job-matching framework enables the spatial pattern of job-to-job matches to be compared with job matches after unemployment. Spatial patterns of job-to-job matches and job matches after unemployment may differ due to different motives for changing a job. Job-to job matches are likely to be mainly voluntary and career-oriented and aim at better job matches. Destinations with good income prospects and attractive amenities may be particularly popular among job-to-job changers. By contrast, job matches after unemployment are more likely to be concerned with job opportunities. To the extent that job-to-job matches and job matches after unemployment are not equally distributed across skill groups, such differences may also affect the skill composition of internal job matching flows. This study therefore extends previous studies by examining differences in destination choices not only by skill level, but also by type of job match.

For the econometric implementation, I use a partially degenerate two-level nested logit model that distinguishes between a job change within the local area and an interregional job change to one of the destination regions. Estimation results show some major differences in the spatial pattern of job matches by skill level. Moreover, including destination fixed effects turns out to significantly affect estimation results. In a model with destination fixed effects, the spatial pattern of job matches by high-skilled individuals is mainly driven by interregional income differentials, while job matches by less-skilled individuals are much more affected by regional differentials in job opportunities. Interregional differences in wage dispersion as well as amenity differentials slightly contribute to spatial sorting processes in Germany. Differences in destination choices by skill level are, however, partly modified by different spatial patterns of job-to-job matches and job matches after unemployment. Simulating the spatial pattern of job matches in a scenario of economic convergence between eastern and western Germany thus demonstrates that converging wage levels is the most effective means of attracting human capital to eastern Germany.

The research outline of the paper is as follows. After a short theoretical discussion in section 2, section 3 and 4 introduce the data set and some descriptive evidence regarding the skill composition of internal job matching flows in Germany. Section 5 introduces the econometric specification. Section 6 discusses estimation and simulation results for an economic convergence between western and eastern Germany. Section 7 concludes.

2 A theoretical underpinning of skill sorting across space

Consider a framework in which movements between K regions are based on utility maximization. For simplicity, I assume that individual i expects to stay in the destination region for the rest of his life at the time of decision making. More specifically, I assume that the net present value of individual i's expected lifetime indirect utility of living and working in k can be expressed as follows:

$$V_{ik} = \int_0^{\infty} [\alpha_{ik} \int_0^{w^{max}} w \, dF_{ik} w + (1 - \alpha_{ik}) b_k + a_{ik}] e^{-rt} dt - C_{iok} \quad (1)$$

$$= \frac{1}{r} [\alpha_{ik} \int_0^{w^{max}} w \, dF_{ik} w + (1 - \alpha_{ik}) b_k + a_{ik}] - C_{iok} \quad (2)$$

with r as the discount rate, and o denoting the origin region of individual i. α_{ik} summarizes individual i's chances of finding and keeping a job in region k which may depend on individual i's occupation and skill level and the demand for these characteristics in region k. $1 - \alpha_{ik}$ thus denotes the probability of future periods without any wage income, but a real transfer income b_k instead that may differ across space due to regional cost-of-living differences. In case of employment, the expected real wage for individual i is given by $\int_0^{w^{max}} w \, dF_{ik} w$ which depends on the moments of the wage distribution F_{ik} in region k for individual i's characteristics. While a variance-preserving increase in the mean wage level should attract individuals irrespective of skill level, a change in the wage dispersion may induce skill sorting. According to the extended Roy selection model developed by Borjas et al. (1992), individuals select themselves into labor markets that offer a favorable wage distribution for their skill level. In particular, conditional on the mean wage, a high-skilled individual who is likely to draw wage offers from the upper quantiles of the wage distribution has a higher expected wage in regions where wage dispersion is greater across skill groups[4]. Consequently, skilled individuals should prefer destinations with a high wage inequality while low-skilled individuals with wages in the lower quantiles of the wage distribution should favor regions with a compressed wage distribution.

In addition to these pecuniary factors that determine the expected utility of moving to k, a_{ik} captures the value of all non-pecuniary benefits or costs that arise from living in region k. These include natural and consumer amenities, available public goods but also disamenities such as lack of housing space, pollution or crime rates. If amenity valuations rise with skill level, as has been suggested by the literature cited in the introduction, amenity-rich regions should be more frequent destinations for migrants with higher skill-levels. Finally, the cost of moving from the origin region o to region k c_{iok} ($c_{ioo} = 0$) can be written as a function of several

[4]This only holds if an individual ranks equally in the skill distribution across all regions. In the case of Germany, this assumption may be problematic if formal skills that have been acquired in former East Germany are less valued in western than in eastern Germany.

sub-components

$$c_{iok} = C(m_{io}, d_{iok}, mp_{iok}). \tag{3}$$

The fixed costs of leaving the origin region, m_{io}, depend on a number of individual characteristics such as age, marital status, home ownership and education. In fact, numerous studies have shown that the propensity to be mobile increases with skill level (e.g. Molho, 1987). One explanation may be geographically broader social networks among high-skilled individuals that reduce both psychological and information costs of moving. Depending on the destination region, there are additional variable costs d_{iok} and mp_{iok}. The psychological costs of migration, for example, should increase with distance (d_{iok}). Again, spatially broader social networks among high-skilled individuals may reduce these costs. mp_{iok} captures migration costs that are associated with specific migration paths. Such costs may arise if individuals perceive an additional proximity or distance between certain regions. Former West Germans, for example, might be reluctant to move to eastern Germany due to perceived differences between both parts of Germany.

One important insight of this framework is that the proportion of high-skilled individuals moving to k may be affected by skill-specific employment opportunities in region k, the level of amenities and the degree of wage inequality across skill-groups. In addition, the skill composition of migration flows may be modified by different destination choices of job-to-job movers and job movers after unemployment since the proportion of job-to-job movers varies across skill groups. For one thing job-to-job movers may be more likely to make use of career networks and other professional contacts to find a new job. Job-to-job movers may consequently experience favorable job finding conditions α_{ik} even under generally unfavorable job-finding conditions as reflected, for example, in high unemployment rates. By contrast, such general job-finding conditions may be more important for post-unemployment job movers who are less likely to have access to career networks. Secondly, I hypothesize that the different destination choice patterns of job-to-job movers and job movers after unemployment may also reflect different job changing motives. In particular, job-to job matches are likely to be mainly voluntary and career-oriented and aim at better job matches. Destinations with good income prospects and attractive amenities thus may be particularly popular among job-to-job changers. By contrast, the main migration motive for job movers after unemployment should be to re-enter the labor market and regional amenity differentials should therefore only be of secondary importance.

To sum up, this framework predicts that destination choices differ by skill level and type of job move. Thus, examining destination choices of heterogeneous individuals is the prerequisite for understanding what determines the skill composition of migration flows and thus the allocation of human capital across space.

3 Data

The analysis is based on the IAB employment subsample 1975-2001 - regional file (IAB-R01[5]). This register data set 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 self-employed individuals and tenured 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 spell of employment, the IAB-R01 includes the micro-census region of the workplace. An intraregional job move thus occurs if the workplace location of the previous and the current job is the same, while an interregional job move implies a change of workplace location across a regional boundary. Since I only observe workplace locations, any choice of regional boundaries entails a possible measurement error if individuals commute across these boundaries. In order to reduce these measurement errors, I define 27 aggregated planning districts (*Raumordnungsregionen*). Planning districts in Germany are defined according to commuting ranges and thus comprise labor market regions that are relatively self-contained. Since using the 97 planning districts for the destination choice model is not feasible, I reduced the number of alternative choices by aggregating planning districts according to an algorithm that reduces the remaining external commuting linkages between these regional planning districts. For details on the procedure see Appendix A. Based on the resulting regional classification, I define the origin and destination region of each job move. According to the definition used in the analysis, a job move occurs if there has been a change in employer[6] and the reason for ending the previous spell of employment is denoted as "end of employment"[7]. Moreover, no job move is assumed if the next spell of employment indicates the same employer and this new period of employment occurs within 90 days. This restriction ensures that recalls linked to seasonal work are for the most part not counted as job moves.

