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Interregional Wage Differentials and the Effects of Regional Mobility on Earnings of Workers in Germany

Florian Lehmer

Dissertationen

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To my wife

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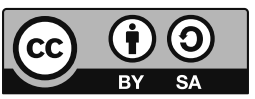

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„Nimm es als Vergnügen, und es ist Vergnügen!
Nimm es als Qual, und es ist Qual!"
Altes Indisches Sprichwort

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Leonberg, April 2010
Florian Lehmer

Introduction

Focusing on interregional wage differentials this thesis analyses the effects of mobility on the earnings of workers. Glaeser and Maré (2001) investigate the agglomeration wage differential in the US and find a raw differential of more than 30 percent. Although the urban wage premium is likely to be smaller in Germany (see, for instance, Haas and Möller, 2003), it is obvious that the wage effects of interregional mobility are strongly interrelated with the characteristics of region of origin on the one hand and region of destination on the other hand. In order to stress the role of regional characteristics for wage determination the thesis uses a classification scheme which classifies the German regions according to their population density and accessibility (see, e.g. subsection 2.2.1.) Defining mobility as changing the type of the region where the workplace is located enables the identification of the mobility effect depending on different region types.

Besides giving the best attention to the heterogeneity of regions the empirical research on wage effects of mobility has to care about the heterogeneity of workers. Workers differ in observable characteristics like gender, age or skill category and unobservable characteristics like intelligence or motivation. Moreover, they work in different firms and industries. If differences between mobile and immobile workers are systematically related then pretended gains or losses of mobility might just be an artefact of the differences of characteristics. Therefore, the thesis highlights the special importance of analyzing the heterogeneity of workers, firms and regions.

The thesis is structured as follows. **Chapter 1** gives a comprehensive review of the literature and introduces the theoretical background. **Chapter 2** examines the effects of changing the so-defined region types on earnings for different groups of workers. Using micro data (IAB employment subsamples regional files, see e.g. subsection 2.2.1 for details) the approach in this paper is to compare the earnings of mobile and immobile workers before and after a change of workplace. In the year before the change we find a significant mean wage disadvantage for prospective movers compared to their immobile counterparts. Replicating the comparison between both groups after migration we observe that the average mobile worker typically catches up with the average stayer in the region of destination or even over-compensates the former negative differential. The instantaneous improvement of their relative wage position leads us to analyze the differences of characteristics between movers and stayers. Either movers exhibit characteristics that are responsible for lower earnings in the year before migration or they are poorly rated by their employers although their characteristics are not inferior to those of stayers. In order to investigate to which extent wage (level) differentials are caused by differences in observed characteristics we use a Blinder (1973)/

Oaxaca (1973) technique for a group-specific decomposition of the raw wage differential between movers and stayers. Afterwards we check the robustness of the general results by employing a fixed-effects model and several variants of a propensity score matching approach which both control for the time-invariant part of unobserved heterogeneity.

Chapter 3 supplements the preceding section in several respects. A more restrictive sample selection for immobile workers leads to more pronounced wage differentials than in chapter 2. Presenting detailed results for the Blinder (1973)/ Oaxaca (1973) type decomposition not only for the type of the region but also for firm size, chapter 3 highlights the gender-specific differences of the migration wage differentials.

While chapters 2 and 3 concentrate on the contemporaneous effect of mobility by comparing wage levels of movers and stayers in the region of destination after the mobility took place, **chapter 4** extensively analyzes short- and long-term wage growth paths of region type movers. The empirical work is based on the employment register data 1995–2000 of the German Federal Employment Services and focuses on the subsample of skilled male workers. We restrict the reference group primarily to local job-to-job movers in order to identify the additional effect of regional mobility relative to job mobility. Since this effect might differ for young and older workers we subsequently split our sample with respect to age. Moreover, we estimate the extra returns to regional mobility depending on the type of the regions of origin and destination. Additionally, we extend our econometric models by inclusion of fixed district and establishment effects to account for region-specific amenities or price level effects and to decompose the returns to mobility into pure search gains and effects related more specifically to human capital.

Chapter 5 considers wage growth differentials separately for different sectors. Thereby, we adopt an approach of eliminating regional price level differentials. More precisely, we observe movers between regions which are roughly of the same type. That is, holding the characteristics of the region (or the type of the region) constant, this eliminates price level differentials. Then, we use a classification scheme which differentiates between 15 sectors and analyze how the extra return to regional mobility differs in this respect. Finding considerable heterogeneity of the mobility wage growth differentials across sectors, we proceed with investigating possible explanations for the observed heterogeneity. Firstly, we inspect the role of sector mobility. Secondly, we investigate whether regional mobility is systematically related to long-distance moves in some sectors and short-distance moves in other sectors. Since one can argue that wage effects of mobility are more pronounced for long-distance movers, this could explain sector-specific differences. Thirdly, we

consider the age structure on a sector level since it is obvious that the success of migration differs for young and old workers.

After having analyzed the effects of regional mobility in a very comprehensive way, **chapter 6** turns to explain the nature of interregional wage differentials. In order to do so we observe the wage growth of mobile workers again. According to Glaeser and Maré (2001) this approach allows identifying rural-to-urban wage level and wage growth effects. In fact they find evidence for both effects but they also observe that movers to cities exhibit lower wages than their immobile counterparts after several years. The authors conclude that part of the urban wage premium is due to the fostered opportunities of accumulating human capital in cities. In contrast to Glaeser and Maré (2001) we place emphasis on the interrelationship of the agglomeration wage differential and the firm-size wage premium. Since large firms are overrepresented in cities we ask to which extent the urban wage premium is driven by this overrepresentation. The observation of workers who change between region types and firms of different size simultaneously makes it possible to portion the wage level and growth effects to the urban environment on the one hand and the firm level on the other hand. Thus, conclusions on the nature of productivity enhancing knowledge spillovers can be drawn.

Finally, **chapter 7** summarizes the main results and gives some concluding remarks.

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1 Review of the literature and theoretical background

Workers move within and between employers, occupations and/or industries. Simultaneously, workers move within and between cities, districts, states and/or countries. It is obvious that the effects of mobility strongly depend on the definition of mobility. Since the effects of regional mobility are most closely related to the effects of changing the job, we start with discussing the latter. Subsection 1.2 gives then a comprehensive overview of the most influential studies dealing with wage effects of regional mobility. Besides presenting their central results we focus thereby on the implication of selectivity issues. Lastly, we develop a theoretical model which is able to explain the economic calculus behind an individuals' decision to move between different types of the region.

1.1 Job mobility

Job mobility is an important factor in an individual's work history. Topel and Ward (1992) find in their pathbreaking study that one third of wage growth in the first ten years of young men's working life is due to job mobility.[1] Using longitudinal employee-employer data they follow a cohort of male high-school graduates from their labour market entry in 1957 until the first 15 years of their employment history. Analyzing the within-job wage growth in absence of job mobility the authors estimate the following earnings function:

$$w_{jt} = H(X_{jt}, T_{jt}) + \phi_j + \varepsilon_{jt}, \tag{1.1.1}$$

where log wages (w_{jt}) are regressed on quadratic terms of labour market experience (X_{jt}) and current job tenure (T_{jt}) on job j at time t. The job-specific fixed effect ϕ_j is included to capture unobserved heterogeneity among jobs and ε_{jt} is the error term. By differencing equation (1.1.1) the fixed effect is eliminated, so the within-job wage growth can be estimated as

$$\Delta w_{jt} = \Delta H(X_{jt}, T_{jt}) + \Delta \varepsilon_{jt}. \tag{1.1.2}$$

As main result of estimating equation (1.1.2), the authors empirically find in the first ten years an annual wage growth rate of 7 percent. For labour market entrants, however, the annual growth rate is about 14 percent. This result suggests that the

1 Murphy and Welch (1989) point to the fact that wage growth in this decade accounts for two third of an individuals' life-time wage growth.

within-job wage growth declines with experience and tenure. Controlling for the duration of the current job in equation (1.1.2), they observe that wage growth rates are lower in jobs which ends within the next year. Altogether, they conclude that the job mobility decision is mainly determined by the wage growth within the current job: "Jobs that yield higher wage growth tend to survive, and sluggish wage growth is associated with impending mobility" (Topel and Ward; 1992, p. 457).[2] Turning to analyze the effects of passing from job j - 1 to job j, the between-job-wage growth is formulated as

$$E\left(w_{j,t} - w_{j-1,t-1} \mid w_{j,t+1}, w_{j-1,t-2}\right) = w_{j,t+1} - w_{j-1,t-2} \\ -E\left(w_{j,t+1} - w_{j,t} \mid .\right) - E\left(w_{j-1,t-1} - w_{j-1,t-2} \mid .\right). \qquad (1.1.3)$$

The wage growth between the valid observations for the new job $w_{j,t+1}$ and the old job $w_{j-1,t-2}$ is adjusted by within-job wage growth estimates using equation (1.1.2). According to the results of equation (1.1.3) the cumulative (log) wage gains at transitions in the first ten years amount to 0.313. Related to an estimate of cumulative wage growth in this time span of 0.947, it follows that one third of wage growth is due to job mobility.

From a theoretical point of view, the basic idea for the explanation of job mobility is that both employer and employee have ex ante imperfect information on the quality of a match between both sides. With increasing job tenure, both sides get information on the workers productivity in a given job. If the match turns out to be less productive than expected, this leads to quits (voluntary labour turnover) or lay-offs (involuntary labour turnover). Empirically, this is reflected in the negative relationship of job mobility on the one hand and job tenure on the other hand. Theoretical models which started to discuss this relationship are Johnson (1978), Jovanovich (1979), Viscusi (1979) and Wilde (1979). In these models, jobs are treated as "experience goods". In another category of theoretical models jobs are treated as pure "search goods". In these models (important early studies are Lucas and Prescott, 1974; Burdett, 1978 and Mortensen, 1978), labour turnover results from additional information being obtained for an alternative job match. Thus, the models can be categorized accordingly whether the additional information refers to the current job or to an alternative job opportunity.[3]

2 Munasinghe (2000) presents a model which provides a theoretical underpinning for this empirical fact.

3 Of course, this differentiation is not selective in all cases. For instance, Bartel and Borjas (1981) differentiate between job-related quits and quits due to personal reasons. The former include (i) dissatisfaction with wages, hours, working conditions, and/or location of his job, (ii) antipathy to fellow employees or (iii) better alternative job offer. Personal quits occur because of (i) health problems or (ii) family reasons. The authors report than young workers quit for job-related reasons while for old workers personal reasons are the decisive factor.

In the tradition of Burdett (1978) who presented a formal model of on-the-job search given wage dispersion across employers a number of search models focus on this issue. The most influential studies are Jovanovich (1984), Mortensen (1990) and Pissarides (1994). Typically, labour turnover occurs because workers move from lower-paid to higher-paid jobs with or without intervening spells of unemployment.[4] Thus, this type of models is able to explain the positive wage growth of workers after a change of employer took place.

Empirically, the finding of positive effects of job mobility on the wage growth of workers is corroborated in a firm-specific human capital framework[5] by the studies of Mincer and Jovanovich (1981), Bartel and Borjas (1981), Bartel (1980), Borjas (1981), Mincer (1986) or more recently, Antel (1991) or Farber (1994).[6] However, one has to note that the effects depend on the type of separation. Bartel and Borjas (1981), for instance, report that job-related quits have a larger positive impact than quits for personal reasons. Moreover, they find negative effects for those who were laid off. Keith and McWilliams (1999) add to the literature that being fired results in larger wage disadvantages than being laid off.[7] Since this thesis focus on the wage effects of mobility of employed workers, which include primarily voluntary moves, we do not discuss this further.

In some cases, however, also for voluntary moves one can find negative wage growth effects. Light and McGarry (1998, p. 280) find that "workers who change jobs only once in eight years receive an average wage boost of 9 % when they do so, workers who separate 3 or 4 jobs receive an average wage boost of 15 %, and workers who leave 7 to 9 jobs receive an average wage boost of only 4 %." Similar results are obtained by Munasinghe and Sigman (2004) who additionally show that the negative wage growth effect is even more pronounced for older movers. One can conclude that this group is devastatingly affected by the loss of firm-specific human capital. Similar results are already obtained by Borjas (1981). In spite of short-run gains after job separations, he finds that stayers have higher wage rates when getting older than movers. Hence, short-run advantages of job mobility become less important over the life cycle. This result can mainly be explained by disincentives for movers with a high amount of separations to invest

4 In this type of models, unemployed workers accept a job offer if the wage is above their reservation wage. Since mobility of unemployed workers is not in the focus of the thesis, we won't discuss this further.

5 The standard human capital model of migration predicts that workers migrate when the discounted value of real income available at a potential destination exceeds that at the origin by more than the costs of moving (Sjaastad, 1962).

6 All these studies use longitudinal data. By contrast, the early literature on labour turnovers consists of cross-sectional studies (e.g. Stoikov and Ramon, 1968; Burton and Parker, 1969; Pencavel, 1970 or Parsons, 1972). These studies are not discussed in this thesis.

7 The difference here is that layoffs are due to circumstances beyond the workers' control while discharges are consequences of workers' inability.

in firm-specific skills. Hence, this corroborates the view that the empirical findings regarding job mobility are consistent with the human capital interpretation.

1.2 Regional mobility

The above cited studies predominantly treat regional mobility as (not further discussed) component of overall job mobility. If regional mobility has a positive impact on the empirical results, then the effects being obtained in job mobility studies are biased upwards. The other way round, when analyzing the effect of regional mobility this implies that one should notice the pure effect of changing the job. Recent studies (see Yankow, 2003 for the US or Böheim and Taylor, 2007 for Britain) seek to disentangle both effects. Yankow (2003), for instance, finds an extra-positi ve effect of regional migration which becomes with a lag of 2–3 years for highly-skilled workers.

The bulk of studies which analyzes the effects of regional migration on earnings fails to make this distinction. To give a comprehensive overview, seventeen empirical studies are selected, and are listed alphabetically in *Table 1.1*. For each study, *Table 1.1* lists the data source, the observation period, the definition of mobility and the research population employed within the analyses. It can be seen that regional mobility is overwhelmingly defined as change of residence. This change takes place between census regions (e.g. Shaw, 1991), states (e.g. Borjas et al., 1992a; Krieg, 1997; Yankow, 1999, 2003), SMSAs/MSAs[8] (e.g. Gabriel and Schmitz, 1995; Glaeser and Maré, 2001; Hunt and Kau, 1985) or counties (e.g. Bartel, 1979; Krieg, 1997). All these studies refer to the US. In recent years, a number of studies deal with the effects of regional mobility on wages also in other countries (Böheim and Taylor, 2007 for Britain; Détang-Dessendre et al., 2004 for France; Nakosteen and Westerlund, 2004 and Nilsson, 2001 for Sweden and Pekkala, 2002 for Finland). Also here, however, the mobility definition is based on the residence information. Since wage effects of regional mobility are discussed in the light of human capital accumulation (which takes typically place on workplace and not on place of residence) and/or match quality between employer and employee, this is questionable. Related to this, Glaeser and Maré (2001, p. 324) state: "Ideally, we would consider only the effect of workplace location." Nakosteen and Zimmer (1980, 1982) are the only ones who use a concept of mobility based on workplace.

Furthermore, *Table 1.1* shows differences regarding the research populations. This accompanies the chosen data source. Eight of twelve US studies use the National

8 SMSAs stand for Standard Metropolitan Statistical Areas. Over time, this concept was replaced by a similar concept focusing on MSAs (Metropolitan Statistical Areas).

Longitudinal Survey of Youth, primarily the NLSY79, as data source. The NLSY79 is a nationally representative sample of 12,686 men and women (male-female share about 50:50) born between 1957 and 1964. From 1979 to 1994, these individuals were interviewed annually and biennially thereafter. Hence, the data source includes detailed longitudinal records of the employment history of each respondent. Besides the drawback that the geographical coding refers to place of residence only, one observes relatively low observation numbers. Moreover, though the information on female workers is available, most studies focus on male workers (in the NLSY initially 6,403 persons). Evidence for female workers and older persons is rare.

Though the cited studies predominantly concentrate on the same research population of young male workers and use similar definitions of mobility, the empirical evidence is not uniform. Primarily, this is due to the fact that the studies deal differently with unobserved heterogeneity (selection/endogeneity issues). Because of its crucial importance, we take a brief time-out to discuss the problem.[9] Staying as simple as possible, in all cited studies the question of interest is: does mobility pay for persons who move? Describing the mobility decision of an individual i with $D_i = \{0, 1\}$ and denoting the wage of a person with W_{1i} if he had moved ($D_i = 1$) one wants to know whether W_{1i} is higher than the wage in a situation where the person had not moved ($D_i = 0$). The latter is, of course, hypothetical/counterfactual and denoted with W_{0i}.[10] Hence, one is interested in the causal effect of mobility which formally is

$$W_{1i} - W_{0i}. \tag{1.2.1}$$

Because both outcomes are not observable for any given individual, the effect of mobility is therefore measured instead by comparing average wages of those who move (movers) and those who don't move (stayers). Formally, this is

$$E[W_i \mid D_i = 1] - E[W_i \mid D_i = 0]. \tag{1.2.2}$$

The drawback of comparing average wages conditional on the migration status is that the observed difference in average outcomes indeed includes $E[W_{1i} \mid D_i = 1] - E[W_{0i} \mid D_i = 1] = E[W_{1i} - W_{0i} \mid D_i = 1]$, which is the average effect of mobility on wages for those who move (= *average treatment effect on the treated*), but also an additional effect $E[W_{0i} \mid D_i = 1] - E[W_{0i} \mid D_i = 0]$. This latter effect is called

9 The "favourable self-selection hypothesis" has been introduced in the migration literature by Chiswick (1978). To discuss this issue, we orientate on Angrist and Pischke (2009), who give an excellent description of the problem.

10 The idea to imagine hypothetical situations dates back to Rubin (1974, 1977). Holland (1986) further develops Rubin's idea of potential outcomes and referred to it as the Rubin causal model.

selection bias. It measures the difference of average wages of movers and stayers in a hypothetical situation where both groups had not moved. Hence, the important question is whether both groups differ independently from the migration status in any respect or not. This is the same as: is selection into treatment and control group completely random or not? If, for instance, highly-skilled high-wage earners are likely to move and low-skilled, low-wage earners are likely to stay, then a pretended positive effect of mobility may in truth be only due to this bias. Though skill level is a variable which one is able to control for in regression analysis (we come to this point below) there might be other wage determining factors which are not observable. Chiswick's self-selection hypothesis asserts that prospective migrants assess greater innate ability and motivation, which are both not observable, but highly correlated with earnings (see also Greenwood, 1997 and others). One can argue that these highly motivated persons initially expect higher wage after a move than persons with more unfavourable (unobservable) characteristics (see, for instance, Falaris, 1988 or Linneman and Graves, 1983).[11] Hence, prospective movers are possibly more likely to benefit from a move than persons who stay, that is, the mobility decision is endogeneous (this means that D_i depends on potential outcomes).

The existence of a selection problem in mobility wage analyses is corroborated by a number of studies (see, for instance, Nakosteen and Zimmer, 1980, 1982; Robinson and Tomes, 1982; Borjas et al., 1992b; Gabriel and Schmitz, 1995 or Pekkala, 2002). Other studies (see, for instance, Hunt and Kau, 1985, Krieg, 1997 or Axelson and Westerlund, 1998), however, find no evidence of self-selection. Détang-Dessendre et al. (2004) reach the conclusion that one has to differentiate: while high-skilled workers in France are self-selected, low-skilled workers are actually not. Thus, one can argue that selectivity issues have to be considered very carefully with respect to the observed research population.

Basically, there are several ways to solve the selection problem. Angrist and Pischke (2009, p. 15f) show that random assignment is one of them. If D_i is independently from W_{0i}, then

$$E[W_i \mid D_i = 1] - E[W_i \mid D_i = 0] = E[W_{1i} - W_{0i} \mid D_i = 1] + E[W_{0i} \mid D_i = 1] - E[W_{0i} \mid D_i = 0] \quad (1.2.3)$$

11 Besides wages, the other main determinant for regional mobility is unemployment (see Herzog et al., 1993 for an excellent survey on studies analyzing the impact of personal unemployment on migration or see, more recently, Antolin and Bover, 1997 or Eliasson et al., 2003). Of course, there are other determinants as well, for instance regional amenities (see Hunt, 1993 for a survey on the relationship between location-specific amenities and the propensity to migrate, or, more recently, Glaeser and Shapiro, 2003), education and age (see Polacheck and Horvath, 1977 or Plane, 1993) or family ties (since Mincer, 1978 a large literature, which is referred to below, deals with this issue).

becomes

$$E\,[W_i \mid D_i = 1] - E\,[W_i \mid D_i = 0] = E\,[W_{1i} - W_{0i} \mid D_i = 1], \tag{1.2.4}$$

where selection bias is eliminated. This first theoretical solution of the problem can, however, not be implemented in practice (forced settlements of randomly chosen individuals would be an undesirable experimental design).

Practicable ways of analyzing the effects of mobility in absence of random assignment (using observational data) are fixed effects- (diff in diff-) or instrumental variable-approaches. Generally, regression analysis estimates an equation of the form

$$W_i = \alpha + \rho D_i + \eta_i, \tag{1.2.5}$$

which is equivalent to $W_i = E\,(W_{0i}) + (W_{1i} - W_{0i})D_i + (W_{0i} - E\,(W_{0i}))$. If the regressor D_i is correlated with the error term η_i, then the effect of mobility ρ is affected by self-selection bias. Assuming that the whole correlation stems from ability A_i, then $\eta_i = A_i'\gamma + \upsilon_i$. If ability A_i is observable then one can include it in equation (1.2.5), which yields

$$W_i = \alpha + \rho D_i + A_i'\gamma + \upsilon_i, \tag{1.2.6}$$

Hence, the error term is uncorrelated with D_i and coefficients for ρ are unbiased. A problem arises if A_i is unobservable (as initially suggested by Chiswick, 1978). A way to solve this problem is the method of instrumental variables (IV). The idea is to find a variable z_i which has a clear effect on the mobility variable D_i, but which has no effect on wage W_i besides via D_i. The latter (this is equivalent with $Cov = (\eta_i, z_i) = 0$) is called exclusion restriction.[12] If the restriction is satisfied it follows that

$$\rho = \frac{Cov\,(W_i, z_i)}{Cov\,(D_i, z_i)} = \frac{Cov\,(W_i, z_i)/V(z_i)}{Cov\,(D_i, z_i)/V(z_i)}, \tag{1.2.7}$$

i.e. one obtains a covariate-adjusted estimator for the effects of mobility on earnings.[13] Since "good instruments are hard to find, however," (Angrist and Pischke, 2009, p. 221) a more promising way to eliminate selection bias is

12 Examining several studies listed in *Table 1.1*, it can be seen that this exclusion restriction is not met in many cases.

13 The most common used IV approach is two-stage least squares (2SLS). Other IV methods are limited-information maximum likelihood (LIML) or generalized method of moments (GMM). Detailed descriptions of the IV approaches are, for instance, given in Greene (2002), Wooldridge (2002) and Angrist and Pischke (2009).

the individual fixed effects approach which is equivalent to a first differences approach in a two-period model. The idea is quite simple: If unobserved ability A_i is constant over time then analyzing wage differences instead of levels eliminates the bias. This approach is discussed in detail in section 4.2 and therefore not elaborated here.

Turning back to the individual studies listed in *Table 1.1*, we focus now on the estimation method and the main results of each study. Specifically, we consider whether the results are likely to be influenced by selectivity bias. Starting in alphabetical order, Bartel (1979) was the first who tried to disentangle the effects of regional mobility and job mobility. She differentiates between types of moves by including a number of interactions dummies additionally to the migration dummy in a wage growth regression.[14] The interactions are: an individual 1. quit and migrate; 2. was laid off and migrate. 3. migrate but didn't change employer; 4. quit, but didn't migrate. 5 was laid off but didn't migrate. She finds that workers achieve the highest wage contemporaneous growth rates when they migrate but didn't change the employer (3.). Besides these gains from non-local employer-transfers, the effects of migration are also positive in the NLSY sample for young migrants who quit (1.). Lay-off related moves generally lead to negative contemporaneous wage growth rates. The author concludes, that "one must take account of job mobility in studying the determinants and consequences of the decision to migrate" (Bartel, 1979, p. 786). Though her study is outstanding because of early accentuating the link between regional mobility and job mobility she fails to discuss the selection problem. As pointed out above, the problem might be dampened, however, by analyzing wage growth rates instead of wage levels.

Continuing in alphabetical order in *Table 1.1*, Böheim and Taylor (2007) try both, to disentangle migration and job mobility effects as well as accounting for the selection problem. Orientated on Bartel (1979) and Yankow (2003) they employ an IV approach (the instruments are age of the youngest child and whether the person reported wanting to move house in the year before migration) and find a 2.4 percent wage growth premium of migrants over non-migrants (the reference group moved within a local authority) in the year after migration. Restricting the analysis on job changers, the contemporaneous wage growth premium amounts to 3.8 percent. The increase of the premium may have two reasons: either migrants who change jobs are better off than migrants who change the residence only, or, non-migrants who change jobs are worse off than non-migrants keeping their job. The observation that the premium decreases to 2.8 percent when further restricting the sample on

14 Further explaining variables in the wage growth regressions are education, experience, marital status, wife's labor force status and income, presence of school children, tenure, length of residence and unemployment experience.

continuously employed workers adds no further information in this respect. In order to concentrate on labour market related moves the authors repeat the IV-estimates by defining migration now as moving for job-related reasons.[15] While the premium for local job changers remains unchanged, the corresponding value increases up to more than 4 percent for the continuously employed sample. If the job-change restriction is offset, however, the wage growth premium for continuously employed job-related movers is 1.7 percent, only. The latter result can be compared to the result of an individual-specific fixed effects approach. The authors include this approach to investigate medium-term wage growth effects up to 3 years after migration. Now, they find a contemporaneous wage growth premium of 6 percent, i.e. the premium has tripled. In subsequent years, the premium is positive as well but statistically not significant different from zero. We can learn two things from these results: Firstly, if they are reliable,[16] migrants are positively self-selected and the bias is sizeable (since the positive contemporaneous wage growth differential is larger in the fixed effects approach than in the IV estimates); secondly, similar to Bartel (1979) they find the contemporaneous premium to be most pronounced for job related moves. Extending Bartel's study by considering longer-lasting effects as well, this brings no further insights since the coefficients are not significant.[17] The authors' interpretation of the results being in accordance with those of Yankow (2003) who actually found positive and statistically significant long-term premia is questionable.

Fitting perfectly with regard to the content, we jump in *Table 1.1* and come to Yankow (2003). He focuses on wage growth differentials between migratory and non-migratory job changers. His central result is obtained from fixed effects estimates and indicates that highly skilled workers benefit from notable wage growth premia which take an effect with a lag of 2 years. This premium increases up to 10 percent within the five year post-migration period. For low-skilled workers, however, the effects are completely insignificant. To accounting more accurately for selectivity

15 149 migrants (i.e. 28 percent) move for job-related reasons. The remaining 72 percent are now added to the reference group. Unfortunately, this complicates the interpretation of the results.

16 But it is questionable whether this is the case for the IV results. A glance at the first stage results of the IV approach shows, for instance, that the age of the youngest child variable is statistically not significant different from zero in five of six cases (see Böheim and Taylor, 2007, p. 115). From theoretical considerations this is not surprising because it is not clear why the decision to migrate (note that the alternative is moving house within region) should be substantially affected by a child being below school age. The other instrument (individual reported wanting to move house) is also questionable. One could simply imagine that persons who want to move house in the next year are likely to work harder than others. If this affects not only the working hours (which is controlled for) but also work intensity, then the instrument is likely to be correlated with the error term of the wage equation and therefore not sufficient.