Distinguishing between job-to-job moves and job moves after unemployment poses some problems. This is because the IAB-R01 does not allow for identifying registered unemployment

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

[6]Hunt (2004) suggests that high-skilled individuals are quite likely to be interregionally 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.

[7]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.

but only contains information on the receipt of transfer payments. While all unemployed individuals who have previously been employed for at least 12 months are entitled to receive unemployment benefits for a restricted time period, subsequent time-unlimited entitlement to unemployment assistance is means-tested and thus only applies to individuals who lack other financial resources. This means that it is not possible to distinguish between those who have left the labor force and those who are still unemployed but not receiving unemployment assistance. I therefore distinguish between job-to-job moves and job moves after unemployment by using a proxy for registered unemployment (Fitzenberger and Wilke, 2004; Lee and Wilke, 2005). The resulting types of job moves are defined as follows:

1. **Job-to-job change (JJC):** 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 (UJC):** A UJC occurs if there has been a preceding transfer receipt that terminated less than 90 days before the start of employment. Gaps between previous periods of transfer receipt are no longer than four weeks and transfer receipt started within four weeks after the last spell of employment ended. Since a voluntary job quit entails a suspension period in receipt of unemployment compensation of at least 4 weeks, this last restriction ensures that UJC mostly excludes voluntary unemployment.

3. **Job change after all other states (REST):** REST comprises two types of job moves: (1) Job move without any intermediate transfer receipt but a gap of more than 90 days between both spells of employment. (2) Job move with intermediate transfer receipts that does not fulfill the UJC definition due to longer gaps before, during or after transfer receipt. In both cases, long gaps in the employment history may be due to other unobserved labor market states (e.g. self-employment, out-of labor force).

For the subsequent analysis, I use only JJC and UJC since the remaining job moves (REST) are a very heterogenous and unclear sample. I restrict the sample to job moves occurring between 1995 and 2001 since prior to 1995 there have been dramatic changes in the demarcation of eastern regions that complicate any regional analysis. Furthermore, I restrict the sample to prime-age males aged 25 to 45 years in full-time employment in order to receive a relatively homogenous sample. Despite a growing literature regarding the substantial east-west migration of women in Germany (Kröhnert et al. 2006), I exclude women from the analysis due to data restrictions. In particular, the IAB-R01 does not include information on marital status and single and married women cannot therefore be separated. Since these two groups are likely to behave quite differently, with married women often being tied movers, I decided to restrict the analysis to male job movers.

For the analysis of destination choices by skill-level, I distinguish between high-skilled job movers with a college or university degree and less-skilled individuals who are either unskilled or have vocational training[8]. In Germany, unskilled individuals with only a high-school degree comprise less than 10% of all individuals. Based on these definitions, I observe 116,978 JJC and 85,066 UJC by 26,457 high-skilled and 175,587 less-skilled individuals in the period from 1995 to 2001. Moreover, 72% of all individuals experience more than one job move within the seven year period.

4 Background and descriptive evidence

In order to give some descriptive evidence regarding differences in spatial job matching patterns by skill level and type of job change, I consider job matching between four macro-regions (north, mid, south, east) as shown in Fig. 1.

Figure 1: Four German Macro Regions

Table 1 shows average economic conditions in these regions between 1995 and 2001. There are strong disparities among the three western regions (north, mid and south) with regard to unemployment rates. While the south has unemployment rates which are much lower than the national average, the north is struggling with much higher rates of unemployment. Unemployment levels in the mid region lie somewhere between the rates in the other two regions. Eastern Germany still lags behind economically with unemployment rates around twice the average rate of the three western regions. Moreover, eastern wages continue to be one-quarter below the western wage level despite 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

[8]I address the problem of inconsistencies in the education variable in the IAB-R01 by using the IPI imputation rule that has been proposed by Fitzenberger, Osikominu and Völter (2005). This imputation rule assumes that educational degrees do not get lost and that missing values may be overwritten by previous information on the education level if available.

dispersion continues to be less pronounced in the eastern than in the western regions despite growing wage inequality in Eastern Germany since the 1990s. According to the Roy selection model, this should contribute to a positive selection of east-west migrants.

Table 1: **Average economic conditions in four German macro regions, 1995-2001**

Indicator	**East**	**North**	**Mid**	**South**
Median daily wage in euros	60.2	81.4	83.0	83.7
Wage variance index	0.84	1.17	1.06	1.01
Unemployment rate	17.9	11.0	10.4	7.5
Employment growth in %	-1.5	1.2	1.1	1.7

For details on the data sources and exact definitions of indicators see Appendix B and C.
An index of < 1 indicates below average wage variance. See Appendix C for details.

Bearing these regional disparities in mind, Table 2 shows job matching patterns by origin and skill level between these macro regions. Note that an interregional job move can occur within the same macro-region since each of these regions consist of several sub-regions. Consistent with the migration literature, high-skilled individuals are much more likely to experience an interregional move than less-skilled individuals. More importantly, destination choice patterns also differ by skill level. While high-skilled job changers are, for example, two to four times as likely to move to the south than their less-skilled counterparts, the likelihood of moving to the east is similar across both skill groups.

Table 2: **Mobility Pattern by origin and skill level, IAB-R01 1995-2001**

			Destination (in %)				
Origin	**Skill level**	**Obs.**	**Stay Home**	**East**	**North**	**Mid**	**South**
East	Less skilled	49,935	84.0	6.7	2.6	3.3	3.4
	High-skilled	4,862	69.1	12.1	4.2	8.7	6.0
North	Less skilled	28,009	82.1	3.5	6.9	5.9	1.7
	High-skilled	3,913	58.2	5.2	13.2	16.0	7.4
Mid	Less skilled	56,085	79.5	2.1	2.8	12.4	3.2
	High-skilled	10,364	58.4	3.3	5.7	23.0	9.6
South	Less skilled	41,558	83.3	2.5	1.0	3.8	9.4
	High-skilled	7,318	62.1	2.6	3.3	12.4	19.6

According to the theoretical framework of the previous section, different destination choices by skill level may partially reflect different spatial job matching patterns of job-to-job moves and job moves after unemployment since skill groups are not evenly distributed across these

types of job mobility. Fig. 2 thus displays destination choice patterns of interregional job moves not only by skill level but also by type of job move.

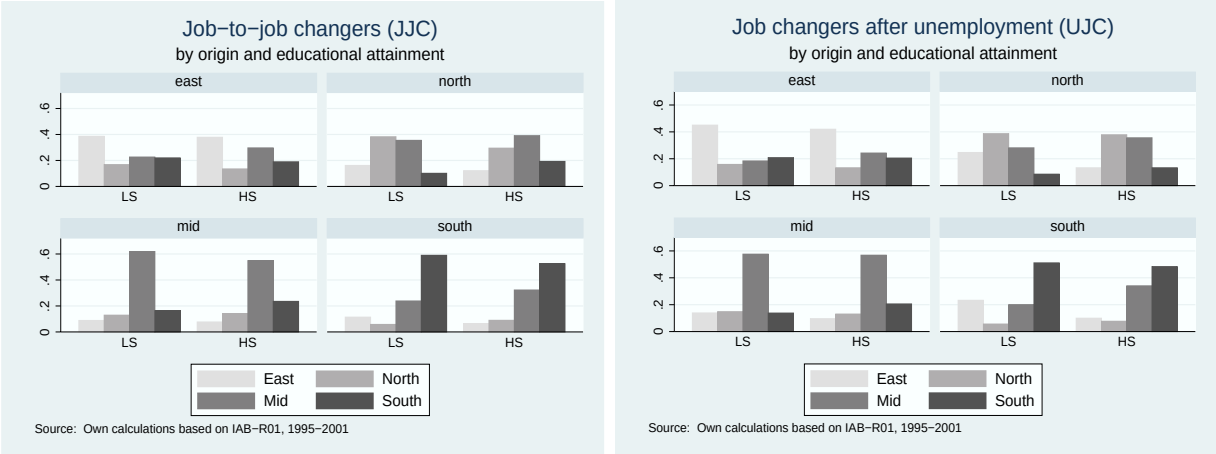


Figure 2: Destination Choice Pattern by skill level, origin and job status

According to Hotelling test statistics, differences across skill groups remain highly significant after controlling for type of job mobility. Moreover, destination choice patterns also differ significantly between JJC and UJC when controlling for skill level. This suggests that the skill composition of job matching flows in Germany may also be affected by different job matching patterns of job-to-job changers and job changers after unemployment.

Table 3: **Share of high-skilled individuals among interregional job movers between the four regions, IAB-R01 1995-2001**

	Destination				
Origin	**East**	**North**	**West**	**South**	**All**
East		13.6%	20.4%	14.7%	16.5%
North	17.2%		27.5%	37.8%	26.5%
West	22.5%	27.3%		35.7%	29.8%
South	15.5%	36.8%	26.5%		30.6%
All	18.7%	24.0%	28.6%	28.4%	24.5%

Table 3 looks at the resulting skill composition of job matching flows between the four macro regions. In particular, it shows the share of high-skilled individuals among job movers between the four regions. On average, 24.5% of all interregional job moves accrue to high-skilled individuals, but there are large differences in the skill composition of particular migration paths. The skill level of flows to the east and the north, for example, is lower than average, while the skill level of flows to the south and the mid region is above the average. Interestingly, regions

with high-skilled inward migration also tend to have high-skilled outward migration and vice versa.

The skill composition of inward and outward flows does not say much about the implied net flow of less-skilled and high-skilled individuals. Table 4 therefore looks at net migration flows and the induced net employment change by skill-level for the four macro regions. Table 4 suggests that both the east and the north experience net losses of human capital. In line with Büchel et al. (2002), the descriptive evidence thus points towards a continued brain drain from eastern to western Germany. However, the east not only loses high-skilled migrants to the south and the mid, but experiences an even larger net loss of less skilled migrants. By contrast, the mid and especially the south have positive net flows for both skill levels. For the south, the employment change that is induced by these net flows is larger for high-skilled than for less-skilled individuals.

Table 4: **Net migration flows, induced net employment change by skill-level, IAB-R01 1995-2001**

Region	**Net migration**		**Net emp. change**	
	LS	**HS**	**LS**	**HS**
East	-1447	-183	-1.40%	-1.17%
North	175	-83	0.24%	-1.25%
Mid	337	29	0.20%	0.17%
South	935	237	0.67%	1.75%

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

There is therefore a re-allocation of population from the east to the west and a re-allocation of human capital from the east and the north to the south mainly. The descriptive evidence suggests that destination choice patterns differ by skill level and type of job move. The following econometric analysis thus examines destination choice patterns of heterogeneous labor in order to identify the factors that drive these observed sorting processes.

5 Econometric specification

Partially degenerate nested logit model 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:

$$P_{iod} = P[V_{iod} + \epsilon_{iod} > V_{iok} + \epsilon_{iok}] \quad \forall\, k \neq d \tag{4}$$

with V_{ioj} denoting the observed utility for individual i of moving to region j=d,k. ϵ_{ioj} is the unknown stochastic part. Assuming independent, identically extreme value distributed error terms between all destination choices yields the logit specification which has been used by a number of recent destination choice studies (Davies et al., 2001; Schündeln, 2002). Since the simple logit representation is inappropriate if choices are related due to unobserved utility components, I choose a nested logit specification that slightly relaxes the independence assumption of the logit specification by allowing for some correlation among non-origin regions[9]. More specifically, I use a partially degenerate nested logit model that distinguishes between two upper-level branches: staying in the local area (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 thus allows for the case that all choices that involve residential mobility are related due to some unobserved migration cost, but still assumes independence between all non-origin regions in branch m conditional on all observed factors, i.e. the the Independence of Irrelevant Alternatives (IIA) assumption has to hold with branch m.

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 ($P_{ik|l}$). The conditional probability for the non-degenerate branch m can be written as

$$P_{ik|m} = \frac{exp(\gamma' z_{ik})}{\sum_{k \in m} exp(\gamma' z_{ik})} \tag{5}$$

while $P_{io|s} = 1$ for the degenerate branch. γ denotes a parameter vector. z_{ik} are covariates that vary across non-origin regions. The upper level marginal probability of migrating can be written as follows:

$$P_{im} = \frac{exp(\beta'_m w_i + \zeta_m iv_{im})}{1 + exp(\beta'_m w_i + \zeta_m iv_{im})}. \tag{6}$$

with

$$iv_{im} = ln[\sum_{k \in m} exp(\gamma' z_{ik})]. \tag{7}$$

β_m is a parameter vector that measures the effect of each individual-level characteristic w_i on the probability of migration. 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 non-origin regions, i.e. from migrating. Moreover, the inclusive value parameter ζ_m reflects the degree of independence among all non-origin regions . Since $\zeta_m = 1$

[9] A less restrictive multinomial probit that allows for correlations between all alternative choices is infeasible due to the computational burden that results from 27 alternative choices and the large sample size.

has been rejected for all estimations in the following section, the alternative choices cannot be considered fully independent such that the nested logit model turns out to be an appropriate specification. I estimate a non-normalized nested logit (NNNL) for which 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 preferred for its consistency with utility maximization if $0 < \zeta_m < 1$. The NNNL specification is consistent with utility maximizing behavior only if no coefficients are common across branches and ζ_m lies inside the interval $[0; 1]$ (Koppelman and Wen, 1998; Hensher and Greene, 2002; Heiss, 2002). Since both conditions are fulfilled in the subsequent estimations, using the NNNL specification is a feasible approach. I estimate the NNNL sequentially by estimating the lower level model and the inclusive value before estimating the upper level model. This sequential estimation 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 may be 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. Moreover, FIML was computationally infeasible for the complete sample. Since the main focus of the paper is on lower level estimates for which both point estimates and standard errors are consistent, I therefore decided to use the sequential estimation method. Both point estimates and standard errors for upper level covariates were quite similar when comparing sequential estimates with FIML estimates for some sub-samples. This suggests that the sequential estimation bias may be negligible. For all estimations, I further impose standard errors that are robust to clustering at the regional level in order to avoid downward biased standard errors (Moulton, 1990).

Upper level Covariates Upper level covariates w_i consist 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 repeatedly have been shown to affect the propensity to be mobile. However, the data set allows for capturing the individual employment history (e.g. duration of previous spells of unemployment, recall by previous employer, previous tenure, previous duration of all non-employment periods) which should at least reduce some of the unobserved heterogeneity among individuals. A long previous tenure, for example, should reflect higher mobility cost due to an increasing attachment to the region. In addition, I include origin fixed effects in order to capture differences in the propensity to be mobile across origin regions as has been shown in table 2. Appendix E contains summary statistics for all upper level covariates.