17 Probably, this is partly due to low observation numbers.

issues,[18] he applies the two-step procedure developed by Heckman (1979) and contrasts the results to those applied from first differencing.[19] For highly-skilled individuals the results demonstrate that the contemporaneous returns remain unaffected by the selectivity correction (they are still statistically not different from zero). For low-skilled persons, however, the short-term effect is now positive in the first differences approach which is in contrast to the long-term analysis (the contemporaneous effect of the long-term analysis was not significant). It becomes insignificant, however, in the two-step approach. Unfortunately, since inverse Mills ratios are not documented in the paper and because the exclusion restrictions are not discussed, the importance of the correction is not clear.[20] Moreover, the conclusion that low-skilled workers benefit from migration immediately after a move is very astonishing.

In a predecessing paper, Yankow (1999) demonstrates that coefficients of OLS estimates are actually higher (by 1–2 percentage points) than those of a fixed effects model. Not differentiating for skill categories he find in the latter model statistically significant wage growth rates which increase up to 5 percent in the five year post-migration period. Altogether, the results of both studies support the view that self-selection bias can be eliminated by individual fixed effects estimates. Moreover, it turns out that gains from migration considerably differ by education groups.

A differentiation of educational categories is also given by Détang-Dessendre et al. (2004) for France. After employing 2SLS, they find for both, highly-skilled and low-skilled young male workers slightly negative wage effects of migration which are statistically not different from zero. Since selectivity issues play a role for highly-skilled individuals and not for low-skilled individuals one can still conclude that skill-specific differences persist.

Gabriel and Schmitz (1995) estimate OLS regression of Mincer-type wage level equations and find earnings advantages of prospective mover over prospective stayers. Although all their results for different years from 1985 to 1990 are

18 Though fixed effects models presents unbiased results if the time-invariant components of the error term are the only components which are correlated with the migration decision, there might be a transitory component of the error as well which is still correlated with the migration decision.

19 For two periods (this is the case here), first differencing is equivalent to the fixed effects approach.

20 Inspecting the paper very deeply the exclusion restrictions in the first stage are most probably number of children and home ownership. As in IV-estimates, the exclusion restrictions should not be correlated with the error term of the wage equation. But this is highly implausible for both restrictions. Home owners are, for instance, wealthier on average, have wealthier parents or have better access to education and job search networks. It is not evident that these effects can be eliminated by control variables like education. Workers with better access to job referral networks may be more productive in exploiting search or mobility rents. As long as the researcher cannot control for these issues (parents' wealth, access to job referral networks) home ownership cannot be justified as a valid and powerful instrument. Similar arguments apply to the other exclusion restriction, i.e. number of children present in household. The number of children becomes important for productivity and wages if couples optimize household income jointly. If, e.g. one of both partners stays at home and takes main responsibility for child care, the other is likely to increase working time and work intensity (for the latter one can hardly control).

statistically not different from zero (on a 5 percent level), they dare to conclude that migrants are positively self-selected.

Besides Yankow (2003), the most influential paper for this thesis is probably Glaeser and Maré (2001). In order to analyze the nature of the urban wage premium in the US, they consider young male workers moving between different type of the region, i.e. metropolitan and rural areas. They employ an OLS approach and an individual specific fixed effects model and reveal in both models positive short- and long-term effects for rural-urban movers amounting up to 12 percent after 3–5 years. For urban-rural movers the coefficients are statistically not different from zero in the long run. One can conclude from their results that the effect of regional mobility is positive and that selection bias is negligible.

A further way to control for selection bias was introduced in mobility analysis by Ham et al. (2004). They use several versions of a propensity score matching approach[21] and apply it for different skill groups and definitions of migration. As in Yankow (2003), the reference group consists of non-migratory job-to-job changers. Applying a distance-based definition of mobility they find the contemporaneous additional effect of regional mobility relative to job-mobility to be zero. The skill differentiation reveals that the effect is quite heterogeneous: It is about +10 percent for college graduates and –12 percent for high-school dropouts. For other definitions of mobility the effects are about +8 percent and –7 percent respectively. Since the statistically significance of the results is very limited (due to high sen sitiveness with respect to choice of bandwith parameter and matching estimator and due to low observation numbers) the interpretation has to account for this.

Hunt and Kau (1985) differentiate the sample of young male workers by type of migration (new and repeat). Employing the Heckman procedure they find the selectivity term to be insignificant. Results of GMM approach reveal – somewhat contradicting to the results of other studies – that returns to mobility are positive for repeat movers (12 percent) and about zero for first-time migrants.

Similarly to the last-mentioned study, Krieg (1997) incorporates the selectivity correction from a first stage probit equation of migration into a second stage earnings function. He finds also that the selectivity term is statistically not different from zero and concludes that "self-selection bias may not be a serious problem in these estimations" (Krieg, 1997, p. 14). As Bartel (1979), he differentiates between types of moves by including a number of interactions dummies capturing a simultaneous change of employer, occupation or both. The results indicate that contemporaneous returns are statistically significantly positive only for those

21 We refer at this point to chapter 2 where this approach is applied as sensitivity check. Please note that the influence of endogeneity bias on the results cannot be quantified with this approach.

movers who change occupation. In succeeding year, however, the effect vanishes. Altogether, the author concludes from his results that firm- and occupation-specific human capital are important factors for the future wage growth of workers.

The finding of insignificant selectivity terms is contradicted by Nakosteen and Westerlund (2004) for Sweden. In a 2SLS approach they find the selectivity parameter in the first stage probit to be statistically highly significant and negative. One can conclude from this result that returns to migration would be biased downwards without selectivity correction. This finding of movers to be negatively self-selected can be seen as diametrically opposed to the bulk of studies which discovers the selection bias to be positive. Turning to the effects on earnings one can conclude therefore that migration has positive effects for those who move.

For the U.S., Nakosteen and Zimmer (1980) employ a similar approach and find most interestingly, that selectivity does not affect the group of movers, but the reference group of stayers. They conclude that individuals decide to stay if – partly due to a relatively high level of current earnings-future wage growth in other location is expected to be moderate. In Nakosteen and Zimmer (1982) they extend their previous study by including the additional dimension of industry changes. Somewhat surprisingly, they now find the selectivity term in the migrant equation to be statistically significant. Also for industry changers they interpret their results as strong evidence for the self-selection hypothesis.

A discussion of self-selection bias is lacking in Nilsson (2001) who estimates wage growth regression for movers and stayers in Sweden. Because of her deep investigation of gender-specific differences as well as the influence of household structure on the migration wage premium the study accomplishes to be contained in *Table 1.1*. According to her results, the wage growth differential of movers over stayers is most pronounced (in the order of 15 percent) for single men without children. Contrarily, for an equivalent group of female movers, gains are distinctly smaller amounting to 4 percent only. Moreover, it turns out that household variables are more important for women. For female movers with children the migration wage growth differential was even negative.

Pekkala (2002) analyzes the migration wage growth differential depending on regional characteristics[22] for Finland. He uses a two-step approach[23] and finds the self-selection bias to be small. The general results of positive short- and long-term

22 Due to data restrictions, however, his regional differentiation is very rough. Moreover, he is able to take the characteristics of the destination region into account, only and not of the region of origin.

23 This approach which dates back to Barnow et al. (1981) is slightly different to the one used by Nakosteen and Zimmer (1980, 1982). The drawback is that one can not assess whether the effect is positive or negative.

effects after migration is extended – similarly to Glaeser and Maré (2001) – by the finding that movers to urban growth centres with high-wage levels and low unemployment rates benefit most from the migration decision.

Also correcting for selectivity bias, Shaw (1991) finds sizeable wage increases after mobility. She highlights the importance of location-specific human capital accumulation on the one hand and industry-specific human capital accumulation on the other hand. Highest returns are obtained for regional movers remaining in the same industry.

Altogether one can draw some conclusions from the considered studies. Though the results are not uniform they tend to indicate a positive effect of regional migration. This effect varies for different groups of workers (young vs. old, low-skilled vs. highly-skilled, men vs. women, first-time movers vs. repeat movers, etc.), depends on regional characteristics and includes the effects of changing the job. Moreover, one should note that contemporaneous returns might be different to long-term effects (for instance due to low entry wages or long-lasting human capital accumulation effects). Regarding the selectivity bias, a detailed inspection of the papers reveals that individual fixed effects estimates yield similar results as IV-approaches, but they are different from ordinary least squares. Hence, one can conclude that the self-selection hypothesis holds (at least to a small extend), but can be tackled rather by fixed effects- than by IV-approaches. The instruments used by several studies mostly disenchant their quality after deeper investigation.

Table 1.1: Empirical Studies on the Effects of Regional Migration on Earnings of Workers

Study	Country	Data Source	Definition of Mobility	Population
Bartel, 1979	USA	NLSY 1973–75 / NLSMM 1966–71 C-R 1964–69	intercounty/ interstate change of residence	male workers
Böheim and Taylor, 2007	Britain	BHPS 1991–2002	res. change between local authority districts	male workers
Borjas et al., 1992a	USA	NLSY 1979–86	interstate change of res.	young male workers
Détang-Dessendre et al., 2004	France	CEREQ (1988/91 and 1989/93)	res. change of départements	young male workers
Gabriel and Schmitz, 1995	USA	NLSY 1985–91	res. change of SMSA	young male workers
Glaeser and Maré, 2001	USA	PSID 1968–85, NLSY 1983–93	res. change of MSA (between rural/urban)	male workers

Table 1.1 (continued):

Study	Country	Data Source	Definition of Mobility	Population
Ham et al., 2004	USA	NLSY 1979–96	distance-based measure (based on res.)	different educational groups
Hunt and Kau, 1985	USA	NLSY 1966–71	res. change of MSA	young male workers
Krieg, 1997	USA	PSID 1981–87	intercounty/ interstate change of res.	household heads
Nakosteen and Westerlund, 2004	Sweden	Household Data 1995/1995	res. change of labor market regions	unmarried persons (of diff. age)
Nakosteen and Zimmer, 1980	USA	CWHS 1971–73	interstate change of employment	all workers
Nakosteen and Zimmer, 1982	USA	CWHS 1971–73	interstate change of employment/ industry	all workers
Nilsson, 2001	Sweden	TOPSWING 1985–95	res. change between municipalities	young male and female workers
Pekkala, 2002	Finland	Census Data 1987–95	res. change between regions (NUTS3)	all workers
Shaw, 1991	USA	PSID 1967–1980	res. change of census regions	household heads
Yankow, 1999	USA	NLSY 1979–93	interstate change of res.	young male workers
Yankow, 2003	USA	NLSY 1979–94	interstate change of res.	young male workers

Notes: BHPS: British Household Panel Survey
CEREQ: Centre d'études et de recherches sur les qualifications
CPS: Current Population Survey
C-R: Coleman-Rossi-dataset
CWHS: Continuous Work History Sample
IPUMS: Integrated Public Use Microdata Series
MSA/SMSA: (Standard) Metropolitan Statistical Areas
NLSMM: National Longitudinal Survey of Mature Men
NLSY: National Longitudinal Survey of Youth
PSID: Panel Study of Income Dynamics
TOPSWING: Total Population of Sweden, Individual and Geographical Database
Source: Compiled by the author from the literature.

1.3 A theoretical model of regional mobility

The subsection analyzes the economical calculus behind the migration decision. In order to do this, we adapt a theoretical model of Fitzenberger and Spitz (2004) which was developed originally to analyze changes between apprenticed profession

and profession held. This model reflects the relationship between change of professions and wages of workers. Within each profession, workers aim to maximize their remuneration. The underlying assumption in the model is that workers have imperfect information on future earnings. Moreover, the model explicitly accounts for unobserved heterogeneity. Factors like motivation and intelligence are allowed to affect wages in both professions differently. The decision to change the profession is interrelated with varying earnings possibilities. Each change is associated with a depreciation of a part of the former accumulated human capital.

All these factors play also a crucial role in the analysis of changes between regions. Bringing into mind that wages are differing especially between region types (in the simplest case between urban and rural areas), it becomes clear that applying the model to the regional context is appropriate. Region type movers loose a fraction of their location-specific human capital; they migrate if earnings opportunities are expected to be better in other areas. Furthermore, one can easily imagine that unobserved skills are more valuable in metropolitan areas than in the countryside.

1.3.1 Assumptions of the model

1. In a two-period model ($t = 1, 2$), an individual i decides at the beginning of the first period in which of two regions he starts to work. Holding a job in region $j = 1, 2$ at time $t = 1$ is denoted by $r_1 = j$. The individuals are employed in both periods and earn w_t, i.e. log wages at time t. The location decision in the first period is made with uncertainty on earnings in the second period.
2. The wage in period 1 equals the accumulated human capital (s_r) in one of the two regions, that is $w_1(r_1) = s_1$ in region 1 and $w_1(r_1) = s_1$ in region 2.
3. At the beginning of the second period, individuals reconsider their location decision. If expected earnings are higher in the other region, workers decide to migrate. The change of location is associated with a specific loss of former accumulated human capital. The share of human capital which can be transferred from region 1 to region 2 is denoted by k_{12} and k_{21} corresponds to the other direction of migration, respectively.
4. In the second period, wages are additionally positively affected by experience. Both, the experience effect as well as the region-specific human capital entail the random component a. Thereby, the character a stands for unobserved (wage-increasing) ability of an individual. Moreover, the experience effect includes a further random component ε.[24] Formally, one assumes

24 We assume for $(\varepsilon_1, \varepsilon_2)$ that both effects are jointly normally distributed.

$$s_1 = s_1^0 + a,\ s_2 = s_2^0 + \theta_0 a,\ e_1 = \varepsilon_1 + \theta_1 a,\ e_2 = \varepsilon_2 + \theta_2 a,$$

where s_1^0, s_2^0, θ_0, θ_1 and θ_2 are constants and e_1, e_2 and a are iid.-random variables with $Var(a) = 1$. It is obvious that both, the human capital effect and the experience effect depend on the individual-specific unobservable factor a. By assumption, the randomly assigned human capital should be smaller in region 2 than in region 1. One can imagine, for instance, that region 1 is more densely populated than region 2. Then, $\theta_0 < 1$ reflects a limited potential of increasing the unobserved part of human capital through contacts with others in region 2 compared to region 1. Consequently, for the experience effects it is necessary that $\theta_1 > \theta_2$. Altogether, the assumptions yield heterogeneous returns in each region.

1.3.2 Location decision in the second period

The model will be solved by backward induction: Firstly, we model the location decision in the second period. This decision depends on the location chosen in the first period. At this point of time, individuals are assumed to know the realizations of the experience effects e_1 and e_2. An individual changes from one region to another, if earnings are expected to be higher in the other region. Depending on (r_1, r_2), wages in the second period equal

$$w_2(r_1, r_2) = \begin{cases} s_1 + e_1 & for(r_1 = 1, r_2 = 1) \quad \text{"No Change of Region"} \\ k_{12}s_1 + e_2 & for(r_1 = 1, r_2 = 2) \quad \text{"Change from Region 1 to Region 2"} \\ k_{21}s_2 + e_1 & for(r_1 = 2, r_2 = 1) \quad \text{"Change from Region 2 to Region 1"} \\ s_2 + e_2 & for(r_1 = 2, r_2 = 2) \quad \text{"No Change of Region"} \end{cases} \tag{1.3.1}$$

According to equation (1.3.1), people move from region 1 to region 2, if $w_2(1, 2) > w_2(1, 1)$ or $k_{12}s_1 + e_2 > s_1 + e_1$, respectively.[25] Assumption (4) implies that this is equivalent to

$$\varepsilon_2 - \varepsilon_1 > (1 - k_{12})s_1^0 + (1 - k_{12})a + (\theta_1 - \theta_2)a. \tag{1.3.2}$$

A change from region 1 to region 2 is the more likely to occur,

- the higher the random component of the experience effect in region 2 is compared to region 1;
- the higher the share of transferable human capital (if it is completely transferable, the first two terms on the right sight of equation (1.3.2) are zero);
- the smaller the differential of contact potential of both regions.

25 For simplicity, we assume that individuals stay in the corresponding region if $w_2(1, 2) = w_2(1, 1)$ and $w_2(2, 1) = w_2(2, 2)$, respectively.

Accordingly, individuals leave region 2 if

$$\varepsilon_1 - \varepsilon_2 > (1 - k_{21})s_2^0 + (1 - k_{21})\theta_0 a + (\theta_2 - \theta_1)a. \tag{1.3.3}$$

As result, wages in the second period equal

$$w_2(j_1, j_2(j_1)) = \begin{cases} max\{s_1 + e_1, k_{12}s_1 + e_2\} = e_1 + s_1 + \\ max\{0, (k_{12} - 1)s_1 + (e_2 - e_1)\} & for r_1 = 1, \\ max\{k_{21}s_2 + e_1, s_2 + e_2\} = s_2 + e_2 + \\ max\{0, (k_{21} - 1)s_2 + (e_1 - e_2)\} & for r_1 = 2 \end{cases} \tag{1.3.4}$$

where $r_2(r_1)$ denotes the region in the second period, given the region in the first period.

1.3.3 Location decision in the first period

In the beginning of the first period, individuals aim to maximize their expected earnings over both periods (V). Conformable to the assumption made for the second period, we assume here that individuals know the realizations of s_1 and s_2 as well as a, k_{12} and k_{21}. Since ε_1 and ε_2 are unknown at this point of time, the decision is made under uncertainty. Neglecting discounting issues, formally this is

$$\max_{r_1} V(r_1) = w_1(r_1) + E\,[w_2(r_1, r_2(r_1))]. \tag{1.3.5}$$

In order to determine the expected value for the maximum of two normally distributed random variables we simplify to some extent and set $\varepsilon_1 - \varepsilon_2 = v$. Regarded from the first period, the expected values for ε_1, ε_2 are both zero, both random variables are uncorrelated and have the variance σ_ε^2. Therefore, the random variable v has a standard normal distribution with mean zero and standard deviation $\sigma_v (v \sim N(0, \sigma_v^2))$. For a truncated standard normally distributed random variable $y \sim N(\mu, \sigma^2)$ one can show that $E(y \mid y > c) = \varphi(c)/\phi(-c)$ with φ as density and ϕ as distribution function (see Ronning, 1991, p. 13). For $c = 0$, one obtains $E(y \mid y > 0) = \mu + \sigma\,\varphi(\mu/\sigma)/\phi(\mu/\sigma)$. With $E[\max(0, y)] = P(y > 0) * E(y \mid y > 0)$ and $P(y > 0) = \phi(\mu/\sigma)$ it follows that

$$E[\max(0, y)] = \mu\phi(\mu/\sigma) + \sigma\,\varphi(\mu/\sigma). \tag{1.3.6}$$

Applying this relationship on equation (1.3.4), it results that

$$E[\max\{s_1 + e_1, k_{12}s_1 + e_2\} \mid s_1, s_2, a] = s_1 + e_1 + m_1\phi(m_1/\sigma_\upsilon) + \sigma_\upsilon\varphi(m_1/\sigma_\upsilon) \quad (1.3.7)$$

and $E[\max\{k_{21}s_2 + e_1, s_2 + e_2\} \mid s_1, s_2, a] = s_2 + e_2 + m_2\phi(m_2/\sigma_\upsilon) + \sigma_\upsilon\varphi(m_2/\sigma_\upsilon)$

where $m_1 = (k_{12} - 1)s_1^0 + (k_{12} - 1 + \theta_2 - \theta_1)a$ and $m_2 = (k_{21} - 1)s_2^0 + ((k_{21} - 1)\theta_0 + \theta_1 - \theta_2)a$.

Hence, depending on the chosen region in the first period (see equation (1.3.5)) the expected earnings over both periods are

$$V(1) = 2s_1 + e_1 + m_1\phi(m_1/\sigma_\upsilon) + \sigma_\upsilon\varphi(m_1/\sigma_\upsilon) \quad (1.3.8)$$

and

$$V(2) = 2s_2 + e_2 + m_2\phi(m_2/\sigma_\upsilon) + \sigma_\upsilon\varphi(m_2/\sigma_\upsilon).$$

If $V(1) > V(2)$, then a person decides in the beginning of the first period to locate in region 1 and the opposite is true for $V(1) < V(2)$. Ex ante, the probability of choosing $r_1 = 1$ is $P(r_1 = 1) = P(V(1) - P(V(2)) > 0$. The difference yields

$$\begin{aligned} D = V(1) - V(2) = {} & 2s_1^0 + 2a + \varepsilon_1 + \theta_1 a - 2s_2^0 - 2\theta_0 a - \varepsilon_2 - \theta_2 a + m_1\phi(m_1/\sigma_\upsilon) \\ & + \sigma_\upsilon\varphi(m_1/\sigma_\upsilon) - m_2\phi(m_2/\sigma_\upsilon) - \sigma_\upsilon\varphi(m_2/\sigma_\upsilon). \end{aligned} \quad (1.3.9)$$

Differentiating the difference with respect to a and having in mind that $\theta_0 < 1$ and $\theta_1 > \theta_2$, it turns out that $\frac{\partial D}{\partial a} > 0$. This result suggests that in the beginning of the first period, individuals who rate their own (unobserved) human capital as high, tend to locate in region 1 where this wage-enhancing factor is higher-valued than in region 2. Contrarily, individuals with a relatively low a decide to live in region 2. Thus, the model is able to explain skill-specific differences between regional units.

1.3.4 Probability of changing the region

Although having obtained first hints on the determinants of mobility in section 1.3.2, we discuss this issue more accurately here. Since the decision for region 1 or region 2 in the first period depends on the unobserved part of human capital, the probability of migration is conditional on a. Formally, this is

$$P(r_2 = 2 \mid r_1 = 1, a) = P(\upsilon > (1 - k_{12})s_1^0 + (1 - k_{12} + \theta_1 - \theta_2)a = \phi(m_1/\sigma_\upsilon) \quad (1.3.10)$$

and

$$P(r_2 = 1 \mid r_1 = 2, a) = P(\upsilon < (k_{21} - 1)s_2^0 + ((k_{21} - 1)\theta_0 + \theta_1 - \theta_2)a = \phi(-m_2 / \sigma_\upsilon).$$

More precisely, one has to take into account, that only individuals with $a > \bar{a}$ reside in region 1 and are therefore considered to be potentially mobile from region 1 to region 2 at the beginning of the second period. Therefore, the probability for a move from region 1 to region 2 is

$$P(r_2 = 2 \mid r_1 = 1) = \frac{\int_{\bar{a}}^{\infty} \phi(m_1 / \sigma_\upsilon)\, \varphi(a)\, da}{1 - \varphi(\bar{a})} \tag{1.3.11}$$

and

$$P(r_2 = 1 \mid r_1 = 2) = \frac{\int_{\infty}^{\bar{a}} \phi(-m_2 / \sigma_\upsilon)\, \varphi(a)\, da}{\varphi(\bar{a})}$$

is the probability for observing a move in the opposite direction.

Although the model is to complex to be solved analytically, it is evident that a move from region 1 to region 2 is the more likely than a move to the opposite direction, the higher – ceteris paribus – k_{12}, θ_2 and s_2^0 and the lower k_{21}, θ_1 and s_1^0.

Altogether, the model explains why there exists an urban skill bias for young workers. Those young workers having a higher amount of unobservable skills move to more dense areas where the possibilities of learning from others are more present. Young individuals with a low amount of unobservable skills start their working lives in less dense areas. After a specific span of life, people reconsider their location decision. Depending on transferability of human capital and the given potential of further increasing human capital, they change their work places to other regions (in this model either to the denser or the less dense type of the region).

1.3.5 Wage effects of regional mobility

To determine the effect of regional mobility on earnings of a given workers, one would ideally compare the wage after migration with the wage in a hypothetical situation where the worker stays in the corresponding region. Formally, the average effect of regional migration would then be given as

$$\begin{aligned} &P(r_1 = 1, r_2 = 2) \cdot [E(w_2 \mid r_1 = 1, r_2 = 2) - E(w_2 \mid r_1 = 1, r_2 = 1)] \\ &+ P(r_1 = 2, r_2 = 1) \cdot [E(w_2 \mid r_1 = 2, r_2 = 1) - E(w_2 \mid r_1 = 2, r_2 = 2)]. \end{aligned} \tag{1.3.12}$$

Thereby, the mobility effect refers to the region of origin.[26] It is clear from equation (1.3.12) that the effect depends on migration streams, that is, whether persons move from region 1 to region 2 or the other way round. Therefore, the empirical analysis presented below, extend the analyses by quantifying mobility effects separately for regions of origin and regions of destination.

Unfortunately, in empirical applications ($w_2 \mid r_1 = 1,\ r_2 = 1$) and ($w_2 \mid r_1 = 2,\ r_2 = 2$) are counterfactual. A common way to deal with this problem is to observe wages of an immobile reference group in the second period. The empirical analysis presented below will highlight the importance of the reference group selection. Ideally one would select a reference group which has exact the same (observed and unobserved) characteristics than the treatment group of movers.

Another way of determining the mobility effect is to compare the wage growth of treatment and control group instead of wage levels. The empirical analyses presented below will primarily be concerned with estimating equations of the form

$$\sum_{i=1}^{mov_{12}} \left(\frac{w_{i2} - w_{i1}}{mov_{12}} \mid r_1 = 1, r_2 = 2 \right) + \sum_{i=1}^{mov_{21}} \left(\frac{w_{i2} - w_{i1}}{mov_{21}} \mid r_1 = 2, r_2 = 1 \right) \tag{1.3.13}$$

for the treatment group of movers (where mov_{12} and mov_{21} denote the actually observed samples of regional movers) and correspondingly (with sta_{11} and sta_{22} as stayers samples) for the reference group of stayers:

$$\sum_{i=1}^{sta_{11}} \left(\frac{w_{i2} - w_{i1}}{sta_{11}} \mid r_1 = 1, r_2 = 1 \right) + \sum_{i=1}^{sta_{22}} \left(\frac{w_{i2} - w_{i1}}{sta_{22}} \mid r_1 = 2, r_2 = 2 \right). \tag{1.3.14}$$

Differencing both equations gives the average (contemporaneous) wage growth differential of movers over stayers. One has to mind that changing the region is overwhelmingly connected within this framework with a change of employer while this is not the case if persons decide to stay in region. Hence, equation (1.3.14) contains within-job wage growth effects and equation (1.3.13) between-job wage growth effects. One could argue that this accounting scheme cause several problems. On the one hand, stayers are not able to benefit from between-job wage growth; on the other hand, movers suffer from the loss of firm-specific human capital (additionally to the depreciation of location-specific human capital). Depending on the strength of both factors (and, of course, several other factors), the mobility wage effects are positive or negative. Not surprisingly, the above cited

26 An alternative concept controls for the region of destination. Then, the average effect is given as $P(r_1 = 1, r_2 = 2) \cdot [E(w_2 \mid r_1 = 1, r_2 = 2) - E(w_2 \mid r_1 = 2, r_2 = 2)]$ $+ P(r_1 = 2, r_2 = 1) \cdot [E(w_2 \mid r_1 = 2, r_2 = 1) - E(w_2 \mid r_1 = 1, r_2 = 1)]$.

studies (see section 1.2) come to different conclusions. A further aspect concerns sample selection bias. Even if movers and stayers have identical (observable) characteristics, the migration decision itself indicates a special selectivity of movers (that is the selection in the treatment group is not random).

Tackling these issues, we therefore additionally consider a reference group of job changers staying in the corresponding region. This reference group also loose firm-specific human capital, they benefit from between-job wage growth and they decide to leave their employer. One could argue that the selection bias should be substantially smaller than in movers-stayers comparisons. Therefore, we are quite confident that this group is well-suited to serve as reference group.

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2 Group-Specific Effects of Interregional Mobility on Earnings – A Microdata Analysis for Germany

joint with Joachim MÖLLER

Abstract

The paper analyses the relationship between regional mobility and earnings for different groups of workers. Using a large panel microdata set we find negative earnings differentials of movers in the year before migration and strong evidence for significant wage gains through mobility. A decomposition of Blinder/Oaxaca type reveals different group-specific rewards effects suggesting a positive post-mobility wage differential of movers over the incumbent workforce for some groups irrespective of the region of destination. The existence of a general wage growth effect of mobility appears to be robust and cannot be explained by the time-invariant part of unobserved heterogeneity.