Lower level Covariates Lower level covariates z_{ik} vary across non-origin regions and are intended to capture observed utility differences between alternative destinations as suggested by the theoretical framework in section 2. As an indicator of regional job-finding conditions for individual i, I use the regional unemployment rate[10], regional employment growth in individual i's skill group and the share of high-skilled employed in region k . While the unemployment rate indicates general job-finding conditions, higher employment growth in individual i's skill group indicates improving employment prospects. Moreover, a region with a high level of qualified jobs as reflected by a high share of high-skilled employees should offer favorable job-finding conditions for high-skilled job movers. z_{ik} also includes the median wage in individual i's sector of activity as an indicator of interregional differences in the wage level[11]. Moreover, I use the ratio between the 80th and 20th wage quantile in region k as an indicator of the regional wage dispersion across skill groups[12]. According to the theoretical framework, higher wage levels should attract migrants irrespective of skill level while a higher degree of wage inequality should attract mainly high-skilled individuals. In addition to income differentials and job-finding conditions, I also try to capture a number of non-pecuniary regional differences. 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 consumer amenities. Moreover, I include the population density as a measure of agglomeration effects as suggested by Ciccone and Hall (1996)[13]. While urban-scale related amenities should be attractive for migrants, especially high-skilled ones, a denser agglomeration for a given urban scale may also capture disamenities such as pollution or lack of housing space[14]. In order to capture a specific source of disutility, I also include regional crime rates. Regional land price differentials are used as a proxy for interregional cost of living differentials. In addition, the model includes the distance between origin and destination region as a measure of variable migration costs.

Except for the distance measure, all z_{ik} are defined as differences between the standardized values for the destination and the origin region, i.e. $z_{ik} = \tilde{z_{ik}} - \tilde{z_{io}}$. This reflects the notion that destination choices are typically made by comparing potential destinations with the current

[10]Unfortunately, no regionally disaggregated unemployment rates by skill group are available.

[11]When using the regional wage level across all sectors, estimates turned out to be weaker. Apparently, interregional differences in the sector wage level appear to be more relevant for mobility decisions.

[12]Both income indicators control for different regional compositions of the labor force such that differences in these indicators reflect differences in labor prices only. Appendix C includes a short description of the methodology which is based on Hunt and Mueller (2002).

[13]In fact, Ciccone and Hall use employment density as a measure of agglomeration economies, but population densities should also be an appropriate indicator.

[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.

region of residence. As a drawback, however, this imposes the restriction that responses to changes in the origin or the destination region are symmetric[15]. Appendix B and C lists the exact definitions and data sources of all lower-level variables, while Appendix D gives the corresponding summary statistics.

Estimation results based on this specification may be biased if covariates such as employment growth and population size are endogenous due to a simultaneity issue. In order to mitigate this problem, I use lagged values for all covariates z_{ik} for which such a simultaneity issue is likely to arise (see Appendix B). 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. Unobserved characteristics of a particular migration path such as the cultural proximity between origin and destination region may, however, continue to 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 inter-German border and for movements between northern and southern Germany. 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).

Marginal effects Due to defining lower level covariates as differences between standardized values, marginal effects measure the effect of an increase in the difference between origin and destination region by one standard deviation. Thus, marginal effects of a change in z_{ik} on the conditional probability of moving to region k are comparable for these covariates and have been computed as follows:

$$\frac{\partial P_{ik|m}}{\partial z_{ik}} = \gamma_z P_{ik|m}(1 - P_{ik|m}) \tag{8}$$

For dummy variables, marginal effects have been calculated instead as $\triangle P_{ik|m}/\triangle z_{ik} = P_{ik|m,z_{ik}=1} - P_{ik|m,z_{ik}=0}$. For the upper level model, marginal effects of a change in w_i on the marginal probability of moving to region d are given as

$$\frac{\partial P_{im}}{\partial w_i} = \beta_w P_{im}(1 - P_{im}) \tag{9}$$

for continuous covariates and as $\triangle P_{im}/\triangle w_i = P_{im|w_i=1} - P_{im|w_i=0}$ for dummy variables. For both lower and upper level marginal effects, the delta method has been applied to calculate standard errors. Marginal effects and standard errors shown in the subsequent tables always refer to the average effects in the sample population (Train, 2002).

[15] A less restrictive specification with origin-specific characteristics in the upper-level model proved quite unstable such that I decided to stick to the more restrictive use of destination-origin differences.

6 Estimation Results

Following the sequential estimation procedure, this section discusses the lower level model of destination choice of interregional job moves before briefly discussing the upper level estimates for the decision as to whether to change a job intra- or interregionally. Based on these results, I then examine the implied change in the mobility pattern of job moves in case of an economic convergence between eastern and western Germany.

Lower level estimates Table 5 shows estimated marginal effects on the conditional probability of moving to destination k by skill level for the pooled sample of job-to-job moves and job moves after unemployment. Specification A includes neither destination-specific fixed effects nor dummy variables for specific migration paths while specification B includes these additional covariates. Comparing both specifications in Table 5 suggests that including a number of regional amenity indicators in specification A does not suffice to prevent biases from unobserved time-invariant interregional amenity variations. In particular, the effect of the wage level seems to be downward biased while the impact of the unemployment rate is upward biased. Estimates for the wage dispersion are upward biased for less skilled and downward biased for high-skilled individuals. This latter finding is not surprising if model A does not fully account for amenity variations and high-skilled individuals have higher amenity valuations than less skilled individuals. In this case, the compensated wage differential that we observe is smaller for high-skilled than for less-skilled individuals in amenity-rich regions such that parameter estimates should be downward biased for high-skilled migrants. The findings thus indicate that estimates without destination fixed effects may be seriously biased. Specification B also seems to be more reliable than specification A when it comes to testing the independence of irrelevant alternatives assumption by running both Hausman tests and Small-Hsiao tests (Small-Hsiao, 1985) for excluding each of the 27 regions, respectively. Table 5 shows how many of these 27 test statistics suggest that the independence assumption is incorrect. While the Hausman test mostly suggests non-independent alternatives, the Small-Hsiao test confirms the iia assumption at least for model B for almost all regions. These mixed test results suggest that estimates should be seen as a starting point only and that they need to be compared with less restrictive specifications such as multinomial probit in future research. For the subsequent analysis, unless stated otherwise, I restrict the discussion of covariate effects to the more reliable specification B. In order to examine whether the type of job move matters for the spatial pattern of job matches, table 6 thus displays estimation results by skill level and type of job move for specification B only[16].

[16]Results for specification A are available from the author upon request.