Keywords: Interregional mobility, migration wage differentials, unobserved heterogeneity, propensity score matching.
JEL-classification: J61, R23.

2.1 Introduction

Given the importance of the economic policy debate on labour market flexibility and labour market reforms especially in continental Europe, there is a renewed interest in the various dimensions of labour mobility. Workers move within and between occupations, firms and industries. Some of these moves take place within the same region while others are connected with a change in the region where the workplace is located. The pioneering studies of Mincer and Jovanovich (1981) and Bartel and Borjas (1981) deal with the correlation of job mobility and wages. Aspects like geographical, industrial and occupational mobility are taken as components of overall job mobility and not treated separately. Both studies stress the consequences of labour turnover for the worker's experience rating: while young workers experience significant wage gains when changing the employer voluntarily, it cannot be predicted how differences in mobility during the first ten years of working life affect the workers' lifetime wage path.

Following these two seminal contributions to research in labour mobility, much effort has been devoted to assessing the relationship between early job mobility and wages also in the context of the theory of general and firm-specific human

capital[27] (e.g. Bartel, 1980; Mincer, 1986; Antel, 1991; Topel and Ward, 1992[28]). All these studies measure the immediate gains of movers typically as between-job wage growth. Mobility reflects the workers' search for better jobs. Even in the early literature this was associated with the realization of individual comparative advantages (Johnson, 1978), high-quality job matches (Jovanovich, 1979) or simply a move to better paid jobs (Burdett, 1978).

The cited studies stress the positive effects of job mobility on wages. However, there may also be negative effects. Typically, workers (and firms) invest in firm-specific human capital and the individual wage increases with the stock of acquired skills that makes the worker more productive within the firm. By changing the employer the worker can no longer profit from his or her firm-specific skills. Some empirical evidence supports this view. Light and McGarry (1998, p. 276), for instance, find "... that workers who undergo persistent mobility have lower log-wage paths than less mobile workers". This result is corroborated by more recent studies like Munasinghe and Sigman (2004). Another strand of the literature explicitly deals with the determinants of job changes (Farber, 1999) and the differences in occupational mobility patterns (Heitmueller, 2004).

The regional dimension of mobility has been stressed by a number of studies following the pioneer work of Harris and Todaro (1970). Antolin and Bover (1997) and Pissarides and Wadsworth (1989)[29], among others, examine how unemployment affects the interregional migration of labour. The employment prospects of unemployed migrants are highlighted in Pekkala and Tervo (2002), for instance. The effect of migration on post-move employment (e.g. Tervo, 2000) can also be considered within the context of family decisions (see, for instance, Nivalainen, 2005). In contrast to the vast literature on the economic consequences of immigration (e.g. Borjas, 1994; Haisken-DeNew, 1996), less effort has been devoted to the wage effect of interregional mobility within a country. Exceptions are especially found for Scandinavian countries. Nakosteen and Westerlund (2004) for Sweden and Pekkala (2002) for Finland both observe significant income gains from migration. For Germany, Jennifer Hunt (2004) investigated migration streams using the German Socio Economic Panel (GSOEP). She stresses the importance of inter-state migration without changing the employer. According to her results, this group represents about one fifth of all

27 The standard human capital model of migration predicts that workers migrate when the discounted value of real income available at a potential destination exceeds that at the origin by more than the costs of moving (Sjaastad, 1962).

28 Topel and Ward (1992) state that job search plays a crucial role for wage growth; they estimate that about 1/3 of overall wage growth in the first decade of working life can be attributed to job switching.

29 Some older studies dealing with the determinants affecting the probability of migration are Da Vanzo (1978) and Herzog and Schlottmann (1981) for the US. For a survey of other relevant studies see Greenwood (1975, 1985).

migrants and is characterized by higher skills and has higher pre-move wages than the group of non-migrants.

The impact of migration on wages has been considered explicitly from a spatial job search perspective by Detang-Déssendre, Drapier and Jayet (2004) using data for young Frenchmen. Taking the possibility of self-selection into account they find no selection effect for low-educated migrants and a positive one for highly-educated ones, especially for those who move to Ile-de-France.

The specific impact of rural-urban mobility on the level and growth rates of individual wages has been analyzed by Glaeser and Maré (2001) with U.S. data. They find that workers moving from rural to metropolitan areas experience significant wage gains immediately after migration, which supports the existence of an urban wage premium. However, although movers benefit from migration to metropolitan areas, they typically fall behind the incumbent urban workforce. This wage disadvantage is gradually reduced by a wage growth effect induced by migration. Glaeser and Maré (2001) argue that these effects stem from faster accumulation of human capital in cities leading to a rise in the urban wage premium over time. Hence, wages are highest for individuals staying in these areas for a longer period.

The immediate wage gains after rural-urban migration corroborate the existence of a so-called *wage-level effect* being associated with the migration of workers to cities. The wage level hypothesis can be justified by arguing that wages in cities are higher than in rural areas because of higher demand in cities and cheaper inputs due to the proximity of suppliers of intermediate goods, for example.[30] The hypothesis would imply a marked decline in wages if workers left the metropolitan area. According to Glaeser and Maré (2001), however, this is not observed empirically. Workers typically face no wage losses if they move away from cities. This is in accordance with Peri (2001), who presents a theoretical model explaining why highly-educated young workers are attracted to big cities and why some of these workers move to less dense areas when old.

The aim of our paper is to investigate the relationship between interregional mobility and earnings from several perspectives. Controlling for their observed characteristics such as skills, experience and gender, we examine the wage differentials between mobile workers and their immobile counterparts. Like Glaeser and Maré (2001) we analyze the earnings of movers before and after migration in order to identify the wage level effect of mobility. In contrast to these authors,

30 Spatial differences in productivity are crucial for explaining spatial wage differentials. Empirical studies in this context typically find a statistically significant positive relationship between density measures of economic activity and productivity (e.g. Ciccone and Hall, 1996; Harris and Ioannides, 2000). This supports the results of previous studies focussing on the positive effects of city population or industry employment on productivity (e.g. Sveikauskas, 1975; Segal, 1976; Moomaw, 1981, 1985; Henderson, 1986).

however, we do not restrict our analysis to the wage effects for migrants to or out of metropolitan areas, but rather study movers between other types of regions as well. This enables us to differentiate between a general effect of interregional mobility and a specific effect being tied to metropolitan areas as the region of destination. The existence of a significant general effect would reduce the magnitude of the rural-to-urban migration wage premium found by these authors.

The remainder of the paper is organized as follows: The next section deals with a description of our data source, methodological issues and basic definitions. Section 2.3 presents some descriptive evidence. Section 2.4 introduces our econometric model. By using a decomposition technique, the migration wage differential is analyzed in section 2.5. Section 2.6 checks the robustness of our results using alternative empirical strategies and section 2.7 concludes.

2.2 Data and basic definitions

2.2.1 Data

The data used in this paper is a one percent random sample from the employment register of the Institute of Employment Research, Nuremberg (IAB). The data base (IABREG) contains all workers, employees and trainees with the obligation of paying social insurance contributions and represents about 80 percent of the total workforce. Not included in the data are, for instance, civil servants, marginal employed persons, students enrolled in higher education, workers under apprenticeship, volunteers and family workers. The employment register contains detailed histories for each worker's time in employment. Here we consider all persons aged 16 to 70 years who were employed on 30th June of each year. The key variable for our analysis is gross daily wages[31] being gathered in the register for administrative purposes. Due to legal sanctions for the employer in cases of misreporting, the variable can be considered highly reliable. Because of the contribution assessment ceiling in the German social security system, however, the earnings information is top coded. This concerns less than 10 percent of all observations. The likelihood of censoring increases with age and education. Moreover, the data set gives information on personal characteristics of workers like gender, age and education as well as some basic information about the employer (industry affiliation, location, firm size).

In our analysis the qualification of workers will be subdivided into three categories:

31 In our data source gross daily earnings are calculated as average over the observed employment period for each person. The notions wages and earnings are used synonymously throughout this paper.

- *low-skilled*: persons with no occupational qualification regardless of which schooling level, that is, with or without upper secondary education (*Abitur*);
- *skilled*: persons with an occupational qualification whether they have an upper secondary education or not;
- *highly-skilled*: persons with upper secondary education holding a university degree or higher education diploma.

The regional information in the data refers to the location of the firm or workplace and not the residence of a worker. Using a classification scheme of the *Bundesanstalt für Bauwesen und Raumordnung* (BBR) we differentiate between nine types of regions at NUTS3 (county) level. The classification scheme of the BBR distinguishes between areas with large agglomerations, areas with features of conurbation and areas of rural character. Within areas comprising large agglomerations, the classification scheme distinguishes between metropolitan core cities (BBR1), highly urbanized districts (BBR2) in the surroundings of those cities, urbanized districts (BBR3) and rural districts (BBR4). The second category contains core cities (BBR5) in regions with intermediate agglomerations, their urbanized surroundings (BBR6) and rural districts (BBR7). In the regions of rural character the differentiation is between urbanized districts (BBR8) and rural districts (BBR9).[32] The firm size information in the data is divided into eight categories (see Appendix, *Table A2.2*).

Because there are still large structural differences in the labour market and the mobility pattern between the eastern and the western part of Germany,[33] we restrict the analysis to workers in pre-unified Germany. Beyond this we drop part-time workers, workers with more than one job and those for whom we have no valid information concerning earnings, age, qualification or the region type they work in (see Appendix, *Table A2.3* for data selection).

2.2.2 Basic definitions

Following Glaeser and Maré (2001) we concentrate on the spatial dimension of mobility. Like these authors our approach stresses the role of the characteristics of regions for wage determination in order to catch possible agglomeration effects. Throughout the paper we therefore define mobility of employed workers

32 For an overview of region types according to this classification see *Table A2.1* in the Appendix.

33 See, for instance, Kemper (2004) for an exploration of migration patterns in Western and Eastern Germany.

as a change in the BBR-region type where the workplace is located.[34] We disregard workers who are not observed at the cut-off date for two succeeding years. Hence we exclude observations of mobile workers who were not employed in period $t = 0$, but employed in $t = 1$ ("drop-ins"), those who were employed in period $t = 0$, but not in $t = 1$ ("drop-outs"), and, of course, those who were unemployed or out of the labour force for both periods. We construct a (0,1)-dummy variable that indicates whether or not a person is employed in a different type of region in period $t = 1$. In $t = 0$ those who are going to reveal their mobility in the next period are called *future movers* (FM). After having moved to a workplace in a different region type, this group of workers is addressed in period $t = 1$ as *current movers* (CM), or simply *movers*. Correspondingly, workers who do not change the type of region where the workplace is located from period $t = 0$ to $t = 1$ are called *future stayers* (FS) in period $t = 0$ and *current stayers* (CS), or simply *stayers* in $t = 1$.

Table 2.1 gives some basic information on the number of observations for movers and stayers in our sample. For the time period 1993 to 1997 the share of (current) movers in the total number of workers is fairly constant at 2.5 percent. In the early stage of the re-unification process (1991 and 1992) the share of mobile workers is higher (2.8 to 3.0 percent). In absolute numbers, the group of movers comprises between 3,900 and 5,200 persons per year.

Table 2.1: Absolute Number and Share of Movers and Stayers in the Sample (1991–1997)

	1991	1992	1993	1994	1995	1996	1997
total	174,337	174,734	169,659	163,949	161,302	156,898	152,917
stayers	169,160	169,825	165,351	159,773	157,203	152,894	149,018
percent of total	*97.0*	*97.2*	*97.5*	*97.5*	*97.5*	*97.4*	*97.5*
movers	5,177	4,909	4,308	4,176	4,099	4,004	3,899
percent of total	*3.0*	*2.8*	*2.5*	*2.5*	*2.5*	*2.6*	*2.5*

Notes: The entries in the table are calculated on the basis of a 1 percent sample.
Source: Authors' own calculations using IAB-REG data.

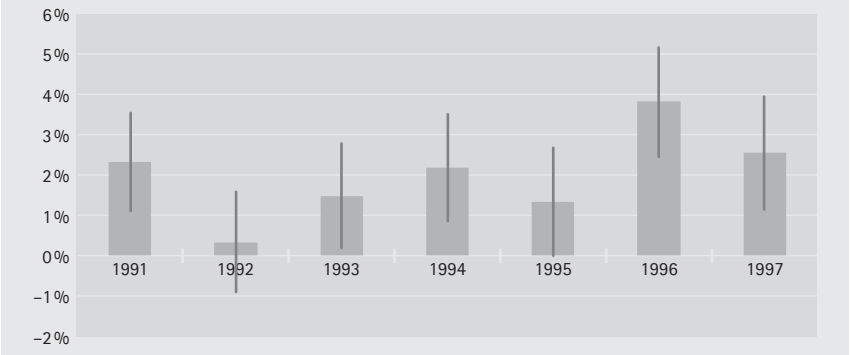
34 This definition does not differentiate between migration and commuting. In analogy to the distinction made by Eliasson et al. (2003, p. 831), the definition of movers in our paper includes the following categories: (i) workers who change their region type of residence and the region type of work place; (ii) workers who do not change their place of residence, but start commuting to a different *type* of region; (iii) commuters who do not change their place of residence, but change the region type where the work place is located. Because our definition of mobility is based on region type, our concept of mobility is predominantly related to the first category. Note that adjacent regions are in many cases of the same type.

2.3 Basic facts about movers and stayers

2.3.1 The mover/stayer-wage differential

Figure 2.1 shows the raw wage differential of movers over stayers and a 95 percent confidence interval for 1991 to 1997. It turns out that the differential varies to some extent but is positive in all years. The differential is lowest (0.3 percent) and statistically not significant in the re-unification boom year 1992 and highest in 1996 (3.8 percent). The average value is about 2 percent and there appears to be no clear time trend.

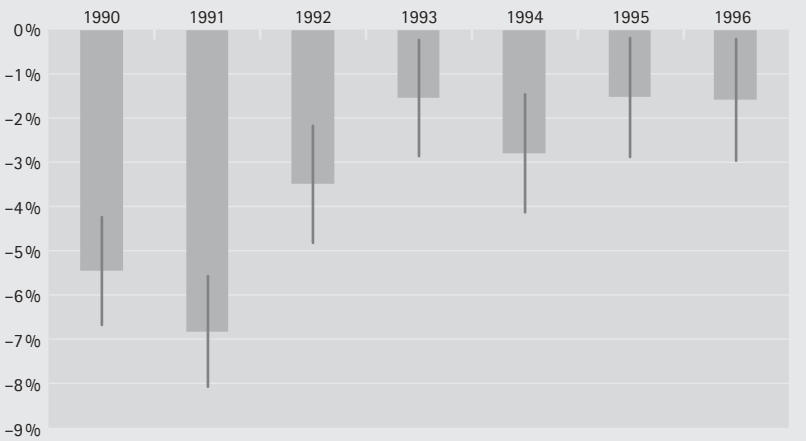
Figure 2.1: Raw Wage Differentials of Movers over Stayers and 95 Percent Confidence Interval, 1991 to 1997



Comparing the average wage of mobile and immobile workers *before* migration gives a completely different picture. As shown in *Figure 2.2*, the corresponding wage differential of prospective movers is negative. This indicates that mobile workers have a wage disadvantage in the year before migration compared to their immobile counterparts. The differential is especially high in the early nineties, where the corresponding raw wage differential reaches almost –7 percent. Between 1993 and 1996 the raw differential is in the range of –1.5 to –2.5 percent. Assuming that differences in personal characteristics between the group of movers and stayers are stable over time, one can combine the information contained in *Figures 2.1* and 2.*2* to conclude that moving entails a positive wage effect. Since movers can substantially improve their relative wage position immediately after getting a workplace in a different type of region, there is first evidence of a general "wage level" effect of mobility. At this stage of analysis, however, it is not clear whether prospective movers are "underpaid" before moving and try to offset their disadvantage by mobility, or exhibit characteristics that are responsible for a lower wage. The negative wage effect before moving might also be due to the famous

Ashenfelter dip (see Ashenfelter, 1978). This would indicate that workers reduce their search effort in the region of origin because the migration decision has already been taken.

Figure 2.2: Raw Wage Disadvantage of Future Movers With Respect to Stayers and 95 Percent Confidence Interval, 1990 to 1996



2.3.2 Differences in the characteristics of movers and stayers

Up to now the raw wage differential of movers and stayers was considered without taking possible differences in observed characteristics of these groups into account. In order to present some basic information on these differences we have chosen the year 1997.[35]

With respect to gender, it can be seen from *Table 2.2* that more than 71 percent of all movers are male workers, while the share of male workers in the reference group of stayers is less than 67 percent. The corresponding over-representation of male workers in the group of movers is also reflected by the measure of concentration.[36] As can be expected by migration theory, movers and stayers also differ in their skills. Compared to the reference group, movers are more likely to be skilled (77.8 percent versus 75.0 percent) or highly-skilled (11.3 percent versus 7.9 percent) as shown in *Table 2.2*.[37] These discrepancies are mirrored by a large difference of shares in the low-skilled category (10.8 percent versus 17.1 percent).

35 The described differences are robust within the sample period 1990 to 1997.

36 The measure of concentration is calculated as: 100*share of movers of this category in total movers divided by the share of movers and stayers of this category in total workers.

37 Hunt (2004) states that those results are strongly influenced by a special group of movers. Workers who migrate from one state to another without changing the employer are more highly educated than stayers.

Table 2.2: Absolute Number and Share of Movers and Stayers by Skills, Firm Size and Region Type (1997)

	Stayers		Movers		
	Absolute Number	Share	Absolute Number	Share	Measure of Concentration
			gender		
male	99,637	0.669	2,799	0.718	107.2
female	49,381	0.331	1,100	0.282	85.4
total	149,018	1	3,899	1	100
			skills		
low-skilled	25,508	0.171	423	0.108	63.98
skilled	111,736	0.75	3,034	0.778	103.68
highly-skilled	11,774	0.079	442	0.113	141.9
total	149,018	1	3,899	1	100
			experience		
low exp.	27,661	0.186	1,110	0.285	151.31
med. exp.	47,647	0.32	1,530	0.392	122.02
high exp.	73,710	0.495	1,259	0.323	65.86
total	149,018	1	3,899	1	100
			firm size		
small firm size	55,260	0.371	1,775	0.455	122.06
med. firm size	53,872	0.362	1,440	0.369	102.1
large firm size	39,886	0.268	684	0.175	66.12
total	149,018	1	3,899	1	100
			region type		
RT1	74,809	0.502	2,014	0.517	102.82
RT2	11,570	0.078	412	0.106	134.86
RT3	36,774	0.247	931	0.239	96.84
RT4	25,865	0.174	542	0.139	80.5
total	149,018	1	3,899	1	100

Notes: Authors' own calculations using IAB-REG; measure of concentration: 100*share of movers of this category in total movers divided by the share of movers and stayers of this category in total workers.

Further aspects concern the workers' potential on-the-job experience,[38] the region type and firm size. Here we consider three experience, four region type and three firm size categories.[39] *Table 2.2* shows that movers are distinctly less experienced than stayers: 28.5 percent of movers have less than 10 years' potential work experience, while the share of stayers in that low experience category is 18.6 percent only. In the intermediate experience category (10 to

38 Here and in the following potential experience in years is measured as age minus average duration of education minus 6. For low-skilled workers without an upper secondary education we assume 10 years as the average educational period, for low-skilled workers with an upper secondary education 13 years, for skilled workers 12.5 and 15 years respectively, for highly-skilled workers holding a polytechnic type of degree 16 years and for highly-skilled alumni of a university 18 years.

39 The potential work experience is categorized as follows: low experience: 0–9 years; medium experience: 10–19 years; high experience: 20 or more years. In order to avoid problems with cell sizes being too small, we aggregated the BBR-region types and firm size categories (see *Tables A2.1* and *A2.2* in the Appendix).

19 years) the share of movers exceeds that of stayers by about 7 percentage points, while the share of movers with high experience is 32.3 percent compared to 49.5 percent for stayers. The two groups also differ with respect to the firm size of their employers. Compared to stayers, movers are more likely to be employed in small firms (45.5 percent to 37.1 percent) and less in large ones (17.5 percent to 26.8 percent).

The regions of destination for more than half of the mobile workers are metropolitan cities and their highly urbanized surroundings (RT1). According to the measure of concentration, the share of movers exceeds the share of the reference category only slightly.[40] The over-representation of movers is more pronounced for less urbanized regions in the farther periphery of metropolitan cities (RT2). At the same time, mobile workers choosing peripheral rural areas (RT4) as their region of destination are strongly under-represented.

To sum up, we find marked differences in the characteristics of mobile and immobile workers. Movers tend to be younger and more skilled than their immobile colleagues. Males and workers in smaller firms are also over-represented in the group of movers. Moreover, mobile workers disproportionately tend to move to less urbanized regions in the farther periphery of metropolitan cities.

2.4 Econometric estimates based on earnings functions

2.4.1 Outline of the estimation approach

In order to analyze the wage differential between mobile and immobile workers more rigorously we estimate a Mincer-type wage equation for each of the four groups defined above.[41] More specifically, for each group we assume a linear relationship between the log earnings and several explanatory variables measuring skill, (potential) experience and other characteristics of the worker and the employer. Potential experience (*EXP*) enters the wage equation in linear and quadratic form to capture a non-linear (concave) wage/experience profile. We measure the effect of six skill/gender categories by corresponding (0,1)-dummy variables, where $DSKILL_n$ (n = 1, ..., 3) indicate male workers with low, intermediate and high skills, respectively, while $DSKILL_n$ (n = 4, ..., 6) stand for the corresponding three skill categories of female workers. The effect of firm size on earnings is captured by eight differentiated firm-size (0,1)-dummy

40 For some years in the sample the share of movers is even under-represented in this region type. In 1994 and 1992, for example, the share of mobile workers in RT1 was just 49 %, while more than 50 % of all stayers worked in this region type.

41 See Mincer (1974).

variables (*FIRMSIZE*) with the smallest category (less than 6 workers) chosen as a reference.[42] In addition, our estimation approach includes eight (0,1)-dummy variables for the type of region (*REGIONTYPE*) taking metropolitan cities (BBR1) as the reference category. Moreover, we introduce interaction effects between the workers' experience with gender and qualification.[43] The equation to be estimated can be formulated as

$$\begin{aligned}\ln w_i^{\theta} = {} & \alpha_0^{\theta} + \alpha_1^{\theta} EXP_i + \alpha_2^{\theta} EXP_i^2 + \alpha_{3,n}^{\theta} \sum_{n=2}^{8} FIRMSIZE_{n,i} + \alpha_{4,n}^{\theta} \sum_{n=2}^{9} REGIONTYPE_{n,i} \\ & + \alpha_{5,n}^{\theta} \sum_{n=2}^{6} DSKILL_{n,i} \\ & + \text{interactions of experience and experience squared} \\ & \text{with gender and qualification} + u_i^{\theta}. \end{aligned} \tag{2.1}$$

The dependent variable w_i^{θ} stands for earnings of individual *i* within a specific group of workers $\theta = \{CM, FM, CS, FS\}$. The error term u_i^{θ} is assumed to be independently and normally distributed. To account for top coding in the data, we use the Tobit estimation method.

2.4.2 Estimation results

Table 2.3 contains the results of the Tobit estimates for the successive years 1996 and 1997[44]. Sign and magnitude of the coefficients correspond to theoretical expectations. The Pseudo-R^2 ranges between 0.38 and 0.43 and the standard error is about 1/3 in all cases. The Likelihood-Ratio Test indicates a significant influence of the explanatory variables at the very high significance level. The number of observations is 3,899 for the group of movers whereof 386 observations or 9.9 percent are right-censored in the year 1996, and 436 (11.2 percent) in 1997. For the group of stayers we have 152,999 observations including 14,453 right-censored observations in 1996 and 149,018 in 1997, thereof 13,895 right-censored.

42 Here we included a category "firm size missing".

43 All workers except for low-skilled male and female workers are considered to be qualified. All interactions are defined for the linear and quadratic experience variable.

44 We calculated corresponding estimates for all successive pairs of years in our sample. It turns out that the findings are sufficiently robust over time. In order to save space, we present the results in the following for the most recent years only. The results for other pairs of years are available from the authors on request.

Table 2.3: Results of the Wage Equation Estimates for Future and Current Movers and Stayers (1996/97)

Variable	1996				1997			
	Future movers (FM)		Future stayers (FS)		Current movers (CM)		Current stayers (CS)	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Low-skilled male (ref.)								
Skilled male	0.080	0.065	**0.265**	0.010	0.085	0.073	**0.311**	0.011
Highly-skilled male	**0.540**	0.067	**0.711**	0.011	**0.588**	0.075	**0.765**	0.011
Low-skilled female	**–0.178**	0.052	**–0.036**	0.008	**–0.143**	0.056	**–0.023**	0.008
Skilled female	–0.013	0.072	**0.209**	0.011	–0.005	0.081	**0.265**	0.012
Highly-skilled female	**0.328**	0.079	**0.581**	0.013	**0.399**	0.088	**0.647**	0.014
Firm size: <= 5 workers (ref.)								
Firm size: 6–20 workers	**0.129**	0.021	**0.211**	0.004	**0.111**	0.020	**0.218**	0.004
Firm size: 21–50 workers	**0.193**	0.021	**0.289**	0.004	**0.153**	0.021	**0.293**	0.004
Firm size: 51–100 workers	**0.202**	0.023	**0.341**	0.004	**0.176**	0.022	**0.345**	0.004
Firm size: 101–250 workers	**0.231**	0.022	**0.378**	0.004	**0.200**	0.022	**0.381**	0.004
Firm size: 251–500 workers	**0.306**	0.025	**0.419**	0.004	**0.247**	0.024	**0.427**	0.004
Firm size: 501–1000 workers	**0.279**	0.027	**0.443**	0.004	**0.291**	0.027	**0.455**	0.004
Firm size: > 1000 workers	**0.345**	0.025	**0.494**	0.004	**0.299**	0.024	**0.512**	0.004
Firm size: missing	**0.270**	0.072	**0.232**	0.015	**0.140**	0.053	**0.154**	0.023
Region type BBR1 (ref.)								
Region type BBR2	**0.019**	0.016	**–0.015**	0.003	**0.050**	0.015	**–0.009**	0.003
Region type BBR3	–0.021	0.020	**–0.059**	0.004	0.011	0.021	**–0.055**	0.004
Region type BBR4	–0.068	0.038	**–0.082**	0.007	–0.030	0.044	**–0.076**	0.007
Region type BBR5	**–0.046**	0.019	**–0.052**	0.003	**–0.035**	0.020	**–0.049**	0.004
Region type BBR6	–0.042	0.018	**–0.070**	0.003	–0.013	0.018	**–0.062**	0.003
Region type BBR7	–0.103	0.023	**–0.093**	0.004	–0.030	0.024	**–0.092**	0.004
Region type BBR8	–0.045	0.025	**–0.107**	0.003	–0.026	0.024	**–0.103**	0.004
Region type BBR9	–0.087	0.038	**–0.129**	0.006	–0.041	0.041	**–0.121**	0.006
Experience	**0.018**	0.007	**0.031**	0.001	**0.018**	0.007	**0.035**	0.001
Experience squared	**–0.019**	0.015	**–0.049**	0.002	**–0.027**	0.015	**–0.053**	0.002
Interaction exp./fem.	–0.005	0.005	**–0.016**	0.001	–0.005	0.005	**–0.016**	0.001
Interaction exp. squared/fem.	–0.005	0.012	**0.023**	0.001	–0.003	0.012	**0.021**	0.002
Interaction exp./qual.	**0.022**	0.007	–0.001	0.001	**0.017**	0.007	**–0.004**	0.001
Interaction exp. squared/qual.	**–0.044**	0.016	0.000	0.002	**–0.032**	0.016	**0.004**	0.002
Constant	**8.986**	0.064	**8.807**	0.010	**9.058**	0.073	**8.741**	0.011
Test statistics								
N	3,899		152,999		3,899		149,018	
(thereof censored)	(386)		(14,453)		(436)		(13,895)	
Pseudo-R^2	0.410		0.429		0.382		0.411	
LR [$\chi^2(27)$]	2009.0		82989.8		1809.2		79661.3	
s.e.	0.330		0.329		0.329		0.337	

Notes: Estimation method is Tobit; all coefficients significant at least at the 5 percent level are in bold; all coefficients related to the experience squared variable are multiplied by 100.
Source: Authors' own calculations using IAB-REG data.

With respect to the estimated coefficients we observe fairly similar results for the group of future and current movers on the one hand and future and current stayers on the other. There are, however, marked differences *between* movers and stayers in general. First, the coefficients of the skill/gender dummy variables for movers are somewhat lower in magnitude than for stayers. The same is true for the coefficients capturing the firm-size differential. Second, for stayers the coefficients for the region type are significantly negative and increase in absolute values for more peripheral regions. For the group of movers we find a significant positive effect for BBR2. According to this result, movers exhibit a positive wage differential in the environs of metropolitan cities compared to the centre itself. Third, the estimated coefficients of the experience variable are lower for future and current movers than for stayers. However, for movers there is a marked positive interaction effect with qualification. By contrast, the corresponding interaction effect is not significant for future stayers and even significantly *negative* for current stayers. Fourth, the interaction of experience and gender is negative in all cases, but lower in magnitude and statistically not significant for movers.

To summarize, the coefficients of wage equations for movers and stayers exhibit some marked differences leading to the conclusion that both groups not only differ in characteristics but also in the way these characteristics are remunerated by the employers.

2.5 Decomposition of the mover/stayer-wage differential

2.5.1 Decomposition method

Of course, the estimated coefficients of the dummy variables in equation (2.1) depend on the choice of reference group. The coefficients would change, for example, if highly-skilled female workers were taken as the reference for the skill/gender category instead of low-skilled male ones. Therefore, it is preferable to base the interpretation of the results on standardized coefficients that do not depend on the specific choice of the reference group. Following a method originally proposed by Greene and Seaks (1991), we therefore re-calculated the estimated coefficients in order to obtain effects relative to the weighted average in the aggregate economy.[45] For the decompositions below we use the somewhat

45 The differential of low-skilled male workers relative to the average in the economy, for example, is obtained as $\hat{\alpha}_{1,1} = -\sum_{n=2}^{6} \omega_n \hat{\alpha}_{1,n}$, where w_n denotes the share of category n workers in total employment. The skill differentials of workers in categories $n = (2, 3, \ldots, 6)$ are re-calculated according to the formula $\tilde{\hat{\alpha}}_{1,n} = \hat{\alpha}_{1,1} + \hat{\alpha}_{1,n}$. A corresponding procedure was applied to the coefficients of firm size and region type category variables as well.

broader classifications as in section 2.3.2. Considering six skill/gender categories, four region types, three experience and firm size categories yields a total of $6 \times 4 \times 3 \times 3 = 216$ cells. The means of the explanatory variables are calculated for each cell. With this information and the estimated coefficients of the wage equations it is straightforward to compute the average wage for each cell as predicted by our model. We then use a Blinder (1973)/Oaxaca (1973) technique for a group-specific decomposition of the raw wage differential between movers and stayers.[46]

2.5.2 Analysis of the mover/stayer wage differential

In order to investigate the net effect of work place mobility by comparing the wage of movers in the year after migration to the wage of their immobile counterparts in the region of destination, we consider decompositions by region type, skill category and experience.[47] *Table 2.4* contains the results at alternative levels of aggregation. Differentiation by region type only shows that earnings of movers and stayers vary substantially across types of regions. Immobile workers earn 6.8 percent above the national average in metropolitan regions (RT1), but 11.7 percent below in rural areas (RT4). While in metropolitan cities the spatial wage differential of movers is similar to that of stayers (6.1 percent), it differs markedly in region types with lower population density (RT2 and RT4). According to our estimates, earnings of immobile workers are well below the total average in RT2 (–6.5 percent), while those of movers exceed the average by 1.5 percent. The corresponding values for stayers and movers in rural regions (RT4) are –11.7 and –3.5 percent respectively. At first glimpse the results seem to suggest that spatial wage differentials vary distinctly between mobile and immobile workers. However, these patterns might be strongly influenced by the characteristics of both groups.

46 An explanation of the Blinder/Oaxaca (1973) type decomposition technique is given in the Appendix.

47 The differentiation by gender and firm size is neglected to keep the *table* readable.

Table 2.4: Estimated Wage Differential and Composition of the Workforce by Region Type, Skill and Experience (1997)

	Wage differential relative to the total average			Composition (column shares in percent)		
	Movers	Stayers	Difference	Movers	Stayers	Difference
RT1	**6.14**	**6.80**	**−0.66**	**51.65**	**50.20**	**1.45**
low-skilled	*−21.45*	*−15.41*	*−6.04*	*5.77*	*8.57*	*−2.80*
low exp.	−30.60	−40.02	9.42	0.87	0.77	0.11
med. exp.	−22.57	−20.17	−2.40	2.28	2.32	−0.04
high exp.	−17.42	−9.97	−7.45	2.62	5.49	−2.87
skilled	*2.48*	*5.06*	*−2.58*	*39.27*	*36.31*	*2.96*
low exp.	−15.24	−14.25	−0.99	10.90	6.51	4.39
med. exp.	2.87	3.00	−0.12	14.88	11.65	3.23
high exp.	16.36	13.31	3.05	13.49	18.15	−4.66
highly-skilled	*51.94*	*54.47*	*−2.53*	*6.62*	*5.32*	*1.30*
low exp.	39.60	36.01	3.59	2.72	1.28	1.44
med. exp.	57.22	53.71	3.51	2.87	2.08	0.79
high exp.	69.86	67.36	2.50	1.03	1.96	−0.93
RT2	**1.52**	**−6.51**	**8.03**	**10.57**	**7.76**	**2.80**
low-skilled	*−26.33*	*−26.16*	*−0.17*	*1.13*	*1.30*	*−0.17*
low exp.	−33.65	−48.85	15.20	0.15	0.12	0.03
med. exp.	−24.83	−30.75	5.92	0.64	0.37	0.27
high exp.	−25.84	−20.65	−5.19	0.33	0.81	−0.47
skilled	*−0.45*	*−5.84*	*5.39*	*8.46*	*6.05*	*2.42*
low exp.	−17.84	−25.05	7.20	2.31	1.26	1.05
med. exp.	0.47	−6.68	7.15	3.18	1.97	1.21
high exp.	12.05	3.31	8.74	2.98	2.82	0.16
highly-skilled	*50.93*	*44.76*	*6.17*	*0.97*	*0.42*	*0.56*
low exp.	32.00	24.60	7.40	0.33	0.10	0.23
med. exp.	56.26	45.55	10.71	0.46	0.17	0.29
high exp.	72.40	57.67	14.74	0.18	0.15	0.03

Table 2.4 (continued):

	Wage differential relative to the total average			Composition (column shares in percent)		
	Movers	Stayers	Difference	Movers	Stayers	Difference
RT3	**−1.49**	**−3.81**	**2.31**	**23.88**	**24.68**	**−0.80**
low-skilled	*−28.86*	*−23.97*	*−4.89*	*2.44*	*4.23*	*−1.79*
low exp.	−36.46	−47.88	11.42	0.54	0.40	0.14
med. exp.	−27.69	−28.71	1.02	0.80	1.12	−0.32
high exp.	−26.00	−18.47	−7.53	1.10	2.71	−1.60
skilled	*−4.84*	*−3.31*	*−1.53*	*18.77*	*18.96*	*−0.18*
low exp.	−22.41	−22.86	0.46	5.95	3.97	1.98
med. exp.	−2.83	−4.17	1.34	7.31	6.18	1.13
high exp.	11.45	6.11	5.34	5.51	8.80	−3.29
highly-skilled	*47.07*	*46.87*	*0.20*	*2.67*	*1.50*	*1.17*
low exp.	34.05	28.97	5.08	0.95	0.37	0.58
med. exp.	50.15	46.15	4.00	1.21	0.60	0.61
high exp.	63.90	60.11	3.78	0.51	0.53	−0.02
RT4	**−3.53**	−11.72	8.19	13.90	17.36	−3.46
low-skilled	*−27.96*	*−30.95*	*2.99*	*1.51*	*3.02*	*−1.51*
low exp.	−36.86	−54.35	17.49	0.10	0.29	−0.19
med. exp.	−29.95	−34.44	4.49	0.59	0.77	−0.18
high exp.	−25.42	−26.09	0.67	0.82	1.96	−1.14
skilled	*−4.91*	*−9.99*	*5.08*	*11.31*	*13.67*	*−2.36*
low exp.	−23.36	−29.58	6.22	3.21	3.32	−0.12
med. exp.	−3.02	−9.47	6.46	4.57	4.48	0.09
high exp.	9.37	0.72	8.65	3.54	5.87	−2.33
highly-skilled	*45.25*	*39.84*	*5.41*	*1.08*	*0.67*	*0.41*
low exp.	31.55	20.36	11.19	0.44	0.17	0.26
med. exp.	50.55	41.25	9.30	0.46	0.27	0.19
high exp.	64.87	53.10	11.77	0.18	0.22	−0.04
Sum				100 100 100	100 100 100	0.00 0.00 0.00

Notes: Wage differential calculated from TOBIT estimates. *Source:* Authors' own calculations using IAB-REG data.

Therefore, a deeper analysis requires the consideration of skill and experience categories for each type of region. We first take differences in the skill level into account. From the right panel of *Table 2.4* it is apparent that highly-skilled workers are clearly over-represented in core cities and their vicinities. Note that more than 10 percent of incumbent workers in RT1 are highly-skilled, while the corresponding share of the top skill category is distinctly lower in other region types (between 4 and 6 percent).

A closer inspection of *Table 2.4* shows that, irrespective of the region type, the share of movers belonging to the highest skill category exceeds that of stayers, while the opposite is true for low-skilled workers. At this level of differentiation, the estimated difference in movers' and stayers' earnings is predominantly negative in the urbanized regions (RT1 and RT3), and mostly positive in more rural ones (RT2 and RT4). Depending on the region type, the average earnings of low-skilled workers in the reference group of stayers are between 15 percent and 30 percent below the total average. For the intermediate skill category we find earnings between 9 percent below and 5 percent above the average. By contrast, the earnings of the highly-skilled are between 40 and 54 percent above average. Thus the wage advantage of movers over stayers tends to increase with the skill level. This is in accordance with theoretical predictions.

The finest form of decomposition is obtained by additionally considering experience. Differentiating by experience turns out to be crucial for understanding the effects of moving on wages. Except for highly experienced low-skilled workers, movers to RT2, RT3 and RT4 are always better off than their immobile counterparts. Somewhat surprisingly, we generally find the highest migration wage differentials for young *low-skilled* workers.[48] Of special interest are the effects in RT1. Low-skilled migrants to this region type exhibit a marked disadvantage with respect to the incumbent workforce if they belong to the intermediate or high-experience category. By contrast, all categories of highly-skilled migrants immediately receive relative wage gains.[49] This result is at odds with the findings of Glaeser and Maré (2001). Their general result that movers to metropolitan areas earn less than the stayers is not supported by the evidence here.

48 This is in accordance with the findings of Yankow (2003) for the US. He points to the fact that this group of migrants searches for immediate wage gains, while highly educated young migrants invest in their human capital.

49 Note that the overall differential between highly-skilled movers and stayers in RT1 is negative, while the differential is positive for all experience groups. This is due to the fact that experience (or age) of movers and stayers differs markedly. Typically the group of young or not experienced workers is clearly over-represented in the group of movers. The fact that this group earns significantly less than the high-experience group explains the negative difference (–2.53) for the category RT1/highly-skilled.

2.5.3 Comparing decomposition results at different levels of aggregation

Table 2.5 gives an overview for the decomposition results at different levels of aggregation. At the highest level we differentiate between region types only (model 1). We then add successively the dimensions gender (model 2), skill (model 3) and experience (model 4). In model 5, the most comprehensive model, all explanatory variables of the estimated equation are considered (region type/skill/gender/experience and firm size). Note that for all models the rewards, characteristics and interaction effects sum up to the total effect of 2.55.

Table 2.5: Decomposition of the Mover/Stayer Wage Differential at Different Levels of Aggregation (1997)

Model	Explanatory variables	Evaluation effect	Character-istics effect	Interaction effect	total
1	Region type	2.28	0.35	–0.09	
2	Region type/gender	0.98	1.91	–0.34	
3	Region type/gender/skill	–2.10	4.55	0.10	
4	Region type/gender/skill/experience	0.70	1.59	0.26	
5	Region type/gender/skill/experience/firm size	2.35	–1.01	1.21	2.55

Source: Authors' own calculations using IAB-REG data.

In model 1 we observe that the rewards effect clearly dominates the characteristics effect. Including the gender dimension in model 2 yields a positive characteristics effect (1.9 percent). This is due to the over-representation of male workers in the group of movers. Taking the qualification of workers into account (model 3) reinforces the characteristics effect since movers are more skilled on average than immobile workers. So far, however, an important negative wage-determining factor in the typical characteristics of movers – their low level of experience – has been neglected. Hence, model 3 overstates the characteristics effect, which is mirrored by a strongly negative deviation in the rewards effect. As shown by model 4, controlling for experience reduces the characteristics effect considerably (from 4.5 to 1.5 percent). Consideration of firm size adds a further negative component to the characteristics effect (model 5). The reason for this lies in the fact that movers tend to work in smaller firms than stayers. As can be concluded from the most comprehensive model, movers have less favourable characteristics in total than stayers. Hence, the positive overall effect of mobility cannot be explained by observed characteristics.

2.6 Robustness checks

2.6.1 Unobserved heterogeneity

An objection against the earnings-function approach used so far is that the results could possibly be biased because of the neglect of unobserved heterogeneity. Mobile and immobile workers, for instance, might differ in their career attitudes, working behaviour and other related factors that we cannot directly observe. Hence, the positive earnings effects attributed to interregional mobility might actually be due to this hidden information. A well-known approach for taking account of the time-invariant part of unobserved heterogeneity is the fixed-effects model. Using data for 1996 and 1997 we ran a fixed-effects version of the earnings-function approach described in section 2.4, where the time invariant explanatory variables were dropped. According to the results shown in *Table 2.6*, the wage growth of movers exceeds that of observationally equivalent stayers by about 1.7 percentage points with a t-statistic of 7.85. Hence the results of a wage advantage of movers over stayers survive the consideration of time-invariant unobserved heterogeneity of workers.[50]

Table 2.6: Results of the Fixed Effect Estimates (1996/97)

Variable	Coef.	t-statistics
Dummy 1997	**0.0602**	47.44
Region type BBR1 (ref.)		
Region type BBR2	**0.0121**	3.53
Region type BBR3	0.0055	1.08
Region type BBR4	–0.0134	–1.20
Region type BBR5	–0.0026	–0.49
Region type BBR6	**–0.0138**	–2.93
Region type BBR7	**–0.0208**	–3.17
Region type BBR8	–0.0114	–1.66
Region type BBR9	0.0061	0.54
Age squared	**–0.0005**	–32.91

50 A further objection against our method is that only workers are considered who are employed before and after moving. If participation and employment rates vary systematically over types of regions, our results cannot be generalized to the whole working age population. Pekkala and Tervo (2002) present an approach which explicitly takes account of this selectivity issue. Their approach requires instruments which are not available in our data set. However, we checked the existence of a possible influence of the type of region on employment and participation rates. A scatter plot between population density and employment or participation rates across 439 German NUTS3 regions shows no significant relationship. Therefore, we feel confident that this possible source of bias in our results is not substantial.

Table 2.6 (continued):		
Migration	**0.0168**	7.85
Constant	**10.4595**	370.26
industry controls	included	
firm size controls	included	
Test statistics		
F (137064, 134744)	33.29	

Source: Authors' own calculations using IAB-REG data. All coefficients significant at least at the 5 percent level are in bold.

2.6.2 Propensity score matching

To deal with the selectivity issue, one could alternatively use a matching approach.[51] The idea is that the best estimate of the outcome variable for (untreated) individuals of a specific group is the outcome of individuals with observationally equivalent characteristics in a reference group.

Let W_0 and W_1 denote two random variables for earnings of immobile or mobile workers, respectively, and $D \in \{0, 1\}$ be a dummy variable indicating whether a person belongs to the group of stayers ($D = 0$) or the group of movers ($D = 1$). Furthermore, define X as a vector of characteristics. The impact of migration on earnings for a mobile worker with (observable) characteristics X_i is the difference between the expected outcome of a mover with these characteristics, $E(W_{1i} \mid D_i = 1, X = X_i)$, and the hypothetical situation that this individual would have expected had she or he stayed in the region of origin $E(W_{0i} \mid D_i = 1, X = X_i)$. The problem is to find a suitable estimate for the latter expression which is not observable. The basic idea of the potential outcome approach[52] is to replace the counter-factual with the observed outcome of an individual (or individuals) from the control group with ideally identical characteristics. With highly differentiated characteristics, however, finding exact matches is hardly possible even in large data sets. To circumvent the curse of dimensionality the comparison is based on similar rather than on identical individuals. As a measure of similarity we choose the propensity score $Pr(D_i \mid X = X_i)$ of a probit regression that describes the selection of individual *i* into the treatment group.[53] There are several possibilities for constructing the counter-factual. A simple one is the *n*-nearest neighbour method which uses the *n* observations in the control group most similar to an individual in the "treatment group", i.e. here, in the group of mobile workers.

51 For an overview of recent developments of this approach see Cobb-Clark and Crossley (2003) or Smith and Todd (2005).

52 See Roy (1951) and Rubin (1974).

53 The basic idea goes back to the seminal contribution of Rosenbaum and Rubin (1983).

A more sophisticated approach uses all observations of the control group but attaches weights to them which are lower the more distant the observation is from the observation in the treatment group. These weights are calculated using a kernel estimate of the distribution.

In the probit regression we used all characteristics of workers as described in section 2.4.[54] The selection into future movers and stayers is modelled using characteristics of 1996, i.e. the year before migration. For determining the wage effect of mobility one could either compare movers with stayers in the region of destination or with stayers in the region of origin. For the first (second) alternative one has to use 1997 (or 1996, respectively) characteristics in order to identify the corresponding matches between movers and stayers. For the construction of the counter-factual we analysed the first nearest neighbour approach and kernel matching as two extreme cases. It turns out, however, that both alternative matching methods produce similar results. The standard errors were generated by bootstrapping (see, e.g. Heckman et al., 1998).

In analogy to the fixed-effects method, the matching approach can also be based on wage growth rates rather than on levels. In the empirical literature on programme evaluation (see, for example, Heckman et al., 1999; Smith and Todd, 2005) it is assumed that the impact of unobservable characteristics on the outcome is constant over time. Under this assumption, unobserved heterogeneity is differenced out by using difference-in-differences matching. In our empirical application we considered this as a further alternative.

The results for the different variants of the matching approach are given in *Table 2.7*. Comparing an unmatched selection of movers and stayers in the year before migration confirms the result in *Figure 2.2*, showing that future movers have a wage disadvantage against future stayers. Matching reduces the wage differential markedly in case of the nearest neighbour method (where it becomes statistically insignificant) and less so in the case of kernel matching. This finding suggests that less favourable characteristics of movers are at least partly responsible for lower wages in the year before moving.[55]

54 The results of the probit model are not documented in the paper, but are available on request from the authors. For the calculation of the matching model we used the Psmatch2 Stata module (Version 3.0.0) by Leuven and Sianesi (2003).

55 We conducted the usual diagnostics on the success of matching without finding any clues for questioning the results. The common support assumption is fulfilled in our case. After matching, the differences in characteristics between movers and controls are statistically insignificant.

Table 2.7: Results from Nearest Neighbour and Kernel Matching

Level approach, outcome variable: wage				
	future movers	controls	ATET	z-value
	1996			
Unmatched	149.86	152.26	–1.59	–
Nearest neighbour matching	149.86	150.00	–0.09	–0.09
Kernel matching	149.86	151.75	–1.25	–2.29*
	movers	controls	ATET	z-value
	1997			
Unmatched	157.40	153.70	2.38	–
Nearest neighbour matching	157.40	153.28	2.65	2.51*
Kernel matching	157.40	153.33	2.62	3.52**
Difference-in-differences approach, outcome variable: wage growth (in %)				
	movers	controls	ATET	z-value
	1996/1997			
Unmatched	4.96	2.03	2.93	–
Nearest neighbour matching	4.96	2.42	2.54	4.79**
Kernel matching	4.96	2.13	2.83	4.83**

Notes: **/* indicates statistical significance at the 1 % level and 5 % level. z-values are calculated by using a bootstrap method (300 replications for Nearest Neighbour Matching and 50 replications for Kernel Matching). The average treatment effect on the treated (ATET) is measured as log wage differential. Wages are calculated from log earnings. The probit regression is based on skill/gender, experience, firm size and region type variables. In case of Kernel Matching the bandwidth is 0.06 (Stata standard). The presented results are robust with respect to the choice of the bandwidth.
Source: Authors' own calculations based on IAB-REG.

In the year after migration the average treatment effect on the treated is about 2.6 percent for both methods of constructing the counterfactual. This is in accordance with the 2.55 percent wage differential we found using the earnings function approach. Thus, the results of the matching procedure based on (log) wage levels of movers and stayers support the findings documented in section 2.5.1.

Applying difference-in-differences matching we find that the positive differential between the wage growth rates of movers and stayers is only slightly reduced (from roughly 3 percent to 2.5 in the case of nearest neighbour and 2.8 for kernel matching). We conclude that the positive effect of mobility on wage growth cannot be explained by favourable unobserved characteristics of mobile workers at least if these characteristics are not subject to a marked change over time.

The results of the different specifications of the matching approach using 1996 characteristics only are contained in *Table 2.8*. Here we additionally included 35 industry dummies and log wages in the year before migration as further explanatory variables in the probit regression. The average treatment effect of the treated turns out to be quite robust with respect to these changes.

Table 2.8: Results From Nearest Neighbour Matching Using 1996 Characteristics

Level approach, outcome variable: wage				
	movers	controls	ATET	z-value
	1997			
Nearest neighbour matching	157.40	153.77	2.33	2.14*
Difference-in-differences approach, outcome variable: wage growth (in %)				
	movers	controls	ATET	z-value
	1996/1997			
Nearest neighbour matching	4.91	2.63	2.28	4.61**

Notes: The probit regression is based on skill/gender, experience, firm size and region type, log wages and industry variables in 1996. For further notes see Table 2.7.

As a further check of robustness we excluded data from metropolitan core cities and re-ran the different estimation approaches. The effect of mobility exceeded those in *Table 2.8* by about 0.5 percentage points and also remained highly significant in this case.[56]

2.7 Conclusions

The aim of this paper was to investigate the general and group-specific effects of interregional mobility on earnings. We find that in the year before workers migrate they have distinctly lower mean earnings than their immobile colleagues. After migration, the average mobile worker typically catches up with the average stayer in the region of destination or even experiences higher wages. This is the case although movers tend to have less favourable characteristics than stayers. Hence, labour mobility leads to a wage gain relative to stayers in the region of destination that cannot be attributed to observed characteristics.

One should stress that the overall characteristics effect of movers is the result of strong opposing forces. On the positive side, movers are typically more skilled. The fact that males are over-represented in the group of movers also contributes to higher mean earnings. On the negative side, mobile workers are younger, i.e. less experienced than their immobile counterparts. Compared to stayers, a further structural disadvantage of movers is that they are more likely to work in smaller firms. This aspect has been neglected in most of the literature concerning the migration wage differential.

It is interesting to compare our results with those of Glaeser and Maré (2001). These authors find wage gains for movers to metropolitan areas because of a *wage level effect* due to the urban environment. Compared to the incumbent

56 The results are available from the authors on request.

workforce in these areas, however, the earnings of movers fall behind. Their explanation of this phenomenon is that the impact of favourable agglomeration forces becomes fully effective only after a certain period of time. Our results are at least partly at odds with these findings. The evidence in the present paper indicates that earnings of several groups of movers even surpass those of the incumbent workforce in core cities. All in all, our results support the hypothesis that the *wage level effect* is not uniform across different groups of workers (as was implicitly assumed in the approach chosen by Glaeser and Maré (2001)). Moreover, Glaeser and Maré (2001) do not consider the effect of moving between non-metropolitan areas. Therefore, they are not able to detect a positive effect of mobility independent of urban influences. Our empirical evidence supports the hypothesis of a general effect. The estimation results presented indicate that the post-migration wage differential is positive for most groups of workers *irrespective of the region of destination*. Hence, it is at least questionable whether the wage level effect is fully caused by the urban environment. Our findings corroborate the view that the gains from mobility mainly stem from the actual decision to migrate.

Checking the robustness of the general results, we employ a fixed-effects model and several variants of a matching approach. Irrespective of the method used, the positive effects of mobility are in the order of magnitude of 2 to 3 percent and statistically highly significant. We conclude that the positive impact of interregional mobility on earnings is not an artefact generated by differences in either observed or unobserved characteristics of movers and stayers as long as the latter are confined to being time-invariant.

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Appendix

Description of the decomposition technique

Let the usual wage equation for mobile and immobile workers be given as $\mathbf{y} = \mathbf{x}'\beta + \varepsilon$ and $\mathbf{Y} = \mathbf{X}'\mathbf{B} + \mathbf{E}$ respectively. Then define $\Delta\hat{\beta} := \hat{\beta} + \hat{\mathbf{B}}$ and $\Delta\bar{x} := \bar{x} - \bar{\mathbf{X}}$, where the vectors $\bar{x}$ and $\bar{\mathbf{X}}$ contain average values of the explanatory variables for movers and stayers respectively. The decomposition of the raw earnings differential $\bar{y} - \bar{\mathbf{Y}}$ can be obtained as

$$\begin{aligned}\bar{y} - \bar{\mathbf{Y}} &:= \bar{x}\hat{\beta} - \bar{\mathbf{X}}\hat{\mathbf{B}} \\ &= \underbrace{\bar{\mathbf{X}} \cdot \Delta\hat{\beta}}_{\text{evaluation effect}} + \underbrace{\Delta\bar{x} \cdot \hat{\mathbf{B}}}_{\text{characteristics effect}} + \underbrace{\Delta\bar{x} \cdot \Delta\hat{\beta}}_{\text{interaction effect}}.\end{aligned} \tag{A2.1}$$

Table A2.1: Regional Classification Scheme Based on BBR-Classification

Structural region type	District type (BBR-Classification)	Region types (RT) used in the paper	Description of region type (BBR)
Regions with large agglomerations	BBR1	RT1	Core cities
	BBR2	RT1	Highly urbanized districts in regions with large agglomerations
	BBR3	RT2	Urbanized districts in regions with large agglomerations
	BBR4	RT2	Rural districts in regions with large agglomerations
Regions with features of conurbation	BBR5	RT3	Central cities in regions with intermediate agglomerations
	BBR6	RT3	Urbanized districts in regions with intermediate agglomerations
	BBR7	RT4	Rural districts in regions with intermediate agglomerations
Regions of rural character	BBR8	RT4	Urbanized districts in rural regions
	BBR9	RT4	Rural districts in rural regions

Table A2.2: Classification of the Firm Size

Firm size categories	Aggregated firm size categories	Number of workers
FS1	small	1–5
FS2		6–20
FS3		21–50
FS4	medium	51–100
FS5		101–250
FS6		251–500
FS7	large	501–1000
FS8		> 1000

Table A2.3: Selection of Data (1996/1997)

	number of cases
total number of individual observations	535,578
West Germany (old *laender*) only	432,663
multiple employed workers excluded	428,579
with valid earnings information	416,334
workers under apprenticeship, volunteers, family workers excluded	392,986
with valid information about age, qualification and place of work	359,795
part-time workers excluded	309,815
Observations used in our sample	309,815

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3 Gender-Specific Migration Wage Differentials

joint with Joachim MÖLLER

Abstract

This paper analyzes gender-specific effects of interregional mobility on earnings. Using a large panel microdata set we find negative earnings differentials for prospective movers in the year before migration for both genders but more pronounced for males. While female movers are able to over-compensate the negative differential in the year after migration, male movers are worse off relative to the incumbent workforce in the region of destination. Our results suggest that contemporaneous returns to interregional mobility are more pronounced for females. Applying a Blinder/Oaxaca type decomposition technique demonstrates that the positive post-migration wage differential for female movers compared to stayers in the region of destination cannot be explained by differences in the observed characteristics. While this is not the case for male workers, mobile female workers are favored by a better evaluation of their characteristics after moving.