Table 5: **Lower level marginal effects**[a] $\frac{\partial P_{id|m}}{\partial z_{id}}$ **by skill level for a pooled sample of JJC and UJC (in pp), IAB-R01 1995-2001**

	Model A		Model B		
Variable	**LS**	**HS**[b]	**LS**	**HS**[b]	p-value[c]
Median sector wage	0.057	1.364**	0.532**	2.061**	0.031
Wage variation	-0.222*	-0.029	-0.382†	0.029	0.239
Unemployment rate	-0.453**	-0.153	-1.265**	-0.591	0.290
Employment growth	0.638**	0.179†	0.130	0.217†	0.572
Share of HS employment	0.703**	1.293**	0.634	-0.573	0.176
Log(Distance)	-6.446**	-4.664**	-6.131**	-4.317**	0.089
Population size	1.271**	1.365**	0.393*	0.483*	0.543
Population density	-0.222**	-0.314*	-0.228*	-0.183	0.589
Crime Rate	0.292**	0.384**	-0.045	0.097	0.417
Hotel capacity	0.252**	0.206*	-0.972*	0.533	0.144
Child care facilities	-0.091	-0.088	0.054	0.570**	0.206
Land prices	0.121	0.175	-0.135	-0.266	0.571
East-West migration			5.048	-2.048	0.681
West-East migration			-3.495**	-2.708**	0.249
South-North migration			0.384	0.479	0.903
North-South migration			-0.095	0.257	0.787
Destination dummies[d]	No	No	Yes	Yes	
LL (Lower level)	-86646.9	-28762.9	-85348.5	-28369.7	
# of regional moves	31,465	10,225	31,465	10,225	
IIA fails[e](Hausman)	27/27	23/27	26/27	15/27	
IIA fails[e](Small-Hsiao)	9/27	4/27	0/27	1/27	

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

[a] Marginal effects and standard errors have been calculated as sample averages.

[b] LS: Less-skilled individuals with high-school degree or vocational training; HS: High-skilled individuals with tertiary education.

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

[d] Additional 27 destination dummies that are not shown, but available from the author upon request.

[e] Number of regions (out of 27) for which IIA fails at a significance level of 5%.

Economic conditions As expected, interregional job changers tend to move to regions with higher wage levels in their sector of activity. Interestingly though, the last column in table 5 suggests that this effect is significantly stronger at a 5% significance level for high-skilled than for less-skilled interregional job movers. While for less-skilled individuals a one standard

deviation increase in the sector wage level in region k increases the probability of moving to k by only $0.5pp$, the corresponding effect for their high-skilled counterparts is four times as large. Consistent with higher labor supply elasticities among high-skilled as compared to less-skilled individuals[17], high-skilled individuals thus have stronger preferences for high-wage regions. Point estimates in Table 6 further suggest that the wage level is a more important determinant of destination choice for job-to-job movers than for job movers after unemployment. Differences between the two types of job movers are not significant though (p-value for high-skilled: 0.23). The estimates are, however, consistent with the theoretical notion discussed in section 2 that income prospects may be more important for career-oriented job-to-job moves than for job moves after unemployment.

There is no significant evidence in Table 5 that high-skilled job movers prefer regions with a high wage dispersion, while there is evidence that their less-skilled counterparts avoid such regions. Controlling for the type of job move in Table 6 does not alter this result. Consistent with the extended Roy model, this finding thus indicates some skill sorting based on interregional differences in wage inequality. Compared to the U.S. study by Hunt and Mueller (2004), the impact of wage inequality is relatively weak however[18]. This may be because interregional differences in wage dispersion are much smaller in Germany than in the US with the exception of east-west disparities. Such disparities, however, may be of minor importance compared to the strong east-west differences in wage levels. In this case, a selection based on interregional differences in wage dispersion may not be a major determinant of the skill composition of interregional job moves in Germany. Instead, interregional wage level differences not only affect the level of inter-state migration in Germany as suggested by Burda and Hunt (2001) but also strongly affect the skill composition of these flows.

The skill composition of interregional job flows is also affected by interregional differences in employment opportunities. More specifically, Table 6 shows that job-finding conditions differ by both skill level and job status. Irrespective of the type of job move, less-skilled individuals tend to move to regions with low unemployment rates. By contrast, significantly positive effects of employment growth can be found for job-to-job movers only. Consistent with the hypotheses in section 2, generally favorable job-finding conditions, as reflected by low unemployment levels, seem more important for less-skilled job movers who are less likely to make use of interregional career networks and thus experience strong job competition in regions with high levels of mainly less-skilled unemployed[19]. By contrast, job-to-job changers are likely to make use of career

[17] Arntz et al. (2006) estimate labor supply elasticities by skill groups for Germany based on the ZEW microsimulation model and find that labor supply elasticities for high-skilled individuals exceed labor supply elasticities for less-skilled individuals.

[18] The stronger U.S. findings may also reflect specification issues since Hunt and Mueller (2004) do not use standard errors that are robust to clustering at the regional level.

[19] Unfortunately, the unemployment rate by skill-group which would be more informative on this issue is not

networks such that high unemployment rates may be less relevant for their job destinations.

Table 6: **Lower level marginal effects**[a] $\frac{\partial P_{id|m}}{\partial z_{id}}$ **by skill level and type of job mover (in pp), IAB-R01 1995-2001**

	Less-skilled			**High-skilled**		
Variable	**JJC**	**UJC**	**p-value**[b]	**JJC**	**UJC**	**p-value**[b]
Median sector wage	0.62*	0.36	0.39	2.22**	1.42**	0.23
Wage variation	-0.24†	-0.49**	0.28	-0.06	0.35	0.32
Unemployment rate	-0.93**	-1.17*	0.56	-0.60	-0.60	0.95
Employment growth	0.49*	-0.15	0.15	0.24†	0.15	0.59
Share of HS employment	0.22	1.26**	0.21	-0.89	0.10	0.38
Log(Distance)	-6.07**	-6.25**	0.70	-4.22**	-4.68**	0.47
Population size	0.56**	0.23†	0.19	0.57**	0.22	0.37
Population density	-0.24*	-0.23†	0.78	-0.19†	-0.17	0.82
Crime Rate	0.02	-0.15	0.34	0.18	-0.20	0.30
Hotel capacity	-0.66*	-1.16**	0.16	0.37	0.95	0.48
Child care facilities	0.34†	-0.19	0.30	0.70*	0.23	0.35
Land prices	-0.08	-0.28	0.44	-0.28	-0.23	0.77
East-West migration	3.95	6.91	0.88	-2.18	-1.60	0.76
West-East migration	-3.31**	-3.63**	0.17	-2.77**	-2.43**	0.57
South-North migration	0.53	0.17	0.91	0.53	0.24	0.84
North-South migration	-0.12	-0.03	0.92	0.47	-0.39	0.84
Destination dummies[c]	Yes	Yes		Yes	Yes	
LL (Lower level)	-53615.7	-31591.5		-22410.0	-5930.1	
# of regional moves	19,906	11,559		8,093	2,132	
IIA fails[d](Hausman)	19/27	24/27		23/27	17/27	
IIA fails[d](Small-Hsiao)	1/27	2/27		0/27	0/27	

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

[a] Marginal effects and standard errors have been calculated as sample averages. See previous section for details.

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

[c] Additional 27 destination dummies that are not shown, but available from the author upon request.

[d] Number of regions (out of 27) for which IIA fails at a significance level of 5%.

available in Germany on a regionally disaggregated level.

We can conclude that interregional economic differences affect the skill composition of interregional job flows for two main reasons. Firstly, higher wage levels disproportionately attract high-skilled migrants, especially high-skilled job-to-job changers. Secondly, lower unemployment rates mainly attract less-skilled job seekers. Interregional differences in wage dispersion further contributes to skill sorting across space, but only plays a secondary role. Employment growth attracts mainly job-to-job changers irrespective of skill-level, but weakly contributes to skill-sorting due to a disproportionate share of high-skilled JJC.