Keywords: Interregional migration, migration wage differentials, gender-wage gap.
JEL-classification: J61, R23.

3.1 Introduction

The phenomenon that individuals move from one place to another driven by economic forces is one of the oldest themes in regional economics. A voluminous literature deals with the determinants of migration. Since the human capital approach of Sjaastad (1962), it is a well established finding that expected earnings are of paramount importance for the migration decision (see also Todaro, 1969; Harris and Todaro, 1970). Moreover, it is recognized that individual characteristics such as education, labor market status, work experience or gender matter for the propensity to migrate. Greenwood (1975) gives an excellent survey of migration determinants on the individual level in the early literature. Family background variables are also known to affect the likelihood of migration (see Long, 1974; Mincer, 1978). In addition, push and pull factors at the regional level play a crucial role. Potential migrants should be expected to take into account regional differences in the costs of living, amenities and other aspects influencing the quality of life. Another major factor is that the likelihood of migration falls with

increasing distance between the region of origin and the region of destination (see for example Long et al., 1988; Lucas, 2001).[57]

Alternative approaches are pursued by different authors in classifying mobility in space. Some authors like Hunt and Kau (1985) or Gabriel and Schmitz (1995) define migration as change of the standard metropolitan statistical area where persons are living and/or working. Other possibilities are to consider inter-county migration (e.g. Linneman and Graves, 1983) or rural-urban migration (Harris and Todaro, 1970; Glaeser and Maré, 2001). It is obvious that the effects of migration differ markedly depending on the choice of the definition.

Another strand of the literature analyses migration in a broader context. Typically, regional migration is associated with change in the employer and/or occupational mobility. This interdependence between these different aspects of mobility is explicitly modeled in some studies (see Bartel, 1979; Linneman and Graves, 1983; Herzog and Schlottmann, 1984; Krieg and Bohara, 1999 and more recently Yankow, 2003; Ham et al., 2004). In most cases, the geographical component is defined as inter-state migration.

A further difference between migration studies concerns sample selection. While a rich literature exits concerning the effects of migration for young men,[58] the consequences of migration for most other groups of workers have mostly been neglected in migration research.

Economically, perhaps the most interesting aspect of migration is the effect on wages or earnings. There are, however, alternative approaches to deal with this effect: one can investigate contemporaneous returns, wage growth effects, or both. Most studies focus on the average contemporaneous returns to migration. The results seem to depend on the sample of migrants selected for the study. Contemporaneous returns are positive for younger workers (Bartel, 1979), for repeat migrants (Hunt and Kau, 1985) and for less-educated workers (Gabriel and Schmitz, 1995; Yankow, 2003). According to Bartel (1979) the wage effect is statistically not significant for older workers. This is also found for one-time migrants (Hunt and Kau, 1985) and for highly-educated workers (Yankow, 2003). Some studies even find negative return (see for example, Polachek and Horvath, 1977; Borjas et al., 1992; Tunali, 2000).

Our paper differs from the literature in various aspects. Using a large microdata panel set we are able to study the wage effects of mobility in a comprehensive way. We differentiate not only by gender but also along skill and experience as dimensions of personal characteristics being highly relevant for wage determination. Moreover,

57 Of course, this relationship is an old theme since the evolution of gravity models of migration.

58 See, for example: Bartel (1980), Borjas and Rosen (1980), Bartel and Borjas (1981), Mincer and Jovanovich (1981), Borjas (1984), Mincer (1986), Antel (1991), Loprest (1992), Topel and Ward (1992), Light and McGarry (1998), Yankow (1999) and more recently: Ham et al. (2004), Détang-Dessendre et al. (2004).

we show that the neglect of firm size might give rise to misleading interpretations of the mover/stayer wage differential. In contrast to chapter 2, we stress here the difference between male and female workers. The aim of our study is to give a deeper insight into the gender-specific composition and evaluation effects playing a major role for the explanation of the wage effect of mobility.

The remainder of our paper is organized as follows. In section 3.2 we describe our data base and fundamental concepts. Section 3.3 first gives some descriptive evidence on the composition of movers and stayers and presents the results of a probit model designed to explain the propensity to interregional mobility. Section 3.4 outlines the econometric wage equation approach used for estimating the wage effects and presents the results. In section 3.5 we describe the decomposition method and present the various findings. Section 3.6 concludes.

3.2 Data and basic definitions

3.2.1 Data

The data used in this paper is a one percent random sample from the Employment Statistics of the Institute for Employment Research, Nuremberg (IABREG).[59] It includes all workers, employees and trainees with the obligation of paying social insurance contributions. Not included in the data are, among others, civil servants, marginal employed persons, students enrolled in higher education, workers in an apprenticeship, volunteers and family workers. We consider the men and women aged 16 to 70 years who were employed at the 30th of June of each year. The data includes information not only on earnings but also on a series of characteristics of the worker like age, occupation, skill level and some characteristics of the firm like firm size. For the latter we differentiate between eight categories (see Appendix, *Table A3.1*).

The qualification of the considered workers can be subdivided into three categories:

- *low-skilled*: persons with no occupational qualification regardless of which schooling level, that means with or without upper secondary education (*Abitur*);
- *skilled*: persons with an occupational qualification whether they have an upper secondary education (*Abitur*) or not;
- *high-skilled*: persons with upper secondary education holding a university or a polytechnics degree.

59 For a description of the data source please see Bender and Haas (2002).

The data contains regional information which refers to the location of the firm respectively the work place and not the residence of a worker. Using a classification scheme of the *Bundesanstalt für Bauwesen und Raumordnung* (BBR) we differentiate between nine types of regions at NUTS3 (county) level. The classification scheme of the BBR distinguishes between areas with large agglomerations, areas with features of conurbation and areas of rural character. Within areas comprising large agglomerations the classification scheme distinguishes between metropolitan core cities (BBR1), highly urbanized districts (BBR2) in the surroundings of those cities, urbanized districts (BBR3) and rural districts (BBR4). The second category contains central cities (BBR5) in regions with intermediate agglomerations, their urbanized surroundings (BBR6) and rural districts (BBR7). In the regions of rural character the differentiation is between urbanized districts (BBR8) and rural districts (BBR9).[60]

Because there are still large structural differences in the labor market and the migration pattern between the eastern and the western part of Germany we constrict the analysis to workers in pre-unification Germany. Beyond this, we drop part-time workers, workers with more than one job and those with incomplete information on earnings[61], skill level, experience or the region where the workplace is located (see Appendix, *Table A3.3* for data selection).

3.2.2 Basic definitions

Following Glaeser, Maré (2001) we concentrate on the spatial dimension of mobility. Like these authors our approach stresses the role of the characteristics of regions for wage determination in order to catch possible agglomeration effects. Throughout the paper we therefore define mobility of employed workers as a change in the BBR-region type where the workplace is located. We disregard workers who are not observed at the cutoff date in two succeeding years. Hence we exclude observations of all workers who were not employed in period $t = 0$, but employed in $t = 1$ ("drop-ins"), those who were employed in period $t = 0$, but not so in $t = 1$ ("drop-outs"), and, of course, those who were unemployed or out of the labor force in both periods. We construct a (0,1)-dummy variable that indicates whether or not a person is employed in a different type of region in period $t = 1$. In $t = 0$ those who are going to reveal their mobility in the next period are called future movers (FM). After having moved to a work place in a different region type this group of workers is addressed in period $t = 1$ as *current movers* (*CM*), or simply

60 For an overview of region types according to this classification see *Table A2.2* in the Appendix.

61 Earnings in our data source are gross daily earnings calculated as average over the observed employment spell for each person. The notions earnings and wages are used interchangeable throughout this paper.

movers. Correspondingly, workers who do not change the type of region where the work place is located from period $t = 0$ to $t = 1$ are called *future stayers* (*FS*) in period $t = 0$ and *current stayers* (*CS*), or simply *stayers* in $t = 1$.

Table 3.1 gives some basic information on the number of observations for male and female movers and stayers in our sample. Given our selection criteria, the number of males in our sample is more than twice the number of females. For both genders the share of mobile workers in total workers, the mobility rate, was relatively high (3.1 to 3.5 percent) at the beginning of the nineties, the early stage of the re-unification process. Since 1994 mobility rates for males are fairly constant at slightly below 3 percent for males and – somewhat lower at between 2.4 and 2.7 percent for females. In absolute numbers, the group of movers comprises between about 2,750 and 3,500 persons per year for males and 1,100 and 1,600 for females.

Table 3.1: Absolute Number and Share of Movers and Stayers in the Sample (1990–1997)

	1990	1991	1992	1993	1994	1995	1996	1997
	males							
total	100,015	102,201	104,206	102,475	99,037	96,480	94,807	92,771
stayers	96,520	98,678	100,979	99,573	96,171	93,643	92,026	90,022
percent of total	96.5	96.6	96.9	97.2	97.1	97.1	97.1	97.0
movers	3,495	3,523	3,227	2,902	2,866	2,837	2,781	2,749
percent of total	3.5	3.4	3.1	2.8	2.9	2.9	2.9	3.0
	females							
total	46,320	47,603	48,704	48,529	47,481	45,803	44,898	43,690
stayers	44,836	45,998	47,061	47,179	46,225	44,588	43,810	42,605
percent of total	96.8	96.6	96.6	97.2	97.4	97.3	97.6	97.5
movers	1,484	1,605	1,643	1,350	1,256	1,215	1,088	1,085
percent of total	3.2	3.4	3.4	2.8	2.6	2.7	2.4	2.5

Source: Own calculations using IAB-REG data.

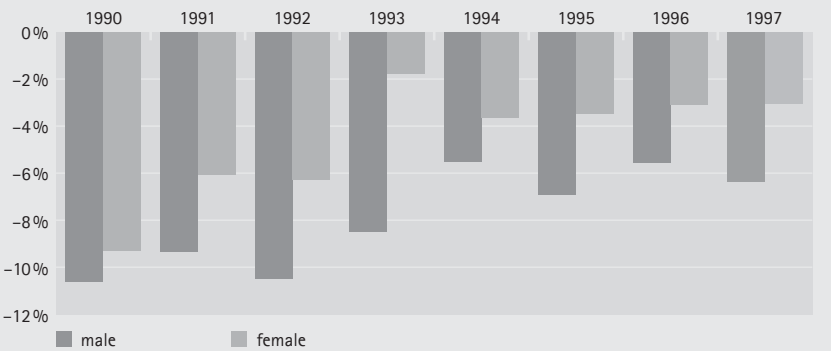
3.3 Evidence on the composition of movers and stayers

3.3.1 The gender-specific mover/stayer-wage differential

In order to investigate the gender-specific differences in contemporaneous returns to mobility between region types, we start by presenting the raw wage differentials of male and female movers relative to their reference groups of stayers in the year before and after migration. It is obvious from *Figure 3.1* that the raw wage differential of prospective movers is negative in all cases and more pronounced for male workers. With values in the order of magnitude of –10 percent for males and

–6 to –9 percent for females, the pre-move wage disadvantage is especially high in the early nineties. After 1993 it is around –6 percent for male and –3 percent for female movers.

Figure 3.1: Wage Disadvantage of Prospective Movers With Respect to Stayers 1991 to 1997



Comparing the average wages of movers and stayers one year later yields the results shown in *Figure 3.2*. While the raw wage differentials of male movers relative to male stayers remain negative, female movers are able to over-compensate the negative differential in six of eight years. These first results indicate gender-specific differences in the composition of movers and in the returns to mobility. Nevertheless, at first glance both genders seem to gain from moving relative to their immobile counterparts.

Figure 3.2: Wage Differentials of Movers over Stayers 1991 to 1997

Comparing yearly *wage growth rates* of mobile and immobile workers instead of the wage level, *Figure 3.3* gives further results. The wage growth rates for all groups

are obviously correlated showing the highest values in the unification boom year 1991and the lowest in 1997. According to the figure, movers exhibit wage growth rates being roughly twice as high as those for stayers. Within the group of movers, the wage increase for females compared to males is about 4 percentage points higher in the beginning of the nineties and about 2 percentage points thereafter. This descriptive result suggests that women might benefit more from moving then men. Before drawing such a conclusion, however, it is necessary to scrutinize the composition of movers and stayers.

Figure 3.3: Wage Growth Rates of Immobile and Mobile Workers 1991 to 1997

3.3.2 Differences in the characteristics of male and female movers and stayers

The raw wage differentials presented so far neglect the role of gender-specific differences in the characteristics of movers and stayers. This section gives some basic information for the year 1997.[62] *Table 3.2* compares the gender-specific composition of movers and stayers by skills and experience as two important individual characteristics and by firm size and region type where the workplace is located. The measure of concentration indicates whether movers are over-represented in a given category (values of the indicator > 100) or under-represented (values < 100).[63]

Relative to the reference group of male stayers, mobile men are slightly over-represented in the skilled (75.6 percent versus 74.8 percent) and more so in the high-skilled category (13.0 percent versus 9.4 percent). The latter is also reflected

62 The described differences are fairly robust within the sample period 1990 to 1997.

63 The measure of concentration is calculated as: 100*share of group in total movers or stayers/share of group total of all workers.

by the measure of concentration which amounts to 136.98 for high-skilled movers. Although the number of cases is lower in absolute value compared to males, female workers are even more concentrated in the skilled and high-skilled categories than their male counterparts.

For both genders, the low and medium experience groups[64] (i.e. younger workers) are heavily over-represented in the group of movers. The bias towards younger workers in the sample of mobile workers is somewhat stronger for males than for females. Note that the share of female workers with potential work experience of less than 10 years in the group of stayers is almost twice as that for immobile male workers.[65] About 42 percent of mobile female workers in our sample belong to the low-experience category, while the corresponding share for male workers is 22.5 percent only. This is mirrored by the fact that female movers are strongly under-represented in the high-experience category.

With respect to firm size *Table 3.2* shows quite similar shares of male and female movers.[66] Irrespective of gender, about 45 percent of movers are employed in small firms while the share of mobile workers in large establishments is 16 percent only. Nonetheless we observe substantial differences in the measure of concentration since females in general are more likely to be employed in smaller firms than males. This leads to the result that female movers are less over-represented in small firms and less under-represented in large firms than male movers.

Further dissimilarities between movers and stayers emerge when it comes to the type of the region.[67] Especially for male workers, the propensity to move to RT2, the farther periphery of metropolitan cities, is evident. At the same time, a disproportionately low share of mobile workers of both genders chooses as destination rural regions in low-density areas.

Summarizing the main results, we find that movers tend to be more skilled and less experienced or younger than stayers. Compared to males, females exhibit higher concentration measures for skilled and high-skilled workers and lower ones for working in small firms and belonging to the low-experience group.

64 The potential work experience is categorized as follows: low experience: 0–9 years; medium experience: 10–19 years; high experience: 20 or more years.

65 Among others, this is due to the fact that the sample here is confined to full-time workers. Female workers in the medium and high experience category are more likely to work part-time.

66 We divide into small firms (0–50 workers), medium firms (51–500 workers) and large firms (more than 500 workers).

67 In order to avoid problems with too small cell sizes, we aggregated the BBR-region types into four broader categories RT1 to RT4 (see *Table A3.2* in the Appendix).

Table 3.2: Absolute Number and Share of Movers and Stayers by Skills, Firm Size and Region Type (1997)

	Stayers		Movers		
	Absolute Number	Share	Absolute Number	Share	Measure of Concentration
			skills		
			male		
low-skilled	14,239	0.158	313	0.114	72.59
skilled	67,321	0.748	2,078	0.756	101.05
high-skilled	8,462	0.094	358	0.130	136.98
total	90,022	1	2,749	1	100
			female		
low-skilled	7,767	0.182	106	0.098	54.21
skilled	32,860	0.771	897	0.827	107.00
high-skilled	1,978	0.046	82	0.076	160.29
total	42,605	1	1,085	1	100
			experience		
			male		
low exp.	10,922	0.121	648	0.236	189.01
medium exp.	30,697	0.341	1,138	0.414	120.64
high exp.	48,403	0.538	963	0.350	65.83
total	90,022	1	2,749	1	100
			female		
low exp.	9,565	0.225	452	0.417	181.70
medium exp.	12,288	0.288	376	0.347	119.56
high exp.	20,752	0.487	257	0.237	49.26
total	42,605	1	1,085	1	100
			firm size		
			male		
small firm size	29,571	0.328	1,253	0.456	137.18
medium firm size	33,412	0.371	1,034	0.376	101.30
large firm size	27,039	0.300	462	0.168	56.69
total	90,022	1	2,749	1.000	100
			female		
small firm size	17,601	0.413	516	0.476	114.69
medium firm size	15,033	0.353	393	0.362	102.59
large firm size	9,971	0.234	176	0.162	69.84
total	42,605	1	1,085	1	100
			region type		
			male		
RT1	44,918	0.499	1,407	0.512	102.50
RT2	6,930	0.077	308	0.112	143.61
RT3	22,336	0.248	647	0.235	95.00
RT4	15,838	0.176	387	0.141	80.49
total	90,022	1	2,749	1	100.00
			female		
RT1	21,771	0.511	578	0.533	104.14
RT2	3,319	0.078	97	0.089	114.34
RT3	10,423	0.245	269	0.248	101.31
RT4	7,092	0.166	141	0.130	78.50
total	42,605	1	1,085	1	100.00

Notes: Own calculations using IAB-REG; measure of concentration: 100*share of group in total movers or stayers/ share of group total of all workers.

In order to examine the differences in the individual probabilities to migrate in a more systematic way, we estimated a probit model separately for men and women.[68] The dependent variable is a binary choice variable with $y_{it} = 1$ if individual *i* changes the region type at time *t* and $y_{it} = 0$ otherwise. The exogenous variables are (0,1)-dummy variables for the characteristics described above and a battery of industry control variables.[69]

Table 3.3 presents the results of the probit estimations with and without using industry control dummies. The number of observations is about 92,000 for males and about 43,000 for females. The results confirm the findings from descriptive statistics and are in accordance with theoretical expectations. The estimations appear to be robust with respect to the inclusion of industry control dummies. Considering the skill category for male workers in the probit estimation with industry controls, one can conclude from the estimates for male workers that being *low-skilled* decreases the probability of changing the region type by roughly 8 percent, while being *high-skilled* increases it by about 14 percent. Significant positive effects are observed for the variables *small firm size*, *low* and *medium experience* as well as for *region type 2*. This is mirrored by the negative effects of the remaining variables. For example, *large firm-size* and *high experience* drop the propensity of migration for male workers by more than 20 percent each.

The probit estimates for female workers exhibit a similar pattern than that for males. The standardized coefficients of the variables *high-skilled* (+21 percent), *region type 2* (–21 percent) and *high experience* (–34 percent) indicate more distinct effects than those for male workers.

68 The values for the industry dummies are not included and available from the authors on request.

69 In order to interpret the results independently from the choice of the reference group, the estimated coefficients are standardized following a method originally proposed by Greene and Seaks (1991). We re-calculated the estimated coefficients in order to obtain effects relative to the weighted average in the aggregate economy. For example, the differential of low-skilled male workers relative to the average in the economy is obtained as $\hat{\alpha}_{1,1} = -\sum_{n=2}^{3} \omega_n \hat{\alpha}_{1,n}$, where the weight ω_n denotes the share of category *n* workers in total employment. The skill differentials of workers in categories $n = (2, 3)$ are re-normalized according to the formula $\hat{\alpha}_{1,n} = \hat{\alpha}_{1,1} + \hat{\alpha}_{1,n}$. A corresponding procedure was applied to the coefficients of firm size-, region type-, experience- and industry-category variables as well.

Table 3.3: Results of the Probit Estimates (1996)

Variable	Standardized Coefficients	Standardized t-statistics	Standardized Coefficients	Standardized t-statistics
	Male			
Low-skilled male	**–0,0778**	–3,37	**–0,0768**	–3,45
Skilled male	**–0,0105**	–2,10	–0,0084	–1,74
High-skilled male	**0,1395**	5,59	**0,1260**	5,31
Firm-Size: small	**0,1000**	9,98	**0,1236**	13,53
Firm-Size: medium	**–0,0274**	–2,32	**–0,0305**	–2,68
Firm-Size: large	**–0,2201**	–10,90	**–0,2793**	–15,76
Region Type 1	0,0007	0,08	**0,0209**	2,40
Region Type 2	**0,1210**	4,69	**0,1026**	4,03
Region Type 3	0,0022	0,15	–0,0123	–0,84
Region Type 4	**–0,0941**	–4,63	**–0,1236**	–6,20
Experience: low	**0,1975**	13,40	**0,2073**	14,33
Experience: medium	**0,0297**	2,80	**0,0283**	2,70
Experience: high	**–0,2068**	–17,03	**–0,2135**	–17,90
Constant	**–0,1669**	–1,93	**–0,2749**	–8,53
Industry dummies	yes		no	
N	92,767		92,771	
Pseudo-R^2	0,0533		0,0336	
	Female			
Low-skilled female	–0,0482	–1,28	–0,0511	–1,41
Skilled female	**–0,0133**	–1,99	–0,0094	–1,45
High-skilled female	**0,2066**	4,11	**0,1704**	3,49
Firm-Size: small	**0,0425**	2,91	**0,0620**	4,59
Firm-Size: medium	0,0165	0,90	0,0041	0,23
Firm-Size: large	**–0,1892**	–5,68	**–0,2259**	–7,33
Region Type 1	–0,0071	–0,52	0,0051	0,38
Region Type 2	**0,2088**	5,73	**0,2029**	5,63
Region Type 3	–0,0205	–0,86	–0,0340	–1,45
Region Type 4	**–0,1508**	–4,39	**–0,1674**	–4,97
Experience: low	**0,1799**	12,23	**0,1837**	12,66
Experience: medium	–0,0282	–1,40	–0,0287	–1,44
Experience: high	**–0,3412**	–14,38	**–0,3486**	–14,87
Constant	**–0,3184**	–2,16	**–0,1997**	–3,99
Industry dummies	yes		no	
N	43,629		43,690	
Pseudo-R^2	0,058		0,0422	

Notes: All coefficients being significant at least at the 5 percent level are in bold.
Source: Own calculations using IAB-REG data.

3.4 Econometric estimates using a wage equation approach

3.4.1 Outline of the estimation framework

In order to analyze the wage differential between mobile and immobile workers by gender more rigorously, we estimate separate Mincer-type wage equations.[70] More specifically, for each group we assume a linear relationship between log earnings and several explanatory variables measuring skill, (potential) experience and other characteristics of the worker and the employer. Potential experience enters the wage equation in linear and quadratic form to capture a non-linear (concave) wage/experience profile. Again, the skill-effects are measured by corresponding dummy variables using the low-skilled category as reference. Deviating from the specification in the probit model presented in subsection 3.3.2 we specify the firm size and region type variables in a more differentiated way, the effect of firm size on earnings is captured here by eight differentiated firm-size (0,1)-dummy variables with the smallest category (less than 6 workers) chosen as a reference. The region type also comprises more categories than above taking metropolitan cities (BBR1) as the reference category. Moreover, we introduce interaction effects between the workers' experience with gender and qualification.[71] Hence the equation to be estimated can be formulated as

$$\begin{aligned}\ln w_i^{\theta}\,\alpha = {} & \alpha_0^{\theta} + \alpha_1^{\theta} EXP_i + \alpha_2^{\theta} EXP_i^2 + \alpha_{3,n}^{\theta} \sum_{n=2}^{8} FIRMSIZE_{n,i} + \alpha_{4,n}^{\theta} \sum_{n=2}^{9} REGIONTYPE_{n,i} \\ & + \alpha_{5,n}^{\theta} \sum_{n=2}^{6} DSKILL_{n,i} \\ & + \text{interactions of experience and experience squared with qualification} \\ & + u_i^{\theta}. \end{aligned} \tag{3.1}$$

The dependent variable w_i^{θ} stands for earnings of individual i within a specific group of workers $\theta = \{CM_{male}, FM_{male}, CS_{male}, FS_{male}, CM_{female}, FM_{female}, CS_{female}, FS_{female}\}$. The error term is u_i assumed to be identically and independently distributed. Since earnings data is censored at the upper ceiling in the German social contribution system, we use the Tobit estimation method.

70 See Mincer (1974).

71 All skilled and high-skilled workers are considered as qualified. All interactions are defined for the linear and quadratic experience variable.

3.4.2 Estimation results

The results are contained in *Table 3.4a* for the year before migration takes place and *Table 3.4b* for the following year, respectively. Sign and magnitude of the coefficients correspond to theoretical expectations. The Pseudo-R^2 ranges between 0.34 and 0.50 for male workers in both years and between 0.31 and 0.34 for the observed groups of females. The standard error is between 0.27 and 0.35.

The estimated coefficients are fairly similar if the results for the same group are compared over time, i.e. putting the corresponding entries in *Tables 3.4a* and *3.4b*. However, there are marked differences between movers and stayers as well as between males and females. Relative to those for males, the results for female movers and stayers exhibit higher absolute coefficients for the dummy variables measuring skill, firm size and region type than males. Note that the coefficient of the (potential) experience gives the gradient of the experience/earnings profile at the beginning of a worker's career for a person in the reference skill group. For male (current or future) stayers this gradient is twice as high (2.1 to 2.2 percent) as for females (1.0 to 1.1 percent). The coefficient of the interaction of experience with qualification is significantly positive for males but not for females. This result indicates that experience rating of male workers in the intermediate or high-skill category is higher than for those in the lowest. For female workers there is no such an effect.

Comparing with the reference group of stayers one can observe that the coefficients of the skill dummy variables for male movers are somewhat lower in magnitude while the opposite is true for female movers. For both gender we find that the coefficients indicating a firm-size wage differential are generally lower for movers. Regarding the type of the region, for all groups of stayers the coefficients are significantly negative and increase in absolute values for more peripheral regions. Perhaps due to the lower sample size, the coefficients for movers are predominantly statistically not significant at the 5 percent level. As a striking exception there is a positive effect for male movers in BBR2 in both years indicating that wages for this group are – ceteris paribus – highest in the highly urbanized surroundings of metropolitan cities. On the one hand the coefficients of the experience variable are generally lower for movers than for stayers being partly not or only weakly statistically significant. On the other hand there is a marked positive interaction effect with qualification at least for male workers.

To sum up the results of the wage equation, we find differences for males and females as well as for movers and stayers leading to the conclusion that these groups differ not only in their average characteristics but also in the evaluation of these characteristics.