Amenities and rents Table 5 contains some indication that high-skilled individuals have higher amenity valuations than their less-skilled counterparts. In particular, public goods such as the availability of child care facilities significantly attract only high-skilled job movers (marginal effect of $0.6pp$). Moreover, parameter estimates for the urban scale effect of higher population levels are not contradictory to the notion that high-skilled individuals have higher valuations of consumer amenities. Table 6 suggests, however, that evidence in favor of higher amenity valuation among high-skilled movers almost vanishes when controlling for the type of job move. Instead, both high-skilled and less-skilled job-to-job movers are significantly attracted to regions with a favorable child care infrastructure. What is more, point estimates for the urban scale effect of higher population levels are twice as large for JJC than for UJC irrespective of skill-level. Although differences between JJC and UJC are not significant[20], these results weakly indicate that JJC may have higher amenity valuations than UJC. Since JJC are relatively well-educated on average, these preferences also weakly affect the skill sorting across space. Additional indicators such as regional crime rates or land prices do not significantly affect skill composition of job flows. Similarly, a higher population density is a comparable disamenity for all sub-groups and thus also leaves the skill composition mainly unaffected.

Variable migration cost As expected, the likelihood of moving to a region significantly decreases with distance for all skill levels. Moreover, consistent with the theoretical framework, migration costs associated with migration distance are higher for less-skilled than for high-skilled job changers at a 10% significance level. In order to keep the probability of moving to region k constant if migration distance marginally increases from 100 to 101 km, the hourly wage level in k has to be 0.02 euros higher for high-skilled and 0.12 euros higher for less-skilled individuals[21]. Thus, the proportion of high-skilled following a particular migration path clearly increases with distance. According to Table 6, this finding is robust if the type of job move is

[20] 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] The change in wages that keeps the probability of moving to k constant if distance (km) increases is given by: $\frac{\partial wage}{\partial km} = \frac{\partial wage}{\partial log(km)} \frac{\partial log(km)}{km}$. Coefficient estimates are not shown, but are available from the author upon request.

controlled for.

For individuals born in West Germany, moving to the eastern part of the country is associated with a strong and significant disutility and thus additional migration costs. These costs may partially reflect economic disparities between both parts of Germany that are not captured by other covariates. Since no other migration paths yield any additional utility or disutility, however, the other covariates already seem to capture major regional disparities. Therefore, the disutility of moving to eastern Germany is likely to reflect some reluctance to cross the former border that is not explicable by observed regional disparities. Such reluctance has also been found by Büchel et al. (2001) in a study of migration intentions among West Germans. 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. Thus, at least for individuals born in West Germany, the former border still seems to exist in their minds.

Upper level estimates Table 7 shows marginal effects on the marginal probability of leaving the local region, i.e. to experience an interregional instead of an intraregional job move. The estimates include the inclusive value estimate $\hat{iv}_{im}$ from the lower level specification B. This inclusive parameter 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. High-skilled job-to-job changers appear to be more responsive to pull factors than other sub-groups. As a consequence, the share of interregional movers who are high-skilled slightly increases if other labor markets gain in attractiveness. Apart from the inclusive value, there are a number of additional upper level covariates that significantly affect the decision to change a job interregionally. Across all sub-groups, younger, better skilled and previously well-earning job changers are more likely to be interregionally mobile. The latter two findings may both reflect higher migration propensities among individuals with higher skill levels since the previous wage income is likely to capture some heterogeneity in skills that is unexplained by formal education. Among the employment history indicators, having previously been recalled dramatically reduces the likelihood of changing a job interregionally because these individuals tend to be recalled locally again and may simply not be looking for jobs elsewhere. Longer average tenure also reduces the probability of leaving the local region, probably due to the regional attachment that comes with a long job tenure. Furthermore, migration levels increased during the observation period from 1995 to 2001. This is in line with Heiland (2004) who finds that increasing migration levels coincided with a period of stagnation in eastern Germany in the mid to late 1990s. Finally, the estimates suggest a much higher probability of changing a job interregionally for less-skilled East Germans as compared to West Germans. This may reflect unfavorable employment conditions that force especially less-skilled individuals in eastern Germany to look for jobs in alternative locations.

Table 7: **Upper level marginal effects**[a] $\frac{\partial P_{im}}{\partial w_i}$ **for specification B by skill level and type of job move (in pp), IAB-R01 1995-2001**

	JJC & UJC		**JJC**		**UJC**	
Covariates	**LS**	**HS**	**LS**	**HS**	**LS**	**HS**
Age 25-30	0.86*	5.15**	1.23**	4.61**	0.27	5.19**
Age 30-35	1.08**	4.15**	1.29**	3.37**	0.80*	6.81**
Age 40-45	-0.07	-3.90**	-0.11	-4.62**	-0.07	-2.08
UJC	-1.92**	4.66**	n/a	n/a	n/a	n/a
Unskilled	-2.07**	n/a	-2.32**	n/a	-1.51*	n/a
Born in East Germany	9.27*	-3.26	9.08†	-3.36	9.26*	-2.60
2nd wage quintile	0.17	-6.27**	0.01	-7.44**	0.25	-2.48
3rd wage quintile	2.02**	-2.02*	2.69**	-3.31**	1.29	2.13
4th wage quintile	5.70**	3.87**	6.41**	2.70†	4.27**	7.54**
5th wage quintile	12.9**	9.51**	13.66**	7.58**	14.6**	18.1**
Average tenure	-0.75**	-0.87**	-0.78**	-1.05**	-0.67**	0.22
Mth. non-employed	-0.13	-0.50*	-0.28**	-0.37	-0.05	-0.70**
Prev. recall	-16.41**	-20.70**	-3.17**	-6.66*	-16.3**	-35.5**
1996	-1.00*	-0.45	-0.44	1.09	-1.18*	-5.30
1997	-0.43	1.88	-0.18	2.74*	-0.16	-0.48
1998	0.55	2.38*	0.41	2.68**	1.19†	2.21
1999	0.44	2.69†	0.85	2.93	0.45	2.66
2000	2.06**	1.82	2.24*	1.52	2.49**	5.14*
2001	1.86**	3.29*	2.35**	3.22†	1.93**	5.17†
Other covariates[b]	X	X	X	X	X	X
ζ_m[c]	0.31**	0.47**	0.28**	0.46**	0.34**	0.29**
LL (upper level)	-77495.2	-16892.4	-47106.2	-13473.5	-29812.4	-3335.4
# of job moves	175,587	26,457	95,938	21,040	79,649	5,417

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

[a] Marginal effects and standard errors have been calculated as sample averages. See previous section for details.

[b] Includes 13 sector of activity dummies, 9 types of occupation dummies, 27 origin dummies. Full estimation results are available from the author upon request.

[c] Displays coefficient estimate instead of marginal effect.

Simulation Results Based on the preceding estimation results, this section simulates how the level and skill composition of job matching flows changes in a scenario of economic con-

vergence between western and eastern Germany. This is an interesting case to study because of the continued regional disparities between both parts of Germany and the resulting loss of population and human capital in eastern Germany that has been discussed in section 4. I therefore simulate job matching patterns for a scenario of economic convergence based on specification B in table 5. I simulate mobility patterns by using the observed wage level, wage variation, unemployment rate and employment growth for all western regions while adjusting the corresponding values for eastern regions according to the following formula:

$$\tilde{z_e^s} = \tilde{z_e} + (\frac{1}{N_w}\sum_{k\in w}\tilde{z_w} - \frac{1}{N_e}\sum_{k\in e}\tilde{z_e}) \tag{10}$$

where $\tilde{z_e^s}$ refers to the simulated standardized value[22] for the eastern region and N_e (N_w) denotes the number of eastern (western) regions. This simulation results in higher wage levels, increasing wage variation, lower unemployment rates, increasing employment growth for high-skilled and slightly increasing employment growth for less-skilled individuals in eastern Germany. Moreover, this mean convergence maintains regional disparities within eastern Germany. Appendix F shows average observed and simulated values for eastern Germany.