Table 3.4a: Results of the Wage Equation Estimates for Male and Female Future Movers and Stayers (1996)

	Male				Female			
	Future movers (FM)		Future stayers (FS)		Future movers (FM)		Future stayers (FS)	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Low-skilled (ref.)								
Skilled	0.069	0.075	**0.129**	0.013	**0.225**	0.123	**0.214**	0.021
High-skilled	**0.531**	0.077	**0.563**	0.013	**0.553**	0.128	**0.576**	0.022
Firm size: <= 5 workers (ref.)								
Firm size: 6–20 workers	**0.075**	0.025	**0.178**	0.004	**0.228**	0.037	**0.206**	0.006
Firm size: 21–50 workers	**0.130**	0.026	**0.224**	0.005	**0.304**	0.038	**0.324**	0.007
Firm size: 51–100 workers	**0.139**	0.027	**0.260**	0.005	**0.324**	0.042	**0.405**	0.007
Firm size: 101–250 workers	**0.187**	0.027	**0.287**	0.004	**0.315**	0.040	**0.454**	0.007
Firm size: 251–500 workers	**0.246**	0.030	**0.319**	0.005	**0.411**	0.046	**0.497**	0.007
Firm size: 501–1000 workers	**0.231**	0.031	**0.336**	0.005	**0.365**	0.051	**0.529**	0.007
Firm size: > 1000 workers	**0.273**	0.030	**0.386**	0.004	**0.497**	0.048	**0.582**	0.007
Region type BBR1 (ref.)								
Region type BBR2	**0.036**	0.018	0.003	0.003	–0.012	0.031	**–0.059**	0.005
Region type BBR3	–0.006	0.024	**–0.045**	0.004	–0.053	0.038	**–0.098**	0.007
Region type BBR4	–0.019	0.046	**–0.064**	0.008	**–0.149**	0.066	**–0.125**	0.014
Region type BBR5	–0.029	0.022	**–0.046**	0.004	**–0.093**	0.040	**–0.057**	0.007
Region type BBR6	–0.023	0.021	**–0.049**	0.003	**–0.076**	0.033	**–0.126**	0.005
Region type BBR7	**–0.082**	0.026	**–0.079**	0.004	**–0.151**	0.048	**–0.145**	0.007
Region type BBR8	–0.042	0.029	**–0.099**	0.004	–0.020	0.053	**–0.140**	0.007
Region type BBR9	–0.070	0.046	**–0.112**	0.006	**–0.142**	0.072	**–0.172**	0.012
Experience	**0.017**	0.008	**0.022**	0.001	0.019	0.012	**0.011**	0.002
Experience squared	–0.017	0.017	**–0.035**	0.002	–0.037	0.028	**–0.018**	0.003
Interaction exp./qual.	**0.023**	0.008	**0.007**	0.001	0.015	0.013	0.004	0.002
Interaction exp. squared/ qual.	**–0.045**	0.019	**–0.012**	0.002	–0.027	0.031	**–0.011**	0.004
Constant	**9.032**	0.074	**9.021**	0.012	**8.690**	0.122	**8.806**	0.021
			Test statistics					
N	2,749		90,022		1,085		42,605	
(thereof censored)	(355)		(12,198)		(25)		(1,089)	
Pseudo-R^2	0.379		0.499		0.337		0.329	
LR [χ^2 (27)]	1244.5		41941.1		402.8		16033.8	
s.e.	0.324		0.275		0.342		0.348	

Notes: Estimation method is Tobit; all coefficient being significant at least at the 5 percent level are in bold; all coefficients related to the experience squared variable are multiplied by 100;
Source: Own calculations using IAB-REG data.

Table 3.4b: Results of the Wage Equation Estimates for Male and Female Current Movers and Stayers (1997)

	Male				Female			
	Current movers (CM)		Current stayers (CS)		Current movers (CM)		Current stayers (CS)	
Variable	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Low-skilled (ref.)								
Skilled	0.038	0.087	**0.127**	0.014	**0.279**	0.134	**0.218**	0.023
High-skilled	**0.549**	0.088	**0.582**	0.015	**0.664**	0.138	**0.590**	0.025
Firm size: <= 5 workers (ref.)								
Firm size: 6–20 workers	**0.080**	0.025	**0.176**	0.005	**0.170**	0.036	**0.219**	0.006
Firm size: 21–50 workers	**0.124**	0.025	**0.220**	0.005	**0.207**	0.038	**0.339**	0.007
Firm size: 51–100 workers	**0.143**	0.027	**0.259**	0.005	**0.238**	0.041	**0.414**	0.007
Firm size: 101–250 workers	**0.154**	0.026	**0.291**	0.005	**0.293**	0.038	**0.459**	0.007
Firm size: 251–500 workers	**0.183**	0.029	**0.321**	0.005	**0.384**	0.043	**0.507**	0.007
Firm size: 501–1000 workers	**0.236**	0.033	**0.339**	0.005	**0.397**	0.047	**0.542**	0.008
Firm size: > 1000 workers	**0.258**	0.029	**0.397**	0.005	**0.390**	0.044	**0.593**	0.007
Region type BBR1 (ref.)								
Region type BBR2	**0.053**	0.018	0.003	0.003	0.041	0.028	**–0.061**	0.005
Region type BBR3	0.011	0.024	**–0.046**	0.004	0.019	0.042	**–0.102**	0.008
Region type BBR4	–0.033	0.053	**–0.066**	0.008	–0.022	0.080	**–0.148**	0.015
Region type BBR5	–0.028	0.024	**–0.046**	0.004	–0.045	0.036	**–0.061**	0.007
Region type BBR6	–0.012	0.021	**–0.047**	0.003	–0.009	0.033	**–0.128**	0.005
Region type BBR7	–0.003	0.028	**–0.081**	0.004	–0.083	0.047	**–0.154**	0.007
Region type BBR8	–0.028	0.030	**–0.100**	0.004	–0.032	0.045	**–0.147**	0.007
Region type BBR9	–0.052	0.047	**–0.111**	0.006	0.021	0.085	**–0.179**	0.012
Experience	0.015	0.008	**0.021**	0.001	0.022	0.013	**0.010**	0.002
Experience squared	–0.022	0.018	**–0.033**	0.002	–0.044	0.028	**–0.017**	0.003
Interaction exp./qual.	**0.020**	0.009	**0.007**	0.001	0.007	0.014	0.003	0.002
Interaction exp. squared/ qual.	–0.035	0.019	**–0.011**	0.002	–0.018	0.030	–0.010	0.004
Constant	9.135	0.085	**9.044**	0.014	**8.718**	0.134	**8.830**	0.023
			Test statistics					
N	2,749		90,022		1,085		42,605	
(thereof censored)	(400)		(12,374)		(30)		(1,173)	
Pseudo-R^2	0.337		0.446		0.344		0.314	
LR [χ^2 (27)]	1101.1		39472.0		371.7		15845.7	
s.e.	0.330		0.288		0.328		0.356	

Notes: Estimation method is Tobit; all coefficient being significant at least at the 5 percent level are in bold; all coefficients related to the experience squared variable are multiplied by 100;
Source: Own calculations using IAB-REG data.

3.5 Decomposition of the mover/stayer wage differential

3.5.1 Decomposition technique

The estimation results described so far depend on the choice of the reference groups. In analogy to the method described in subsection 3.3.2 we therefore standardized the estimated coefficients. On the basis of the corresponding results we are able to calculate different effects with respect to region type, experience, skills and firm size. In order to concentrate on the main effects we therefore use the somewhat broader classifications as in subsection 3.3.2. For male and female workers separately, we concentrate on three skill categories, four region types, three experience and firm size categories. This yields a total of $3 \times 4 \times 3 \times 3 = 108$ cells. For each cell the means of the explanatory variables are calculated. With this information and the estimated coefficients of the wage equations it is straightforward to compute the average wage for each cell as predicted by our model. We then use a Blinder (1973)/Oaxaca (1973) technique for group-specific decompositions of the raw wage differential between movers and stayers of both genders.[72]

3.5.2 Analysis of the gender-specific mover/stayer wage differential by firm size, skills and experience

We start the decomposition analysis by considering the wage differentials between male movers and stayers on the one hand, and female movers and stayers on the other. Starting with firm size, *Table 3.5* shows the decomposition for increasing level of differentiation. All entries are deviations of estimated cell mean wages relative to the overall average. In order to keep things tractable, differentiation by region type is neglected here but will be analyzed separately in the next subsection.

According to our estimates, the firm size wage differential is substantial. The earnings of immobile male workers are about 14 percent below the national average of male workers in small firms and about 14 percent above in large companies.[73] The firm size differential for male movers is similar to that of stayers indicating that differences in the firm-size differential are not very prominent at this high level of aggregation. For female stayers the raw firm-size differential is even higher than for their male counterparts. Compared to the average, immobile female workers in small firms have a wage penalty of 18.9 percent while the wage advantage in large firms amounts to +21.4 percent. Relative to the national average of female

72 An explanation of the Blinder/Oaxaca (1973) type decomposition technique is given in the Appendix.

73 Various studies have reported that workers in large firms systematically earn more than those in small firms. For a survey of the firm size wage literature, see Oi and Idson (1999).

workers' wages, mobile women earn 10.4 percent less in small firms, and 7.6 and 18.2 percent more in medium or large firms, respectively. Comparing these values with those for stayers shows that the wage disadvantage for females in small firms is markedly lower in case of mobility.

However, these raw differentials might be due to the differences in experience or skill composition of workers in firms of different size. As a next step we additionally consider the results differencing by skill categories. As an interesting result, moving to a medium or large firm implicates for both genders a wage disadvantage relative to the incumbent employees in these categories. In five of six cases the dip is larger for male than for female movers. Skilled and high-skilled workers being employed in a small firm after their change of the region type are always better off compared to their new colleagues. This is especially true for female workers since in small firms the earnings of female stayers relative to the female average are distinctly lower than those of male stayers relative to their average, respectively.

The finest form of decomposition is obtained by additionally including experience. Irrespective of the firm size category, we are able to identify two groups of male movers being always better off than the corresponding reference group. These groups are high-skilled workers with intermediate and high experience.[74] The wage advantages for both groups are highest in small firms where we can also observe positive effects for high-skilled movers with low experience and all groups of skilled movers. Generally, male low-skilled workers are not able to profit from migration.

Except for the group of high-skilled with high experience, the firm size wage premium is distinctly lower for female movers than for stayers. For female employees in a medium sized firm we observe higher earnings for movers with a potential work experience of 20 or more years, only. This result is strikingly different from the findings for male movers as the wage advantages of older female movers do not depend on the observed skill category. A further discrepancy between both genders is the fact that even low-skilled women working for a small firm can benefit from moving. The wage advantages are noticeably high for female movers, reaching 12 to 14 percent for the skilled and high-skilled with potential experience of 10 or more years. For male workers the corresponding benefits from moving are between 3 and 9 percent, only.

The results presented so far indicate that male and female movers gain differently from migration. Especially if human capital is transferred to small firms, females tend to benefit from moving.

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74 Note that the overall differential between high-skilled movers and stayers in large firms is negative, while the differential is positive for two of three experience groups. This is due to the fact that experience (or age) of movers and stayers differs markedly. Typically the group of young or not experienced workers are clearly over-represented in the group of movers. The fact that this group earns significantly less than the high-experience group explains the negative difference (–3.55 percent) for the category *large firm size/high-skilled*.

Table 3.5: Estimated Wage Differential of the Male and Female Workforce by Firm Size, Skill and Experience (1997)

	Wage differential with respect to the total average					
	Male			Female		
	Movers	Stayers	Difference	Movers	Stayers	Difference
FS: small	**–12.77**	**–14.26**	**1.49**	**–10.41**	**–18.90**	**8.49**
low-skilled	*–37.88*	*–33.80*	*–4.09*	*–37.86*	*–38.92*	*1.05*
low exp.	–47.46	–47.78	0.33	–46.97	–46.66	–0.30
med. exp.	–40.00	–37.93	–2.06	–37.94	–40.93	2.98
high exp.	–33.47	–30.17	–3.30	–36.64	–37.87	1.23
skilled	*–12.73*	*–12.82*	*0.08*	*–9.48*	*–16.50*	*7.02*
low exp.	–30.60	–31.70	1.10	–18.11	–24.13	6.02
med. exp.	–13.92	–17.08	3.16	–4.69	–16.52	11.82
high exp.	–0.60	–5.66	5.06	–1.29	–14.20	12.90
high-skilled	*33.84*	*31.54*	*2.29*	*31.81*	*21.71*	*10.10*
low exp.	20.11	15.28	4.83	22.80	15.21	7.59
med. exp.	36.50	28.69	7.81	34.61	22.28	12.34
high exp.	50.18	41.06	9.12	38.72	25.03	13.69
FS: med.	**–1.32**	**1.73**	**–3.04**	**7.67**	**7.89**	**–0.22**
low-skilled	*–29.67*	*–19.61*	*–10.06*	*–21.91*	*–10.62*	*–11.29*
low exp.	–38.69	–33.90	–4.79	–31.88	–18.60	–13.28
med. exp.	–31.93	–24.01	–7.92	–20.22	–13.25	–6.97
high exp.	–33.47	–30.17	–3.30	–36.64	–37.87	1.23

Table 3.5 (continued):

skilled	*−3.56*	*1.97*	*−5.53*	*8.86*	*11.49*	*−2.64*
low exp.	−23.20	−17.79	−5.41	−0.33	4.51	−4.84
med. exp.	−6.26	−3.41	−2.85	11.74	11.41	0.33
high exp.	7.41	7.87	−0.46	15.35	13.81	1.54
high-skilled	*41.70*	*45.95*	*−4.24*	*42.27*	*49.76*	*−7.49*
low exp.	29.48	29.03	0.45	37.64	44.25	−6.60
med. exp.	43.68	42.36	1.32	48.66	50.13	−1.48
high exp.	58.66	54.41	4.26	57.27	53.62	3.65
FS: large	**14.53**	**13.81**	**0.71**	**18.20**	**21.36**	**−3.16**
low-skilled	*−20.63*	*−9.02*	*−11.61*	*−11.64*	*2.22*	*−13.86*
low exp.	−30.02	−24.72	−5.30	−19.60	−5.62	−13.98
med. exp.	−20.88	−13.95	−6.92	−10.80	−0.72	−10.08
high exp.	−14.83	−6.52	−8.31	−9.13	3.35	−12.48
skilled	*6.38*	*11.51*	*−5.13*	*17.87*	*24.35*	*−6.48*
low exp.	−13.51	−8.12	−5.39	9.20	17.96	−8.77
med. exp.	3.48	6.60	−3.12	22.41	24.40	−1.99
high exp.	16.88	17.65	−0.77	24.41	26.96	−2.54
high-skilled	*51.33*	*54.88*	*−3.55*	*55.82*	*62.08*	*−6.26*
low exp.	37.86	38.38	−0.52	49.09	56.24	−7.15
med. exp.	54.47	51.77	2.69	60.45	62.91	−2.46
high exp.	66.96	64.02	2.93	67.43	66.44	0.98

Notes: FS: firm size. *Source:* Own calculations using IAB-REG data.

3.5.3 Analysis of the gender-specific mover/stayer wage differential by region type, skills and experience

In order to compare our findings with those of Glaeser and Maré (2001), we analyze the effects of changing the region type in this subsection. To avoid an overloading of the table, we neglect firm size categories here. As becomes evident from *Table 3.6* there are considerable wage differentials between the types of the region. Wages of immobile male workers in RT1 are 6.5 percent above the national average and 11.2 percent below in RT4. Spatial wage differentials are even more pronounced for females who earn 8.6 percent above the average wage in metropolitan areas and 14.1 percent below in rural ones. At this level of aggregation we detect large gender-specific differences of the mover-stayer wage differential. Male movers into RT1, RT2 and RT3 exhibit negative wage differentials compared to the reference groups of stayers within these region types. Only for movers to the rural periphery (RT4) our results indicate a positive wage differential over stayers. The findings for female movers deviate from those of males. The agglomeration wage premium is 5.07 percent for female movers, 3.52 percentage points less than for stayers. By contrast, in regions of destination other than RT1, female movers earn always more than the incumbent workforce.

The results described so far are in accordance with those of Glaeser and Maré (2001). Both, male and female movers to RT1 earn less than the incumbent workforce, i.e. those workers who have benefited from the productivity enhancing urban atmosphere for a longer time which gives rise to a *wage growth effect*. The positive differential in RT4 additionally corroborates the results of these authors since movers coming from denser areas are able to carry over some of their former wage advantage. However, at this low level of differentiation these results might be influenced by composition effects. Therefore we continue our analysis with introducing skill and experience categories.

Comparing skill groups within the different region types yields the result that the estimated wage differentials between male movers and stayers are predominantly negative. The major exception is the group of high-skilled movers whose earnings exceed those of stayers in the more peripheral *region types 2* and *4*. Considering female movers we additionally get positive earnings differentials for high- skilled movers in RT3 as well as for skilled workers choosing RT2 or RT4 as region of destination. In accordance with theoretical predictions, the wage advantage of male and female movers tends to increase with the skill level.

Taking experience into account replicates some of the results of the preceding subsection. The estimated wage differentials for male workers indicate that it is again the group of high-skilled with more than 10 years of potential experience

who benefit from moving irrespective of the region of destination. By entering RT1, this group is able to appropriate the whole urban wage premium immediately after migration. This contrasts the finding of Glaeser and Maré (2001) that the urban wage premium for workers immediately after moving lags behind to that of the incumbent workforce. These authors argue that the urban wage premium for movers only gradually accrues over time because of knowledge spillover and other positive effects of agglomeration on the productivity of workers.

Mirroring the gains for experienced high-skilled movers, *Table 3.6* shows that experienced low-skilled workers do not benefit from moving in general (compared to their immobile counterparts in the region of destination).

For the female workforce the previous findings that high-skilled movers gain and low-skilled movers loose are corroborated. Thereby we observe that the wage advantages for female high-skilled tend to be higher than those for males. Moreover, we recognize positive wage differentials of movers over stayers also for most groups of skilled women. These findings indicate that women tend to gain more from interregional migration than men.

Table 3.6: Estimated Wage Differential of the Male and Female Workforce by Region Type, Skill and Experience (1997)

	Wage differential with respect to the total average					
	Male			Female		
	Movers	Stayers	Difference	Movers	Stayers	Difference
RT1	**0.09**	**6.55**	**−6.46**	**5.07**	**8.59**	**−3.52**
low-skilled	*−29.27*	*−15.90*	*−13.37*	*−21.83*	*−7.13*	*−14.70*
low exp.	−37.72	−33.63	−4.09	−27.22	−18.63	−8.59
med. exp.	−31.52	−20.83	−10.69	−21.03	−10.28	−10.75
high exp.	−24.61	−12.25	−12.36	−20.23	−5.40	−14.83
skilled	*−3.98*	*4.02*	*−8.00*	*4.37*	*8.65*	*−4.28*
low exp.	−22.50	−15.61	−6.89	−4.30	3.29	−7.60
med. exp.	−6.26	−0.77	−5.49	8.64	9.61	−0.98
high exp.	8.20	10.89	−2.70	13.91	10.58	3.34
high-skilled	*43.80*	*49.78*	*−5.98*	*44.57*	*50.30*	*−5.73*
low exp.	31.69	32.97	−1.28	38.46	45.40	−6.94
med. exp.	47.91	46.90	1.00	47.95	51.43	−3.48
high exp.	61.19	59.04	2.14	60.42	53.92	6.51
RT2	**−5.95**	**−5.50**	**−0.45**	**−0.16**	**−8.40**	**8.24**
low-skilled	*−33.05*	*−24.55*	*−8.50*	*−27.18*	*−21.43*	*−5.76*
low exp.	−39.73	−40.74	1.01	−31.50	−29.40	−2.10
med. exp.	−33.86	−29.51	−4.36	−26.22	−23.54	−2.68
high exp.	−27.70	−20.79	−6.91	−26.42	−20.13	−6.29
skilled	*−8.70*	*−5.66*	*−3.04*	*0.68*	*−7.09*	*7.77*
low exp.	−26.74	−25.01	−1.73	−8.56	−14.13	5.58
med. exp.	−10.15	−9.63	−0.52	5.12	−5.09	10.21
high exp.	4.51	2.20	2.31	7.77	−4.23	12.00
high-skilled	*42.44*	*41.77*	*0.66*	*42.28*	*33.04*	*9.24*
low exp.	26.37	23.59	2.77	38.14	27.54	10.60
med. exp.	43.13	39.47	3.67	63.02	38.29	24.73
high exp.	59.10	51.10	8.00	-	-	-

Table 3.6 (continued):

	Wage differential with respect to the total average											
	Male			Female								
	Movers	Stayers	Difference	Movers	Stayers	Difference						
RT3	**−6.91**	**−3.03**	**−3.88**	**−3.95**	**−5.72**	**1.78**						
low-skilled	*−35.72*	*−22.72*	*−13.00*	*−30.52*	*−18.65*	*−11.87*						
low exp.	−42.46	−39.67	−2.79	−38.69	−30.74	−7.95						
med. exp.	−36.95	−28.10	−8.85	−33.04	−21.03	−12.01						
high exp.	−31.12	−18.82	−12.31	−26.11	−16.97	−9.14						
skilled	*−10.71*	*−3.36*	*−7.34*	*−4.65*	*−4.43*	*−0.22*						
low exp.	−28.78	−23.01	−5.77	−13.41	−10.00	−3.41						
med. exp.	−11.62	−7.31	−4.32	2.30	−3.10	5.39						
high exp.	3.19	4.23	−1.04	5.17	−1.71	6.88						
high-skilled	*39.40*	*42.86*	*−3.46*	*39.35*	*37.50*	*1.85*						
low exp.	26.42	27.21	−0.79	36.64	32.29	4.35						
med. exp.	41.18	39.86	1.32	41.36	38.72	2.64						
high exp.	54.92	52.55	2.37	45.81	41.12	4.69						
RT4	**−9.74**	**−11.21**	**1.47**	**−6.12**	**−14.10**	**7.98**						
low-skilled	*−36.15*	*−29.09*	*−7.06*	*−33.15*	*−25.60*	*−7.55*						
low exp.	−43.69	−45.23	1.54	−39.13	−36.96	−2.16						
med. exp.	−39.78	−33.89	−5.89	−29.21	−26.89	−2.32						
high exp.	−32.33	−25.41	−6.92	−33.98	−24.35	−9.63						
skilled	*−10.95*	*−10.59*	*−0.36*	*−6.36*	*−12.15*	*5.79*						
low exp.	−30.04	−29.87	−0.17	−17.09	−18.39	1.30						
med. exp.	−10.94	−13.51	2.56	0.85	−9.41	10.26						
high exp.	1.77	−1.92	3.69	0.53	−8.80	9.33						
high-skilled	*40.33*	*36.23*	*4.11*	*30.16*	*27.45*	*2.71*						
low exp.	27.05	19.14	7.91	25.32	23.64	1.68						
med. exp.	43.63	34.67	8.96	36.25	29.21	7.04						
high exp.	58.65	45.87	12.78	36.07	30.84	5.22						
				100	100	100	100	100	100	0.00	0.00	0.00

Source: Own calculations using IAB-REG data.

3.5.4 Comparing decomposition results at different levels of aggregation

The gender-specific differences are evident from *Table 3.7* where the decomposition results are displayed at different levels of aggregation. In the year after migration, the total raw wage differential of movers over stayers is negative for male workers (–3.75 percent) and positive for females (0.94 percent). At the highest level of aggregation we differentiate between region types only (model 1). We then add successively the dimensions skill (model 2) and experience (model 3). In the most comprehensive model 4, all explanatory variables of the estimated equation are considered (region type/skill/experience and firm size).

For model 1 the wage differential is mainly explained by the evaluation effect which is slightly favourable to female movers (+0.61 percent) and negative for males (–3.96 percent). The characteristics effect is positive for both genders but turns out to be more or less negligible (as well as the interaction effect).

Introducing the skill dimension in model 2 yields a positive characteristics effect (2.73 percent for male workers, 2.95 percent for female workers). The rationale behind this is that movers are more likely to be skilled than stayers. This is mirrored by a highly negative rewards effect, especially for male workers. However, model 2 neglects the fact that movers tend to be skilled or high-skilled, but typically are less experienced. Since the worker's wage markedly increases with work experience, ignoring this aspect could lead to highly misleading conclusions. Considering the experience dimension in model 3 turns the positive characteristics effect for male workers – in model 2 being mainly driven by the skill variable – into a negative one and reduces it to half its former effect for female workers. The much weaker reduction of the characteristics effect through the experience variable for females might reflect the fact that experience rating for female workers is significantly lower than for males. A further important aspect is added in model 4 by including the firm size dimension. In model 4 the characteristics effect is negative for both gender. This means that given the characteristics of movers and size of the firm where they are working, one should expect them to earn less than their immobile counterparts. For male workers the massive disadvantage in characteristics explains the lion's share of the negative total effect for movers. The rewards effect for males is negative, but rather weak (less than 1 percent). For females we find a somewhat stronger rewards effect that is able to over-compensate the negative characteristics effect.

Table 3.7: Decomposition of the Mover/Stayer Wage Differential at Different Levels of Aggregation (1997)

model	Explanatory variables	Rewards effect	Character-istics effect	Interaction effect	total
		Male			
1	Region type	–3.96	0.30	–0.09	–3.75
2	Region type/skill	–6.75	2.73	0.27	–3.75
3	Region type/skill/experience	–2.93	–0.84	0.02	–3.75
4	Region type/skill/experience/firm size	–0.88	–3.34	0.48	–3.75
		Female			
1	Region type	0.61	0.59	–0.26	0.94
2	Region type/skill	–2.80	2.95	0.80	0.94
3	Region type/skill/experience	0.03	1.43	–0.52	0.94
4	Region type/skill/experience/firm size	1.31	–0.72	0.36	0.94

3.6 Conclusions

Among other factors, regions differ with respects to population density and accessibility. According to these criteria one can differentiate between *types of regions* ranging from metropolitan cities to rural areas far away from the next conurbation. To discriminate between region types we use the BBR-Classification, a scheme commonly employed in geographical analysis. The aim of our paper is to analyze the effects of changing the so-defined region type on earnings. The approach chosen here is to compare the wages of mobile workers to those having the same observed characteristics. In contrast to other studies we also control for firm size and differentiate between male and female workers.

The first step was to shed some lights on the characteristics of movers compared to stayers. Our data base is a 1 percent random sample drawn from the employment statistic of the Federal Labor Office. Our descriptive analysis which is confirmed by probit estimates indicates that mobile workers are better skilled and less experienced or younger than their immobile counterparts. Moreover they are more likely to work in smaller firms. With respect to wage determinants these characteristics represent counteracting forces: While a higher skill level typically increases average earnings, less experienced or younger worker and those working in smaller establishments tend to earn less. Moreover, the characteristics of the region where the workplace is located, plays a role. Disregarding theses composition effects and just comparing raw wage differentials between movers and stayers could therefore give rise to highly misleading interpretations. In order to come across with the composition effects we first estimated gender-specific earnings functions for movers and stayers in the year before and after the change has taken place. Building on the estimation results we are able to calculate cell-specific average wages that take

into account differences in evaluations of characteristics for different groups in the labor market. We observe that the coefficients of the econometric model are quite stable in the year before and after the possible change in the region type, but differ markedly between movers and stayers and with respect to gender.

On this basis we are able to analyze the raw differentials using a Blinder/ Oaxaca type of decomposition. According to the approach the raw differential split up into a characteristics effect, a rewards effect and an interaction effect. Our findings indicate that the raw differential of movers over stayers is markedly negative for male workers (almost 4 percent) and slightly positive (1 percent) for females. We show that the decomposition yields very different results at different levels of aggregation. Neglecting the dimensions that tend to lower the wage of mobile workers (experience and firm size) leads to a significant upward bias in the characteristics effect, while ignoring skills gives rise to a considerable downward bias. *Vice versa*, the same is true for the rewards effect**,** since the interaction effect plays a minor role only. Taking all variables into account, we find that the markedly negative raw differential for mobile male workers is mainly due to an overall negative characteristics effect. For mobile female workers, the overall characteristics effect is also negative, but much weaker than that for males. A major difference between genders is found in the strength of the experience effect. Since experience rating is lower for females, the wage penalty for young female workers who are more likely to move than older persons is lower. Interestingly the rewards effect for female movers is positive in the most comprehensive model. Although the magnitude of this effect is not excessive, one can conclude that changing the region type pays out more for female workers. This contrasts with the fact that females are under-represented among movers in general. Given the moderate size of the effects, however, it would barely be appropriate to recommend more female mobility as a remedy against the gender wage gap.

All in all, the use of a large micro data set and the differentiation along several characteristics dimensions gives some deeper insights in the nature of wage effects resulting from mobility of workers.