Table 8: **Predicted mobility pattern of job changes by skill level, IAB-R01 1995-2001**

			Destination (in %)				
Origin	**Skill level**	**Obs.**	**Stay Home**	**East**	**North**	**Middle**	**South**
East	Less skilled	49,935	84.0	8.2	2.6	2.6	2.6
	High-skilled	4,862	69.1	14.8	4.6	6.2	5.4
North	Less skilled	28,009	82.1	2.7	7.5	5.9	1.8
	High-skilled	3,913	58.8	5.1	12.8	16.0	7.4
West	Less skilled	56,085	79.5	1.2	2.8	12.5	4.0
	High-skilled	10,364	58.4	2.3	5.5	22.9	10.8
South	Less skilled	41,558	83.3	1.5	1.0	4.4	9.8
	High-skilled	7,318	62.1	2.5	3.4	13.2	18.8

Table 8 shows the predicted mobility pattern based on specification B in Table 5 for less-skilled and high-skilled individuals. Note that the predicted mobility pattern strongly resembles the observed pattern in Table 2 which suggests some explanatory power of the econometric model. Table 9 shows percentage point differences between the predicted and the simulated mobility pattern in case of an economic convergence. Due to much higher responsiveness to pull factors among high-skilled job-to-job movers than among other sub-groups, the probability

[22] As discussed in section 5, lower level covariates z_{ik} refer to the difference of standardized values. The simulated standardized $\tilde{z_e^s}$ are thus used to calculate the differences in case of a simulated economic convergence.

of leaving the local region strongly increases for high-skilled individuals in western states and strongly decreases in eastern states compared to much weaker reactions for their less-skilled counterparts. More importantly, economic convergence attracts job movers 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 however. In fact, the probability of moving to the eastern states more than triples for high-skilled individuals, but less than doubles for less-skilled individuals.

Table 9: **Simulated change in the spatial pattern of job movements 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	1.38	2.15	-1.18	-1.18	-1.18
	High-skilled	4,862	5.27	6.41	-3.31	-4.47	-3.91
North	Less skilled	28,009	-0.85	2.58	-0.92	-0.61	-0.21
	High-skilled	3,913	-4.97	14.92	-3.61	-4.23	-2.10
Mid	Less skilled	56,085	-0.39	1.42	-0.17	-0.62	-0.24
	High-skilled	10,364	-2.55	8.69	-0.90	-3.49	-1.75
South	Less skilled	41,558	-0.47	1.58	-0.08	-0.31	-0.72
	High-skilled	7,318	-2.86	9.03	-0.63	-2.27	-3.27

As a consequence, economic convergence affects net job flows between both parts of Germany and changes the skill composition of west-east and east-west flows as can be seen in Table 10. Besides looking at the effects of a full economic convergence as described above, Table 10 also identifies the main sources of the simulated change by looking at the effects in case of an isolated convergence of wage levels, wage dispersion, unemployment rates and employment growth, respectively. As suggested by the previous estimation results, the increasing skill-level of west-east flows from 23.5% to 39.6% in case of a full economic convergence is mainly driven by increasing wage levels in eastern states. Higher wage inequality in eastern regions also increases the skill level of west-east flows. This is due, however, to an increasing net outflow of less-skilled job movers. 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, mainly due to an increased net migration of less-skilled job changers. Thus, while higher wage levels turn out to be an effective means of attracting human capital to eastern Germany, the net outflow from eastern to western regions can only be reversed by a combination of higher wage levels and lower unemployment rates.

Table 10: **Net job flows, induced net employment change by skill level and share of high-skilled migrants for various scenarios, IAB-R01 1995-2001**

	Net migration		Net emp. change		Share HS migrants	
	LS	**HS**	**LS**	**HS**	**east-west**	**west-east**
Observed	-1,447	-183	-1.4 %	-1.2 %	16.5 %	18.7 %
Predicted	-1,847	-154	-1.8 %	-1.0 %	16.7 %	23.5 %
Isolated convergence of						
Wage level	-376	1,675	-0.4 %	10.7 %	8.9 %	41.9 %
Wage variance	-2,812	-134	-2.7 %	-0.9 %	14.7 %	27.8 %
Unemployment rate	1,505	247	1.5 %	1.6 %	21.1 %	18.5 %
Employment growth	-1,803	-99	-1.7 %	-0.6 %	16.4 %	24.2 %
Full convergence	2,096	2,559	2.0 %	16.4 %	9.2 %	39.6 %

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

7 Conclusion

Regional economic prospects critically hinge on the skill composition of internal migration flows. Given the brain drain from eastern to western Germany, understanding what drives the skill composition of migration flows is of particular interest in the German context. By looking at destination choice patterns of heterogenous job movers, this paper has identified major determinants of the skill composition of internal job matching flows in Germany. As another contribution, this study has also shown that this skill composition is partially driven by different destination choice patterns of job-to-job changers and job changers after unemployment. Moreover, including destination fixed effects in the destination choice analysis proved important to avoid biases arising from the omission of unobserved regional characteristics. Using a partially degenerate nested logit analysis, this paper comes to the following main conclusions:

- Interregional income differentials affect the skill composition of job matching flows mainly because high-skilled job movers are much more responsive to interregional variation in the wage level than their less-skilled counterparts. There is also evidence consistent with the Roy model that less-skilled individuals avoid destinations with high wage inequality.

- Job-finding conditions affect the skill composition of migration flows because only less-skilled individuals avoid destinations with high unemployment rates.

- Higher amenity valuations of job-to-job changers compared to job changers after unemployment weakly contribute to skill sorting across space since a higher share of job-to-job-movers is high-skilled. There is no evidence in favor of higher amenity valuations among high-skilled job movers when controlling for the type of job move.

- High-skilled job movers face lower migration costs such that the proportion of high-skilled migrants strongly increases with migration distance.

- High-skilled job-to-job movers are more responsive to pull factors than all other subgroups. Improving destination conditions thus disproportionately mobilize this group which affects the skill composition of internal job matching flows.

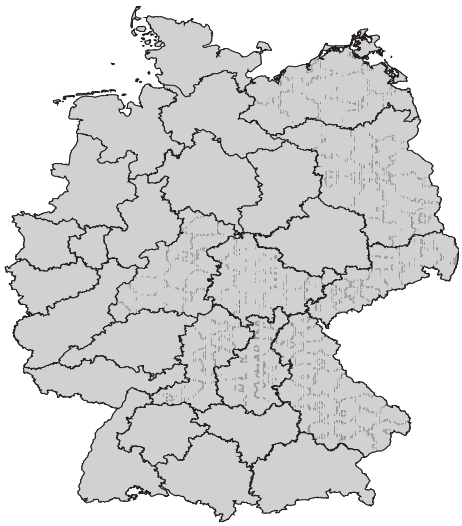
These findings imply that rising wage levels in eastern Germany during the 1990s have been an effective means of preventing a stronger brain drain. However, wages have risen at the cost of higher unemployment levels which mainly boosted east-west migration of less-skilled individuals. Simulated economic convergence between eastern and western Germany shows that higher wage levels are the most effective means of attracting human capital to eastern Germany, but that the net loss of population can only be reversed by a combination of higher wage levels and lower unemployment rates. If maintaining the future viability of eastern Germany is a pronounced policy objective, the findings in this paper thus advocate policies that foster wage convergence without further increasing eastern unemployment levels. For this purpose, policy measures such as continued infrastructure investments that help in closing the productivity gap between eastern and western Germany may be a first choice.

Finally, the study points to a number of upcoming research tasks. First of all, 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 should be compared to less restrictive specifications such as a multinomial probit. Secondly, heterogeneous destination choice patterns point to the need to extend the analysis to endogenously model the job mobility decision since the composition of job movers may change with labor market conditions. If job-to-job movers are more prevalent in boom periods, for example, job matching patterns and thus also the interregional competition for jobs may differ across the business cycle. Finally, due to data restrictions, the analysis leaves out highly mobile and important labor segments, namely single females and university graduates. Future research should examine destination choice patterns of these segments because they strongly affect the skill composition of internal job matching flows.

Appendix

A – The definition of regional boundaries for the analysis

Regional boundaries for the destination choice analysis are based on the 97 planning regions. These regional entities have been delineated by the Federal Office for Building and Regional Planning (*Bundesamt für Raumordnung und Bauwesen*) according to commuting ranges such that the majority of commutes occur within a planning region. For a feasible estimation of the destination choice model, the number of destination regions had to be reduced. For this purpose, an algorithm was used that lumps together planning regions by minimizing external commuting linkages between adjacent planning regions subject to the constraint that no more than five regions may be lumped together and that western and eastern regions remain separated. The latter restriction ensures that flows between western and eastern Germany can still be identified. External commuting linkages between the planning regions have been provided by the Federal Office for Building and Regional Planning for the year 2003. Although commuting linkages may change over time, I assume that linkages from 2003 are still quite similar to the relevant commuting linkages during the observation period 1995 to 2001. Using the described aggregation algorithm results in the following 27 aggregated planning districts:



B – Definition and data sources of lower-level covariates

Variable	Definition	1 yr Lag	Data Source[a]
Covariates with area and individual variation			
Median sector wage	Median wage in individual i's sector of activity l ($l = 1..13$)	No	A
Sector employment growth[b]	Biennial employment growth in individual i's skill group	Yes	B
Covariates with area variation			
Wage variance index	Regional wage quantile ratio divided by aggregate quantile ratio	No	A
Unemployment rate	Average yearly unemployment rate	Yes	C
Share HS employment	Share of high-skilled employment	Yes	B
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 euros per m^2	No	E

[a] A - Own calculation based on IAB-R01 1995-2001. See Appendix C for details on the calculation.
B - Own calculation based on IAB-R01 1993-2001
C - Federal Employment Agency (*Bundesagentur für Arbeit*)
D - Own calculations based on the grid position of county capitals
E - Federal Statistical Office (*Statistisches Bundesamt*)
F - European Regional Crime Database, Entorf und Spengler (2004)

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

C – Estimating moments of the regional wage distribution

The observed regional wage distribution reflects interregional differences in both skill prices and skill mix. For this reason, Hunt and Mueller (2002) control for interregional differences in the skill mix by estimating key parameters of a standardized regional wage distribution that is comparable across regions. Mainly following their methodology, I separately estimate Mincerian-type wage equations for each region k based on the IAB-R01. Since wages in the IAB-R01 are top-coded at the income level above which there is no obligation to be socially insured, I estimate a tobit model. I restrict the estimation to prime age males who are full-time employed on January 1st and include educational attainment, experience, occupation type and

sector of activity as covariates. I predict the standardized wage distribution for region k by using the entire sample of prime age males and the coefficient estimates for region k. Since the same sample is applied to each region, this procedure controls for interregional differences in skills and experience levels and thus yields a standardized wage distribution. Due to the censoring in the data, it is not possible to consistently estimate the moments of this standardized distribution. For this reason, I use percentiles which are unaffected by the censoring of the data to appropriately measure interregional wage differences. Therefore, I estimate the median wage by sector of activity as an indicator of interregional differences in the sector-specific wage levels. As an indicator of the wage variance in region k, I calculate the difference between the 80th and 20th wage quantile based on the standardized wage distribution for region k and divide it by the corresponding quantile ratio of the wage distribution when pooling all regions. If this wage variance index is larger than 1, the wage inequality in region k exceeds the average wage inequality.

D – Sample averages for lower level covariates by sub-sample

	JJC		**UJC**	
Covariates	**LS**	**HS**	**LS**	**HS**
Median sector wage	0.104	0.055	0.139	0.110
Wage variance index	0.066	0.013	0.085	0.034
Unemployment rate	-0.114	-0.057	-0.146	-0.137
Employment growth	0.026	0.028	0.038	0.043
Share of HS employment	-0.009	0.028	-0.009	0.125
Log(Distance)	5.163	5.307	5.209	5.276
Population size	0.012	0.014	0.022	0.050
Population density	0.014	0.003	0.041	0.032
Crime Rate	-0.051	-0.020	-0.066	-0.060
Hotel capacity	0.010	0.002	-0.019	0.012
Child care facilities	-0.048	0.006	-0.062	-0.050
Land prices	0.094	0.071	0.122	0.205
# of interregional moves	19,906	8,093	11,559	2,132

* Except for log(distance), all covariates refer to the difference between the standardized value for the destination (d) and the origin (o) region. Thus a value of 1 indicates a difference of one standard deviation between d and o.

** JJC - Job-to-job changer; UJC - Job changers after unemployment; LS - Less-skilled; HS - High-skilled

E – Sample averages for upper level covariates by sub-sample

	JJC		UJC	
Covariates	**LS**	**HS**	**LS**	**HS**
Migrant	0.21	0.38	0.15	0.39
Age (Reference: Age 30-35)				
25-30	0.29	0.15	0.27	0.13
30-35	0.29	0.37	0.27	0.32
40-45	0.19	0.20	0.22	0.26
Wage quintile in previous job[a](Reference: 1st wage quintile)				
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[b]	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 (Reference: Agriculture and Fishing)				
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 (Reference: Agricultural work				
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
Year of job move (Reference: 1995)				
1996	0.13	0.11	0.15	0.14
1997	0.13	0.12	0.17	0.15
1998	0.13	0.14	0.15	0.15
1999	0.15	0.17	0.15	0.15
2000	0.16	0.18	0.13	0.13
2001	0.15	0.18	0.13	0.13
# of job moves	95,935	21,040	79,649	5,417

[a] Wage quintiles of the wage distribution of all full time employees observed on January 1st of each year (Data: IAB-R01).

[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 JJC and to the unemployment period for UJC.

F – Average observed and simulated unemployment rate, wage level, wage dispersion and employment growth for eastern Germany

Indicator	$\frac{1}{N_e}\sum_{k\in e}\tilde{z}_e^s$	$\frac{1}{N_e}\sum_{k\in e}\tilde{z}_e$
Median wage in agriculture	0.50	-1.75
Median wage in primary ind.	0.49	-1.73
Median wage in inv. good/engineering	0.49	-1.70
Median wage in inv. goods ind./vehicles	0.48	-1.69
Median wage in cons. goods/food process.	0.50	-1.74
Median wage in construction	0.52	-1.80
Median wage in wholesale trade	0.48	-1.68
Median wage in retail	0.47	-1.70
Median wage in transport/communication	0.48	-1.69
Median wage in financial services	0.50	-1.76
Median wage in domestic services	0.42	-1.47
Median wage in social services	0.50	-1.76
Median wage in public authorities	0.47	-1.66
Wage variance	0.46	-1.62
Unemployment rate	-0.46	1.60
Emp. growth for less-skilled jobs	-0.39	-0.56
Emp. growth for high-skilled jobs	1.02	0.25

Note: Average simulated values for eastern regions correspond to the observed average values for western regions, i.e. $\frac{1}{N_e}\sum_{k\in e}\tilde{z}_e^s = \frac{1}{N_w}\sum_{k\in w}\tilde{z}_w$.

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