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Appendix

Description of the decomposition technique

Let the usual wage equation for mobile workers be described as

$$y = x'\beta + \varepsilon, \tag{A3.1}$$

and for stayers as

$$Y = X'B + E. \tag{A3.2}$$

Then define

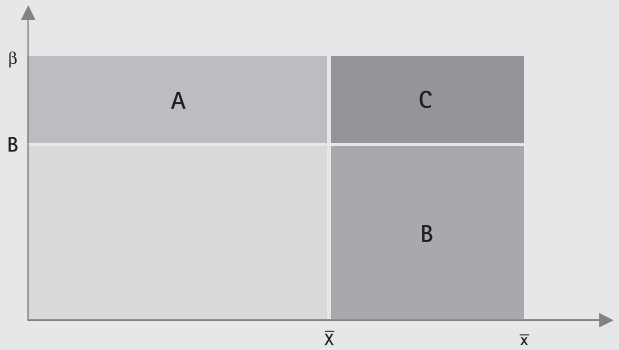
$$\Delta\hat{\beta} := \hat{\beta} + \hat{B} \text{ and } \Delta\bar{x} := \bar{x} - \bar{X}, \tag{A3.3}$$

where the vectors $\bar{x}$ and $\bar{X}$ contain average values of the regressor for movers and stayers, respectively. This yields the decomposition of the raw earnings differential $\bar{y} - \bar{Y}$:

$$\begin{aligned} \bar{y} - \bar{Y} &:= \bar{x}\hat{\beta} - \bar{X}\hat{B} \\ &= \underbrace{\bar{X} \cdot \Delta\hat{\beta}}_{\text{evaluation effect}} + \underbrace{\Delta\bar{x} \cdot \hat{B}}_{\text{characteristics effect}} + \underbrace{\Delta\bar{x} \cdot \Delta\hat{\beta}}_{\text{interaction effect}}. \end{aligned} \tag{A3.4}$$

As an example consider a very simple case, where earnings are explained by a qualification variable only and the regression constant is disregarded for the ease of exposition. Assume that qualification yields a higher premium over the earnings of the low-skilled (the control group) for movers: $\beta > B > 0$. Moreover, consider the case where mobile workers are in the average more qualified than stayers, $\bar{x} > \bar{X} > 0$. Since the regressor is a (0,1)-dummy variable its mean simply gives the share of qualified workers in the group of movers and stayers, respectively. It is evident that movers exhibit a positive earnings differential under these conditions. Then the decomposition of the total differential can be depicted as shown in *Figure A3.1*.

Figure A3.1: Decomposition of the Raw Migration Differential



The total bonus of movers (the shaded areas *A*, *B* and *C*) is the sum of the evaluation effect (area *A, or,* $\bar{X} \cdot \Delta\beta$), where in the example here the evaluation effect indicates that in the average there would be a pay bonus for movers even if there were no differences in observed characteristics (qualification) between movers and stayers; the characteristics effect (area *B, or,* $\Delta\bar{x} \cdot B$) which indicates here that even if movers would receive equal pay for the same observed characteristics as immobile workers, there would be an advantage to movers because in the average they are more qualified;
the interaction effect (area *C, or,* $\Delta\bar{x} \cdot \Delta\beta$) which reflects the fact that, under the assumptions of our example, movers are more qualified than non-movers *and* the skill differential of movers is higher than for stayers.

Of course, under different assumption the evaluation and/or the characteristics effect could be negative. Note that the interaction effect is positive in case of an equal sign of the evaluation and characteristics effect. If both were negative, this would mean that the movers "penalty" is reduced by the fact that the share of relatively ill-paid workers is low compared to the reference group.

Table A3.1: Classification of the Firm Size

Category of firm size	Number of workers
FS1	1–5 workers
FS2	6–20 workers
FS3	21–50 workers
FS4	51–100 workers
FS5	101–250 workers
FS6	251–500 workers
FS7	501–1000 workers
FS8	More than 1000 workers

Table A3.2: Regional Classification Scheme based on BBR-Classification

Structural region type	District type (BBR-Classification)	Region types (RT) used in the paper	Description of region type (BBR)
Regions with large agglomerations	BBR1	RT1	Core cities
	BBR2	RT1	Highly urbanized districts in regions with large agglomerations
	BBR3	RT2	Urbanized districts in regions with large agglomerations
	BBR4	RT2	Rural districts in regions with large agglomerations
Regions with features of conurbation	BBR5	RT3	Central cities in regions with intermediate agglomerations
	BBR6	RT3	Urbanized districts in regions with intermediate agglomerations
	BBR7	RT4	Rural districts in regions with intermediate agglomerations
Regions of rural character	BBR8	RT4	Urbanized districts in rural regions
	BBR9	RT4	Rural districts in rural regions

Table A3.3: Selection of Data (1996/1997)

	number of cases
total number of individual observations	535,578
old laender only	432,663
multiple employed workers excluded	428,579
with valid earnings information	416,334
workers in an apprenticeship, volunteers, family workers excluded	392,986
with valid information about experience, location of work-place and firm size category	358,780
part-timer workers excluded	309,027
Observations used in our sample	309,027

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4 The Additional Wage Growth Effect of Regional Mobility Compared to Local Job-to-Job Changes

joint with Johannes LUDSTECK

Abstract

Analyzing the effects of interregional mobility on earnings this paper compares skilled region-type movers and skilled non-migratory establishment movers. We find clear evidence of an additional wage effect of interregional mobility which becomes fully effective after three years. The huge size of our data sets allows us to partition the estimation sample further by experience level and by direction of mobility (e.g. moves from rural to metropolitan regions may have different wage effects from moves in the opposite direction). The highest returns are obtained by young workers and by rural-urban movers. Introducing fixed district and establishment effects tackles the notorious nuisance of regional price level differences and reveals that the mobility returns can be decomposed into roughly equal contributions of human capital accumulation and search gains.

Keywords: Interregional migration, job mobility, contemporaneous returns, wage growth, regional characteristics.
JEL classification: J61, R23.

4.1 Introduction

In recent years, a number of studies have re-investigated the effects of regional migration on earnings. They have extended our knowledge in several important respects. Firstly, they extend the post-migration period and differentiate between short- and long-term returns. E.g. Glaeser and Maré (2001) identify gains in both contemporaneous returns and long-term wage growth for those migrating to metropolitan areas in the USA. The consideration of extended periods is important from a theoretical point of view since short-term returns may be dominated by matching gains or be biased downwards if firms in the region of destination offer low entry wages for screening purposes or entry wages are low due to implicit training

contracts.[75] Secondly, some of these studies differentiate with respect to the origin and destination of migratory moves to account for the structural economic characteristics of regions. E.g. Pekkala (2002) compares post-move incomes across Finnish regions and finds the highest returns to migration for people moving to urban growth centres. Regional disparities are important from a theoretical point of view e.g. if metropolitan regions offer better opportunities to accumulate human capital. Unfortunately, earnings differences between urban and rural regions may include noteworthy price level effects which bias the comparison and cannot be eliminated if reliable regional price measures are not available. Thirdly, these studies carefully select adequate comparison groups. As regional mobility includes a job change (which may explain a good deal of the gross wage premium), the group of job movers suggests itself as a comparison group. Yankow (2003) follows this idea "by viewing geographic mobility within a job-changing context" (Yankow, 2003, p. 484)[76] and finds that regional migration entails a positive additional effect compared to local job-to-job transitions. And fourthly, migrants are further differentiated by education in these studies to account for the possibility that highly educated workers likely migrate to invest in human capital whereas low skilled workers mainly seem to exploit matching gains. Indeed, Yankow (2003) finds that low-skilled individuals obtain the premium immediately after migration whereas the premium for high-skilled workers is only observed after a lag of two years.

To summarize: the cited studies suggest that the effects of regional mobility (1) might be different in the short- and long run (2) strongly depend on regional characteristics, (3) include the effects of changing the job, and (4) might vary for different groups of workers. In order to tackle all these issues, we exploit administrative data which covers nearly 80 percent of the German workforce. Firstly, we estimate both the short-term and the long-term effect of regional mobility for skilled workers. At this aggregate level, we identify positive short- and long-term effects of regional mobility. Secondly, we restrict the comparison group to establishment movers (remaining in the same region). Thirdly, since young and older workers probably move for different reasons[77] (corresponding with different outcomes) we subsequently split our sample with respect to age. Fourthly, we classify all western German regions into four categories and split the estimation

75 According to the screening theory developed by Salop and Salop (1976), employers offer delayed payment contracts, i.e. they set wages below productivity at job start and raise it above productivity with increasing tenure. They do that to shrink fluctuation costs by deterring workers with high fluctuation propensities from application. Lazear (1981) obtains a similar seniority wage profile as a solution to agency (i.e. monitoring) problems in firms. Implicit training contracts (see e.g. Hashimoto, 1981 or Carmichael, 1983) include training periods (at job start) with low entry wages since workers bear part of the training costs by accepting lower wages. The role of specific and general human capital for the explanation of wages may be paramount especially in the context of migration.

76 This approach goes back to Schwartz (1976).

77 See, for instance, Peri (2002).

sample accordingly in order to investigate further the importance of regional characteristics. This allows us to estimate the additional effect of regional mobility depending on the type of the regions of origin and destination. Fifthly, we extend our econometric models by inclusion of fixed district and establishment effects to account for region-specific amenities or price level effects[78] and to decompose the returns to mobility into pure search gains and effects related more specifically to human capital. Finally, we concentrate on within-match differences to clarify the effect of human capital accumulation.

The remainder of the paper is organized as follows: section 4.2 presents the theoretical background and discusses the implied empirical approach. Section 4.3 deals with a description of our data source, methodological issues and basic definitions. Additionally, section 4.3 presents some empirical evidence regarding the determinants of migration. Section 4.4 describes the estimation approach in more detail and presents the results. Section 4.5 provides the conclusions.

4.2 The theoretical model and the implied empirical approach

We seek to identify the causal effect of mobility on wages and try to decompose it into the important factors human capital growth, worker-firm match quality and other search gains. To assess the statistical properties and interpretability of the econometric specifications presented below, we start with a simple stylized theoretical model and go on to show the relations between theory and the estimated specifications. Theory predicts that workers decide to move to another establishment and/or region by comparing (expected) costs and returns, formally

$$P_{it} = \begin{cases} 1 & if \max\limits_{f \in \{1,\ldots,F\}} E_t[W_{i,t+1,f} + S_{i,t+1,f} - M_{i,t+1,\{c,f\}}] > E_t[W_{i,t+1,c} + S_{i,t+1,c}] \\ 0 & otherwise \end{cases} \tag{4.1}$$

where P_{it} indicates whether individual i moves in period t and the indices f and $c \notin \{1, ..., F\}$ stand for the destination firm and the firm where the worker is employed when considering to move, respectively. $W_{i,t+1,f} = \sum_{\tau=1}^{\infty} \rho^{\tau} w_{i,t+\tau,f}$ denotes the (discounted[79]) stream of wages from period $t+1$ in firm f, $S_{i,t+1,f}$ denotes a future stream of non-wage net returns (amenities and region-specific costs of living)

78 Unfortunately, price information is not available for most German regions. Most studies dealing with regional issues are limited by the lack of regional price indices. A possible solution is shown in the study by Blien et al. (2007). They use a survey of regional price levels for 32 small regional units (see Ströhl, 1994) and estimate regional price differences for all areas of western Germany by multiple imputation.

79 ρ has to be interpreted as a discounting factor capturing time preference and the survival rates. This introduces dependence on the age of the individual but is ignored here for sake of simplicity.

associated with firm f, $M_{i,t+1,\{c,f\}}$ captures the monetary and non-monetary costs of moving from c to f (e.g transport costs and non-moneteray costs as costs of finding new friends or accommodating to a new workplace or living neighbourhood), $E_t[\cdot]$ denotes the conditional expectation based on all information available to the individual in period t. Note that the indices f and c denote firms but implicitly refer to regions too since firms are uniquely located in regions.[80] The above definitions of $W_{i,t+1,f}$ and $S_{i,t+1,f}$ assume implicitly that the worker remains in the same establishment from period $t+1$ onwards. A more general formulation allowing for repeated moves had to define these variables recursively using Bellman equations. We will stick with the simpler formulation here since it suffices to illustrate the most important economic aspects of mobility and the implied econometric issues.[81] The decision model clearly qualifies the mobility dummy P_{it}. as an endogenous variable depending on expected wages, mobility costs and non-wage returns. The following (one-period) wage equation completes the model

$$w_{i,t,f} = \theta_{i,t,f} + \mu_i + \nu_f + \psi_{i,f} + \delta_t + \varepsilon_{i,t,f}. \tag{4.2}$$

Here $w_{i,t,f}$ denotes the log wage of individual i in year t in firm f, $\theta_{i,t,f}$ contains time-varying individual and firm-related (individual) characteristics (e.g. general human capital, proxied by experience, firm-specific human capital proxied by tenure etc.), μ_i represents productivity of *all* time-constant individual characteristics (e.g. ability, ambition, perseverance), $\psi_{i,f}$ represents worker-firm-match-specific factors (match quality), ν_f represents time-constant firm characteristics, δ_f captures aggregate time shocks (e.g. business cycle shocks) and $\varepsilon_{i,t,f}$ represents purely erratic (serially uncorrelated) shocks. Note that the effects of mobility are until now captured by $\psi_{i,f}$ and the relevant terms in $\theta_{i,t,f}$. The wage equation can be modified to identify the effects of mobility as a summary measure by adding the mobility dummy. This allows us to separate the effects of local establishment changes from establishment changes including regional mobility. Then we have

$$w_{i,t,f} = P_{i,t-\tau}\alpha_{t-\tau} + x_{i,t,f}b + \mu_i + \nu_f + \psi_{i,f} + \delta_t + \varepsilon_{i,t,f} \tag{4.3}$$

where $\alpha_{t-\tau}$ depends on the time passed since the move (which occurred in period τ),[82] and $x_{i,t,f}b$ captures effects of all individual and firm level time-varying determinants of wages. The $\alpha_{t-\tau}$ represent the returns to mobility in the years 1, 2, ..., 5 after the

80 In principle establishments may be relocated. Such cases are, however, extremely seldom. Furthermore, relocation of establishments is accompanied by change of the establishment identifier in our data.

81 Furthermore it is a good approximation to reality since workers stay several years with the same firm on average.

82 The $\alpha_{t-\tau}$ are coefficients on interaction terms constructed by multiplying the mobility dummy with time dummies.

move. Their meaning will be explained in more detail below. As already noted, $P_{i,t-\tau}$ is endogenous in the wage equation by its dependence on future wages. After substitution of the wage equation (and similar expressions for *S* and *M*) into the mobility decision equation we obtain a formal expression for the bias implied by the endogeneity of $P_{i,t-1}$. For sake of simplicity we avoid to expand $P_{i,t-1}$ to a rather confusing conglomerate of residual component terms but proceed with a short verbal description of the relevant issues. First note that the period-returns and costs $s_{i,t,f}$ and $m_{i,t,f}$ have the same error component structure as $w_{i,t,f}$, i.e. they all comprise individual-specific, firm-specific, match-specific and time-specific components. $P_{i,t-1}$ depends on the difference between the returns associated with the job chosen in period *t* (yielding the maximum expected return) and the job held in 1999, the first year of the estimation sample. By that it depends on the difference of their respective error components. Fixed effects estimation sweeps out endogeneity caused by fixed person, time and firm effects by controlling for the associated error components but leaves the match-specific term $\psi_{i,f}$ and the residual $\varepsilon_{i,t,f}$. If region-type movers are compared with (within-district) firm-movers, positive averages of the ν_f and the $\psi_{i,f}$ reflect that region-type movers find better-paying firms and yield better matches on average and thus constitute an important component of the returns to mobility. Thus the endogeneity 'bias' due to neglect of the ν_f and the $\psi_{i,f}$ is not a problem in our context as long as we adjust our interpretation of the $\alpha_{t-\tau}$ (they include matching gains) in an estimation without fixed establishment effects and match effects. The only remaining problem comes from $\varepsilon_{i,t,f}$ which cannot be eliminated by the fixed effects approach. If $\varepsilon_{i,t,f}$ is e.g. positive, this shock generates endogeneity bias by raising both the worker's wage in a firm as well as the probability to move to this firm. To assess the size of this bias, it is important to notice that the mobility decision depends on *expectations* of *all* future wages and – by that – on all future residual terms $\varepsilon_{i,t,f}$. If ε is white noise, the average of the sequence $(\rho\varepsilon_{i,t+1,f}, \rho^2\varepsilon_{i,t+2,f}, \ldots, \rho^T\varepsilon_{i,t+T,f})$ approaches zero quickly with increasing length of the decision horizon *T*. This means that the implied bias vanishes unless workers are extremely myopic (i.e. restrict the planning horizon to only one or two periods or the discounting factor ρ is considerably smaller than 1). If $\varepsilon_{i,t,f}$ showed noteworthy positive serial correlation, its effect would be – at least partially – captured by a fixed firm or match effect. Altogether, these considerations imply that bias caused by ε can be expected to be small and become negligible with increasing length of workers' decision horizons.

As noted above, the theoretical model used to derive the econometric specification abstracts from reality by assuming that workers subsequently stay in the same establishment after a move. Though this is a good approximation on average, some workers show repeated moves after 2000. This raises the question

whether the time path of the $\alpha_{t-\tau}$ can then still be interpreted as evolution of the wage profile caused by the move in 1999/2000. We think it can (at least as a good approximation) since mobility decisions are in practice made under limited information. Many relevant environment variables become known to the worker only *after* the move: the possibilities to develop human capital and, depending on that, prospective job or promotion opportunities available in the destination firm and market. Because of that, random shocks and Bayesian learning appear to play an important role in the decision process. This introduces path-dependence into wage and mobility patterns and makes subsequent moves (stochastically) dependent on previous ones.

Based on equation (4.3) we estimate several specifications for various subsamples. To keep things simple, we start with an outline of the estimated effects and then explain the aim and construction of subsamples. Starting with an individual fixed effects approach we firstly estimate the effect of moving to a different establishment within one region and secondly, the effect of moving to a different region type compared to establishment stayers. Since firm-specific human capital of workers is lost when workers change establishment, a more compelling approach is, thirdly, to compare region-type movers and establishment movers directly. The estimated differences provide evidence of an additional effect of region-type mobility over establishment mobility. As this general effect might differ for young and older individuals, we subsequently split up the base sample into three experience groups to obtain separate wage growth differentials for these groups. In a further extension, we account for the possibility that post-migration wage growth might be influenced by the characteristics of both the region of origin and the destination region by partitioning our sample in this respect as well (by running separate regressions for each subsample). From theoretical considerations, mobility wage premia can be expected to be highest for movers from less densely populated rural areas to most densely populated metropolitan areas. These 'premia', however, may reflect mainly price level differentials between rural and urban areas. Analysing streams of mobility between four different region types, it turns out that region-type movers leaving dense urban areas also benefit from mobility to some extent. This indicates that price level differentials do not play a dominant role in explaining the mobility wage growth premium. In order to support this last finding we extend the simplified econometric model by inclusion of fixed district effects accounting not only for price level effects but also for region-specific amenities. For a 25 percent subsample we then estimate the econometric model including fixed establishment effects (see equation (4.3)). As we will discuss below, this approach decomposes the effect of mobility into the components human capital

accumulation and establishment effects (search gains and match effects). To further eliminate match effects the analyses concentrate on within-match differences.

4.3 Data, basic definitions and some descriptive evidence

4.3.1 Data

Our empirical work (which considers the period 1999–2005) is based on the employment register data 1975–2005 of the German Federal Employment Services. Its crucial advantage for our application is its size: it covers nearly 80 percent of the German workforce, excluding only the self-employed, civil servants, individuals in (compulsory) military service, and individuals in so-called 'marginal part-time jobs' (jobs with no more than 15 hours per week or temporary jobs that last no longer than 6 weeks).[83] Furthermore it contains important personal characteristics (sex, age, education, job status) as well as information on occupation, industry, establishment identifiers and wages. The regional information, which refers to the location of the firm/workplace at NUTS3 (district) level, is of particular interest for our analysis. Using a classification scheme developed by the Federal Office for Building and Regional Planning (*Bundesamt für Bauwesen und Raumordnung* – BBR) we differentiate between four types of region according to their centrality and population density. The classification "metropolitan areas" (RT1) covers metropolitan core cities (BBR1) and highly urbanized districts in areas with large agglomerations (BBR2). The term "metropolitan surroundings" (RT2) stands for urbanized (BBR3) and rural districts (BBR4) within areas comprising large agglomerations. A third category called "central cities" (RT3) contains core cities (BBR5) in regions with intermediate agglomerations and their urbanized surroundings (BBR6). All other regions are classified as "rural areas" (RT4). For a schematic overview see Appendix, *Table A4.1*.[84]

The data suffer from some moderate limitations, however. First, though the information on earnings is highly reliable (misreporting is subject to severe penalties), working time is only reported in three classes: full-time, part-time with at least 50 percent of full-time working hours, and part-time with less than 50 percent. To avoid bias due to imprecise information on working time, we restrict our analysis to full-time prime-age (20–60 year-old) individuals. A further problem

83 For a detailed description of the data set see Bender et al. (2000) or Bender et al. (1996). A more commonly used data set in Germany is the IABS, which is a 2 percent random sample of our data set.

84 According to this classification scheme, "metropolitan areas" and "core cities" on the one hand and "metropolitan surroundings" and "rural areas" on the other hand show substantial similarity in their characteristics.

with the data is due to censoring at the upper earnings limit for social security contributions. Censoring is moderate (about 10–15 percent, changing slightly from year to year) for the entire sample. In the case of highly qualified males (university and other higher education graduates), however, more than 50 percent are censored. Since this would call into question all of the results obtained from the highly qualified subsample, we restrict the earnings analysis presented below to the medium qualification group. Furthermore we exclude eastern German workers from our sample to avoid bias due to the economic adjustment process after reunification in 1990.[85] In addition to this, the literature on the determinants of migration shows that gender-specific differences are remarkable. For instance, women are often tied to the migration decisions of their spouses (see, e.g. Astrom and Westerlund 2006 for Sweden or Nivalainen 2005 for Finland).[86] This probably influences the success of migration for female workers. Moreover, due for example to periods of parental leave, women also exhibit less stable employment histories than men. It therefore seems appropriate to concentrate on male workers. Dropping all female workers reduces the number of observations by one third since the labour force participation rate in western Germany is distinctly lower for female workers (see, for instance, Möller and Aldashev, 2007).

The social security notification process requires employers to report any permanent or temporary changes in employment relationships. The employment register therefore contains complete biographies in spell data form. To simplify data processing, we extract spells at cut-off dates (30.6) in every year. This shortcut makes it impossible to observe unemployment spells between 30th June of two successive years. To tackle this, we merge information on unemployment duration from the German unemployment register (LEH) with the employment register data and exclude observations with unemployment spells lasting longer than 30 days between 30th June of two consecutive years.

4.3.2 Basic definitions

To identify the returns to local job changes and job changes involving migration, we define three groups of workers. The reference group of stayers comprises all individuals who are completely immobile in the one-year period between two consecutive cut-off dates (30th June) in the years 1999 and 2000. The second group, establishment movers, contains workers *moving between establishments*

85 See, for instance, Kemper (2004) for an exploration of migration patterns in western and eastern Germany.

86 Other studies which deal with family migration issues are Boyle et al. (2001), Cooke (2001), Smits (1999), van Ommeren et al. (1999) and Jacobsen and Levin (1997). For Germany, gender-specific migration wage differentials are examined in Lehmer and Möller (2006).

in the same region in this one-year period. The last group, region-type movers, is defined as the subsample of establishment movers who migrate to a different region type (RT1 to RT4, as defined in Appendix *Table A4.1*).[87] We use the term 'region-type mobility' in this sense throughout this paper unless otherwise noted. The definition entails that we drop all job-movers who move to a different region, but one which is of the same region type.[88] Additionally, we drop all observations for individuals moving to a different region together with their firm (in the case of establishment relocations). These two restrictions enable us to compare the pecuniary returns of local and migratory job changers, differentiated by the type of region.

4.3.3 Some basic facts on the determinants of mobility

How do the characteristics of the groups defined in this way differ from those of the reference group of stayers? *Table 4.1* presents the marginal effects of important explanatory variables on moving propensities, calculated from multinomial logit models for the consecutive years 1999/2000.[89] The possible exit states are establishment change and migration to a different region type. It is evident from *Table 4.1* that the estimation includes more than 8.8 million observations per year. 494,157 individuals (or 5.6 percent) move to a different establishment within the same region, the number (share) of people moving to a different region type is about 200,000 (or 2.3 percent). To the best of our knowledge there is no other study on migration topics with a comparable number of observations for mobile workers.

The explanatory variables include categories of skills, (potential) experience and tenure as well as log market size and log establishment size. Furthermore, we include regional information referring to the federal state of origin and information on the recent migration history.[90]

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87 This definition does not differentiate between migration and commuting. In analogy to the distinction made by Eliasson et al. (2003, p. 831), this definition of movers in our paper includes the following categories: (i) workers who move their place of residence and their workplace to a different region type; (ii) workers who do not change their place of residence, but start commuting to a different type of region; (iii) commuters who do not change their place of residence, but move to a workplace in a different region type. In order to ensure that our results are not driven by the group of commuters, we exclude the categories (ii) and (iii) in a sensitivity analysis later on (see section 4.5.2).

88 Abandoning this restriction (as we did in a robustness check; results are not reported here) leaves the results practically unaffected.

89 The replication of multinomial logit estimations for all other pairs of years from 2000/2001 to 2004/2005 showed that the described differences are fairly robust.

90 A description of the variables is given in *Table A4.2a* in the Appendix.

Table 4.1: Marginal Effects from a Multinomial Logit Model (1999/2000)

	Establishment mobility within a region		Region-type mobility	
Base outcome	Stayers		Stayers	
Variable	Coef.	t-stat.	Coef.	t-stat.
Low-skilled (ref.)				
Skill missing	**0.58**	17.07	**0.42**	21.89
Skilled	**–1.21**	–47.22	**0.40**	34.50
Highly-skilled	**–0.54**	–19.70	**0.89**	42.95
Experience category: 0–9 years (ref.)				
Experience category: 10–19 years	**–0.58**	–29.23	**–0.14**	–16.39
Experience category: 20–39 years	**–1.54**	–72.83	**–0.64**	–65.80
Experience category: >= 40 years	**–2.87**	–104.57	**–1.00**	–75.58
Tenure category: 0 years (ref.)				
Tenure category: 1–5 years	**–2.31**	–140.32	**–0.55**	–74.57
Tenure category: 6–10 years	**–3.51**	–220.79	**–0.96**	–107.36
Tenure category: > 10 years	**–4.07**	–232.37	**–1.58**	–164.48
Log market size	**0.46**	76.58	**–0.20**	–74.51
Log establishment size	**–0.48**	–128.71	**–0.15**	–79.19
Aggregated federal state "North" (ref.)				
North Rhine-Westphalia	**0.11**	4.96	**–0.82**	–98.16
Hesse	**0.16**	5.48	**–0.28**	–26.10
Rhineland-Palatinate	**–0.42**	–11.72	**–0.20**	–14.79
Baden-Württemberg	**0.49**	19.73	**–0.42**	–45.88
Bavaria	**–0.15**	–6.28	**–0.16**	–16.91
Saarland	–0.01	–0.16	**–0.54**	–27.82
No change of region in the last five years (ref.)				
One change of region in the last five years	**–1.33**	–72.41	**1.98**	126.71
More than one change of region in the last five years	**0.93**	24.57	**0.24**	20.57
Test statistics of MNL estimations				
Total number of observations,	8,833,587			
• stayers	8,133,805			
• establishment movers	494,157			
• region-type movers	205,625			
Pseudo-R^2	0.0507			
LR [$\chi^2(38)$]	301,618.41			
Log likelihood	–2,718,580.90			

Notes: Estimation method is multinomial logit (MNL); all coefficients significant at least at the 1 percent level are in bold. For the MNL estimation (approach I), we use the basic sample without female workers. The aggregated federal state "North" covers Schleswig-Holstein, Hamburg, Lower-Saxony and Bremen.
Source: Authors' own calculations using IAB data.

We differentiate between three categories, expecting that one or more changes of region within the last five years affect the current migration propensity. From the left-hand side of the table, it is obvious that being skilled (completed apprenticeship) or high-skilled (university or technical college) lowers the probability of changing one's job within the region.[91] Considering the experience categories, one can conclude that job movers are younger than stayers on average. This is also true of the group of individuals moving to a different region type.[92] The same pattern for establishment and region-type movers also emerges with respect to tenure. The negative impact of tenure on the propensity for job mobility is well documented in the literature (see, for example, Mincer and Jovanovich 1981; Topel and Ward 1992; Farber 1999). While a larger establishment size reduces the probability of moving as well,[93] differences between the groups emerge with respect to skill category, market size and recent mobility history. Compared to the reference group of low-skilled men, skilled and high-skilled workers are more likely to migrate but are less likely to move to a different establishment within the same region. We find quite different effects regarding market size: a larger market size increases the probability of establishment changes within a region but decreases the probability of migration to a different region type. This turns out to be quite obvious after a closer look at the issue. We compute market size by counting the individuals working in the same region x skill x industry cell. Thus the variable market size captures job opportunities as well as job competition for workers. If plenty of jobs are available within a region, workers are more likely to change firm without needing to leave the region.[94] On the (regionally more aggregated) federal state level, one can observe that the probability of changing one's job within the region is most pronounced in North-Rhine Westphalia, Hesse and Baden-Württemberg. Compared to an aggregated federal state "North" (including Schleswig-Holstein, Hamburg, Lower-Saxony and Bremen) the migration propensity is significantly lower in all other states.[95] Concerning

91 Additionally, we include missing observations as a separate category. Since establishment movers and region-type movers are primarily affected by a lack of data, this seems appropriate to avoid selection bias which would occur if these observations were dropped. For instance, the share of stayers in this category is 6.5 percent while the corresponding value for establishment movers and region-type movers is about 10 percent.

92 This relationship is universal in the literature. For a comprehensive survey on the determinants of migration see Greenwood (1997).

93 Besides the fact that the average tenure increases with firm size (see, for example, Oi and Idson (1999), there are further possible reasons why the likelihood of mobility decreases with increasing establishment size. These include job satisfaction, career opportunities and other factors.

94 Jayet (2000) states that, due to the high concentration of adequate jobs, the group of high-skilled individuals in urban areas is relatively (regionally) immobile. In contrast, for low-skilled workers the competition argument is more pronounced, leading to a higher outflow from large cities for this group.

95 By far, the lowest migration propensity is obvious for North Rhine-Westphalia. This is not surprising, however, since this state is overwhelmingly of urban character and therefore classified with the same region type.

recent changes of region, we observe that previous region-type movers are more likely to be regionally mobile again. This result is comparable to those obtained by Nakosteen et al. (2008), Nakosteen and Westerlund (2004) and Tunali (2000). Interestingly, the propensity for changing to a different establishment within the same region has decreased substantially for this group. We suppose that workers who have moved to a new local labour market are more likely to leave this labour market if their expectations are not met, rather than to change establishment within this labour market. The estimated coefficients for multiple changes within the last five years measure the additional effect relative to one-time mobility. It is evident here, that the propensity for region-type mobility has increased further, whereas the negative one-time effect is dampened for the propensity to change establishment within a region.[96]

4.4 Econometric estimates

To avoid bias due to the censoring of wages in our data set[97] and to eliminate heterogeneity due to education, the earnings estimates concentrate on the group of skilled workers. To keep the sample size tractable, we draw a 10 percent random sample of all stayers. Compared with the multinomial logit estimates presented above, these further restrictions reduce the number of individuals to a figure of 934,200 individuals being observed in both 1999 and 2000 (see *Table 4.2*). Note that a closer look at the observation figures already delivers first evidence against selectivity bias due to differing attrition rates of movers and stayers: the shares of survivors are similar for all three groups. For instance, in 2005, the difference between region-type movers and stayers was only 1.2 percentage points. The share of surviving establishment movers lies between and amounts to 74.7 percent.

Table 4.2: Absolute Numbers of Stayers, Establishment Movers and Region-Type Movers in the Sample

	1999	2000	2001	2002	2003	2004	2005	Total
Stayers	548,112	548,112	500,010	474,932	454,996	433,844	411,704	3,371,710
Establishment movers	283,995	283,995	258,589	244,141	233,381	223,217	212,109	1,739,427
Region-type movers	102,093	102,093	92,904	87,501	82,691	79,197	75,454	621,933
	934,200	934,200	851,503	806,574	771,068	736,258	699,267	5,733,070

96 Alternatively, one could control for recent changes of establishment. For establishment movers (within the district) this generally increases the propensity for a further change of establishment. However, since the effects for region-type movers are similar to the results documented above, we do not present the results in this paper.

97 Censoring affects about 10–15 percent in the base sample of full-time employed men containing all education groups but exceeds 50 percent for the highly skilled (technical college or college).

As outlined in section 4.2, we estimate variants of the fixed effects regression model in equation (4.3) which is repeated here for convenience:

$$w_{i,t,f} = P_{i,t-\tau}\alpha_{t-\tau} + x_{i,t,f}b + \mu_i + \nu_f + \psi_{i,f} + \delta_t + \varepsilon_{i,t,f}.$$

The vector of controls $x_{i,t,f}$ includes experience and tenure as predicted from standard human capital earnings specifications. Moreover, it captures various establishment size interaction variables, further establishment information like share of high-skilled and female workers within an establishment, and information on market size, industry affiliation and the federal state of origin.[98]

It is clear that the matching-component $\psi_{i,f}$ cannot be identified in a standard three way error component model.[99] As explained in section 4.2, its impact on wages is then captured by the $\alpha_{t-\tau}$. This is not a problem as $\psi_{i,f}$ (and the fixed firm effects ν_f) can and should be interpreted as an important component of mobility. Estimation of the wage equation with and without fixed firm effects allows us to decompose the returns to mobility further into pure search gains and a human-capital related component. If firm effects are excluded from the estimation model, the $\alpha_{t-\tau}$ represent gross gains. After adding fixed firm effects as dummies, the $\alpha_{t-\tau}$ represent only match-specific and human-capital related gains. Using a further approach $\alpha_{t-\tau}$ can be purged from the match-specific component too, leaving the pure human capital component: Generate first differences of the above equation, keep only within-match differences (i.e. $\Delta x_{i,t,f} \equiv x_{i,t,f} - x_{i,t-1,f}$) and run standard OLS on this sample. This sweeps out the firm- and match-specific component (as both are constant by definition within jobs) but cannot identify the wage effect α_{2000} of the first move.[100] The argumentation so long is based on asymptotic properties of the estimators which are not met in practice. The combined fixed individual and firm effects estimates account only for *identified* fixed firm effects:[101] 100,840 fixed firm effects out of 120,487 firms in the base sample are identified. The within-match differences estimators on the other hand ignore matches lasting less than 2 years

98 A description of the variables is given in ***Table A4.2b*** in the Appendix. Due to lack of data, household information is not available for our analyses. We are quite confident, however, that this is not of paramount importance for three reasons: Firstly, household information may be most important for highly-skilled individuals. We focus on skilled workers and exclude the highly-skilled from our analysis. Secondly, we hope to tackle these issues already with fixed individual effects. If the (unobserved) family context is not changing over time, then it will be differenced out in our estimation approach. This approach can, however, not tackle changes in the family context. Thirdly, a glance at the results in Yankow (2003) suggests that the effects of the family context are insignificant. The 'add-spouse' and 'lose-spouse' dummies in his regressions explaining returns to mobility (table 6 on page 506) are insignificant at the five percent level in almost all specifications.

99 The three error components are individual, establishment and time.

100 Recall that workers in the sample comparing region-type mover with establishment movers between 1999 and 2000.

101 A firm effect is identified only if the firm has workers moving to or from other firms in the estimation sample and estimation period. A thorough exposition of the identification conditions can be found in Abowd et al. (1999).

which introduces sample selectivity as the short matches are likely the unsuccessful ones. As both estimators have deficiencies, we conducted loose robustness checks by computing both and comparing them. As mentioned above, the fixed firm effects regressions are computationally demanding and pose further identification conditions[102] to identify a sufficiently high number of firm effects. Therefore they are applied only to a random 25 percent subsample of the base sample (all workers, all region types) and the samples differentiated by age groups. Finally, recognizing that the decomposition of the returns to mobility into search and human capital effects provides additional but less clear information than the gross returns, our main results are based on the fixed individual regressions whereas the further decomposition making use of the combined fixed individual and establishment estimates is treated as a qualification and reported in separate sections.

4.4.1 Mobility effects by control group

Before we present the main results which are obtained using establishment movers as the reference group, let us briefly justify this choice by means of a comparison with establishment stayers as the reference group. The importance of this choice can be seen directly from *Figure 4.1,* which portrays (for the base sample) the development of differences in the growth rates of the three groups: region-type movers, establishment movers (remaining in the same district) and stayers (remaining in the same establishment).[103] All estimates are based on the fixed individual effects model. Note that confidence intervals are omitted in the figures since the precision of the estimates is very high and significance is beyond dispute in *all* cases.[104] If region-type movers are compared with establishment stayers, the mobility effects are quite large (about 6 percent after 6 years, see the top line). Furthermore, more than 80 percent of the gross premium is already achieved in 2000, the first year after the move. Establishment movers (switching between establishments in the same district) already obtain their whole mobility premium in the first year. In our sample, however, all regional moves imply a change to a different establishment. Therefore the naïve estimate from the region-type mover/stayer comparison includes an establishment change effect which

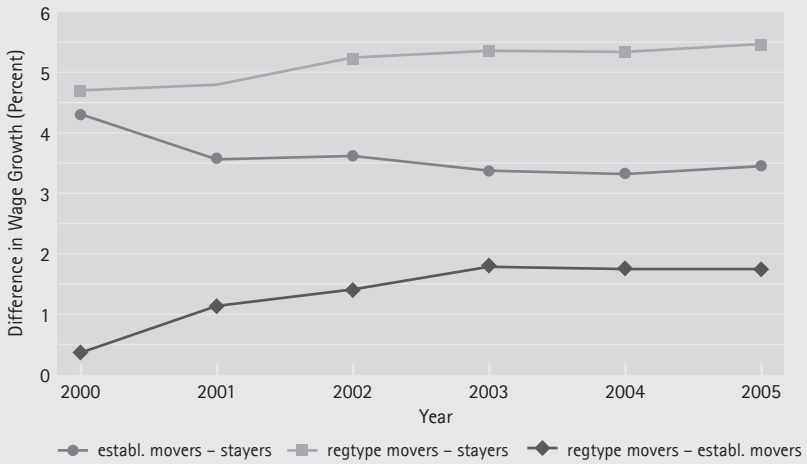
102 We remind that the identification of firm effects requires sufficient numbers on movers between firms in the sample. This becomes problematic e.g. when moves between RT1 and RT3 are analyzed.

103 To prevent the paper from becoming overloaded, the underlying regression results are depicted in ***Table A4.3*** in the Appendix and are not discussed in the paper.

104 For example, the ***most imprecise*** coefficient in the figure below, the region-type mover – establishment mover mobility wage premium in the year 2000 is 0.39 percent with the confidence interval [0.27;0.50]. The point estimate for the year 2005 coefficient is 1.79 percent with the confidence interval [1.66;1.91]. Furthermore, t-values are reported for the more detailed regression results in ***Table 4.3*** and the ***table***s in the Appendix.

can be eliminated by choosing (regionally immobile) establishment movers as a comparison group instead. This becomes clear from the diagram (see bottom line), as the first-year mobility wage growth premium drops from about 5 percent to 0.4 percent and the six-year premium decreases from about 6 to 2 percent. Altogether, at this aggregate level of analysis, this indicates a notable extra effect of regional mobility which becomes effective with a lag of nearly two years.

Figure 4.1: Wage Growth Effects of Mobility by Control Group



4.4.2 Mobility effects by experience group

The bulk of previous studies concentrates on pecuniary returns for *young* workers.[105] A major exception for Germany is the study by Schneider (2007). His results provide evidence that older workers benefit from changing establishment, but less than younger workers do.[106] This is confirmed by our estimates for three experience categories.[107] However, a more compelling approach eliminates seniorit y-related tenure effects by comparing region-type movers and establishment movers (within the district). *Figure 4.2* shows whether or not regional mobility pays off for

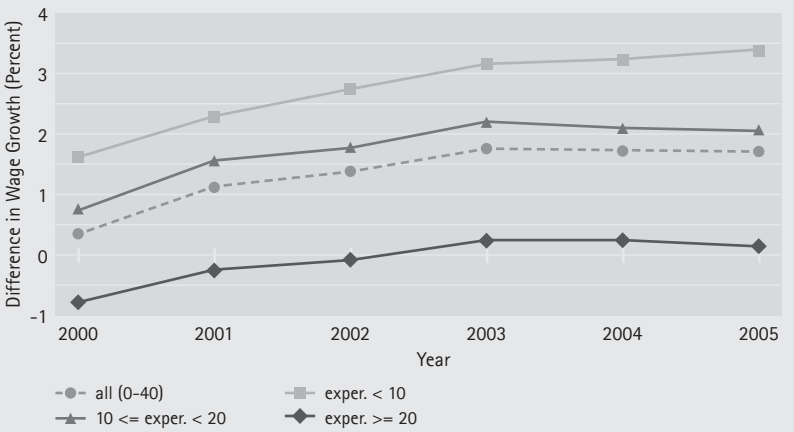
105 See, for example: Bartel (1980), Borjas and Rosen (1980), Bartel and Borjas (1981), Mincer and Jovanovich (1981), Borjas (1984), Mincer (1986), Antel (1991), Loprest (1992), Topel and Ward (1992), Light and McGarry (1998), Yankow (1999, 2003) and, more recently, Ham et al. (2004), Détang-Dessendre et al. (2004).

106 According to Schneider (2007) this result can be expected from theoretical considerations since earnings increase with job tenure (indirectly with age) and workers lose the seniority-related part of their previous wage after changing establishment. He works out that this argumentation is consistent with both human capital theory (see Becker, 1964; Mincer, 1974, 1978) and matching theory (see Jovanovich, 1979) and the theory of deferred payment (see Lazear, 1981).

107 Since comparisons of establishment movers and stayers are not the main focus of the paper, these results are not documented, but are available from the authors on request.

different experience groups. The wage growth differential for region-type movers with a potential work experience of less than ten years is about 2 percent in the year 2000 and increases to about 3.5 percent in 2005 (see top line). Similarly, region-type movers in the intermediate experience category (10–19 years) exhibit a differential which is clearly above the average (see second and third lines). This can be compared with individuals in the third category (20 or more years of potential work experience, see bottom line). For this group the additional effect of regional mobility is even negative in the first years after migration, becoming slightly positive by the end of the observation period. Hence, the results indicate pronounced differences for different age categories.

Figure 4.2: Wage Growth Effects of Mobility by Experience Group



4.4.3 Mobility effects by region type

After having established that mobility effects differ for young and older workers, we now turn to one of the main questions of our paper. *Table 4.3* sheds light on the impact that the region type has on the success of migration. As discussed above, the natural benchmark group is establishment movers within a region. The overall wage increase of region-type movers relative to establishment movers from 0.4 percent in 2000 to 1.8 percent in 2005 (see *Figure 4.1*) exhibits considerable variation for the different types of region of origin.[108] Panel A of *Table 4.3* shows that the short-term return is statistically significantly negative in metropolitan areas

108 Similarly, the wage growth differentials of immobile establishment movers also depend on the type of the region. For instance, the long-term wage growth differential in metropolitan areas relative to stayers is almost twice the value of that in rural areas (see the Appendix, *Table A4.4*). This is in accordance with results from matching theory according to which the likelihood of good matches between employer and employee increases with the size of the labour market.

(–1.31 percent, RT1), around zero in metropolitan surroundings (–0.06 percent, RT2) and statistically significantly positive in central cities (+0.98 percent, RT3) and rural areas (+2.03 percent, RT4).[109] Regarding the long-term effects for workers leaving the most agglomerated areas, it emerges that the negative wage growth differential becomes smaller in the succeeding years (–0.49 percent in 2003) but increases thereafter up to –1.21 percent in 2005. In the other region types, the long-term wage growth differential is positive and ranges from 3.02 percent in metropolitan surroundings to 4.72 percent in rural areas. It is evident here that movers leaving the least densely populated rural areas benefit most relative to the establishment movers who stay in the corresponding region.

More specific information on the outcomes of regional mobility is shown in panel B of *Table 4.3*. These results are obtained after further partitioning the samples used in panel A by the region of destination. Note that the results are precise even at this disaggregated level of the analysis since each migration stream contains a minimum of 2,500 observations.[110] Panel B reveals the gross effects in panel A as conglomerates of quite heterogeneous destination-specific effects. While movers from metropolitan (RT1) to rural areas (RT4) exhibit a wage loss of –2.43 percent in 2005, the negative differential is distinctly smaller for movers to metropolitan surroundings (–1.10 percent, RT2). The wage growth differential in subsequent years is also negative for the group of individuals moving from metropolitan surroundings (RT2) to rural areas (RT4). Here, too, the effect becomes smaller by the end of the observation period. From a theoretical point of view one might expect positive short-term and long-term effects for movers to the more densely populated metropolitan areas and central cities.[111] On the one hand, they should benefit from high urban wage levels immediately after migration, for instance due to high urban price levels; on the other hand the long-term wage growth should be higher, for instance due to wage-enhancing factors like knowledge spillovers, which lead to a higher ability of workers over time. Interestingly, in the year after migration, the wage growth of movers from metropolitan surroundings (RT2) to central cities (RT3) does not differ statistically from the wage growth of establishment movers remaining in metropolitan surroundings. For movers to

109 Note, however, that the effects of region-type mobility are all positive and highly significant, if region-type movers are compared with the group of stayers. This comparison is not included in the paper, but available from the authors on request.

110 The smallest cell size is observed for movers from metropolitan surroundings to rural areas (2,527 observations). By contrast, the largest cell (central cities to metropolitan areas) comprises 16,911 observations.

111 The studies by Ciccone and Hall (1996) for the US or Ciccone (2002) for several European countries show the positive relationship between employment density and productivity. Moreover, in the literature there is overwhelming evidence of the existence of an urban wage premium (see, for instance, Gould, 2007; Yankow, 2006; Rosenthal and Strange, 2008 and Wheeler, 2001 for the USA, Haas and Möller, 2003 for western Germany, Combes et al., 2008 for France, Di Addario and Pattacchini, 2008 for Italy and Tabuchi and Yoshida, 2000 for Japan).

metropolitan areas (RT1) the wage growth differential is also relatively small (0.90 percent). This indicates that price level effects do not play a dominant role in explaining the wage growth effects of region-type mobility. In subsequent years, we observe prominent positive wage growth effects. In accordance with theoretical expectation, the difference is most striking in metropolitan areas (+4.49 percent in 2005), where dynamic human capital externalities are most likely to occur. The latter result is also true for region-type movers leaving central cities (RT3) and rural areas (RT4). The long-term differential for movers from rural to metropolitan (RT1) areas even amounts to 7.47 percent. Though the construction of our cohort allows multiple moves to occur (possibly in other types of region) as well as drop-ins and drop-outs during the observation period after the year 2000 we are quite confident that the wage growth differentials are mainly due to externalities operating in the urban environment.[112]

The observation that movers from central cities (RT3) to rural areas (RT4) do not suffer losses corroborates our finding that the effects are not mainly driven by price level differentials.

Table 4.3: Estimated Dummy Indicators of the Fixed-Effect Estimates: Short- and Long-Term Wage Growth Analysis for Region-Type Movers Relative to Establishment Movers by Region Type

Panel A								
year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
	RT1		RT2		RT3		RT4	
2000	**–1.31**	–12.14	–0.06	–0.33	**0.98**	9.29	**2.03**	15.76
2001	**–0.83**	–7.62	**1.45**	8.15	**1.84**	17.21	**2.87**	22.06
2002	**–0.92**	–8.45	**1.65**	9.16	**2.39**	22.00	**3.61**	27.42
2003	**–0.49**	–4.40	**2.02**	11.07	**2.81**	25.50	**4.07**	30.51
2004	**–0.86**	–7.69	**2.52**	13.65	**3.11**	27.78	**4.18**	31.03
2005	**–1.21**	–10.61	**3.02**	16.13	**3.09**	27.27	**4.72**	34.58
Panel B								
year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
	RT1 to RT2		RT2 to RT1		RT3 to RT1		RT4 to RT1	
2000	**–1.27**	–7.34	**0.90**	4.36	**1.69**	12.47	**3.69**	18.50
2001	**–0.45**	–2.54	**2.67**	12.95	**2.91**	21.43	**4.83**	24.50
2002	**–0.44**	–2.48	**2.89**	13.94	**3.55**	25.88	**5.69**	28.80
2003	**–0.49**	–2.68	**3.34**	15.94	**4.07**	29.40	**6.45**	32.37
2004	**–0.89**	–4.83	**3.84**	18.15	**4.64**	33.09	**6.80**	33.81
2005	**–1.10**	–5.87	**4.49**	20.99	**4.69**	33.01	**7.47**	36.74

112 This is confirmed by sensitivity analyses where multiple movers after the year 2000 (and/or drop-ins and drop-outs) are excluded from the sample. These restrictions ensure that the region-type-specific within-job wage growth differentials are estimated consistently. Since all the findings turned out to be robust, the results of this check are not included in the paper (but are available from the authors on request).

Table 4.3 (continued):

	RT1 to RT3		RT2 to RT3		RT3 to RT2		RT4 to RT2	
2000	**–1.03**	–7.34	–0.13	–0.43	**1.23**	4.44	**1.98**	7.17
2001	**–0.84**	–5.91	**1.10**	3.59	**2.20**	7.71	**1.93**	6.76
2002	**–0.88**	–6.07	**1.59**	5.11	**2.31**	7.96	**2.37**	8.17
2003	–0.18	–1.24	**1.99**	6.30	**2.72**	9.19	**2.29**	7.80
2004	**–0.60**	–4.04	**2.58**	8.08	**2.90**	9.63	**2.27**	7.63
2005	**–1.04**	–6.90	**2.55**	7.84	**2.31**	7.58	**2.62**	8.65
	RT1 to RT4		RT2 to RT4		RT3 to RT4		RT4 to RT3	
2000	**–3.03**	–14.35	**–2.35**	–7.51	–0.11	–0.72	**1.21**	7.75
2001	**–2.22**	–10.33	**–1.62**	–5.02	0.18	1.18	**2.01**	12.58
2002	**–2.51**	–11.55	**–1.74**	–5.30	**0.71**	4.49	**2.71**	16.66
2003	**–1.95**	–8.83	**–1.80**	–5.41	**0.95**	5.90	**3.06**	18.53
2004	**–2.15**	–9.58	**–1.35**	–4.01	**0.84**	5.14	**3.03**	18.18
2005	**–2.43**	–10.72	**–0.84**	–2.45	**0.85**	5.13	**3.55**	20.95

Notes: All specifications include all control variables listed in *Table A4.2b.* Coefficients are multiplied by 100. Estimated coefficients significant at least at the 5 percent level are in bold. *Interpretation example*: The entry –1.31 in block RT1 of Panel A means that movers leaving region type 1 between 1999 and 2000 face a (ceteris paribus) wage loss of –1.31 percent compared to establishment movers staying in the same region. The corresponding wage loss decreases to –0.83 percent in 2001 and to –0.38 percent in 2005. The entries in block RT1 to RT2 of Panel B give the corresponding wage growth effects for workers moving from region type 1 to region type 2, again compared to establishment movers staying in the same region.

Legend: RT1 stands for "metropolitan areas".
RT2 is equivalent to "metropolitan surroundings".
RT3 is "central cities", RT4 stands for "rural areas".
For a more detailed explanation of the region types see *Table A4.1.*

Source: Authors' own calculations using IAB data.

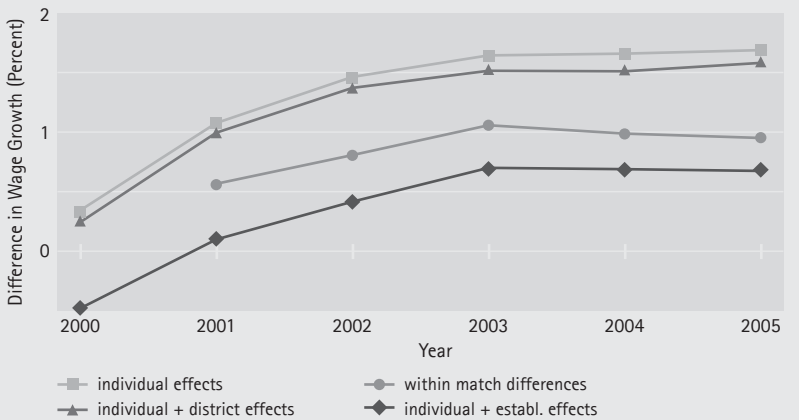
4.4.4 The relevance of district and establishment control dummies and the decomposition of mobility returns into search gains and a human capital component

In order to support this last finding we extend our econometric models by inclusion of fixed district effects.[113] This accounts not only for price level effects but also for region-specific amenities. As mentioned above, effects of migration on wages may additionally be biased if migrants extract rents by moving systematically to better-paying firms. The inclusion of firm dummies suggests itself as a conceptually simple remedy. Before we step into the details we note that either district or firm effects (but not both) can be identified since the district dummies are sums of the corresponding firm dummies. We can, however, estimate specifications with fixed district and firm effects separately. Fortunately, the differences between the corresponding mobility

113 Alternatively, the bias due to regional price level differences could be eliminated by restricting the sample further to migrants moving to distant regions ***within*** the four region types. The results of this approach corroborate the minor importance of price-level effects. Since effects of region-specific amenities are not tackled by this approach, however, the results are not included in the paper (but are available from the authors on request).

returns $\alpha_{t-\tau}$ are highly informative. If inclusion of district effects reduces the $\alpha_{t-\tau}$ considerably, a good deal of the mobility premium may be explained by regional price levels or amenities. If, however, they are insensitive to inclusion of fixed district effects but shrink considerably after inclusion of fixed firm effects, we conclude that regionally mobile workers gain significantly by finding better-paying firms. The results in *Figure 4.3* (which are repeated in Appendix *Table A4.5)* show that this is the case for our data. To reduce computation time, these regressions are based on a random 25 percent subsample of the base sample. To show that the results are insensitive to this reduction of the sample size, individual fixed effects estimates are repeated here (top line with dot markers). As can be seen from the figure, they are almost insensitive to an inclusion of fixed district effects (indicated by diamond markers) whereas the within match differences estimation reduces them by about 40 percent to roughly one percent in 2005 and inclusion of fixed establishment effects by even about 60 percent to roughly 0.7 percent in 2005. Exploiting only within match differences should reduce the mobility premium more than inclusion of fixed establishment effects since it removes constant job match effects too. Given the above mentioned problems associated with both estimators,[114] we should, however, abstain from a narrow and structural interpretation of this difference. Anyway, the fact that both estimators reduce the total mobility premium significantly suggests that search gains play an important role in regional mobility decisions, roughly equally important as human capital considerations.

Figure 4.3: Returns to Mobility With and Without Inclusion of Fixed District, Job Match and Establishment Effects



114 The within match estimator ignores spells shorter than two years and the combined fixed individual and establishment effects estimator includes only identified establishment effects. In the sample used to run the regressions 100,840 out of 120,487 establishments are identified. The main problem appears to be that small establishments are more likely to be not identified as they show smaller absolute numbers of movers.

Table 4.4 contains corresponding results for these models by experience groups. Note that the results for the specification including fixed individual and district effects are not reported since deviations from the fixed individual estimates are negligible.[115] For the young, the reduction of mobility returns being brought about by the within match differences and fixed establishment effects are inverse to the effects for the base sample. If the differences were taken seriously this should be interpreted as an indication that job match effects are more important for the young workers whereas they play a negligible role for the other groups. Anyway, we find that search gains matter for all experience groups but do not completely dominate the gross mobility premium.

Table 4.4: Extensions of the Fixed Individual Effects Models by Experience Group

Experience categories	year	Ind	t-stat	match diff	t-stat	Ind+Estab	t-stat
0–9 years	2000	**1.49**	7.42	–	–	0.76	1.17
	2001	**2.24**	10.04	**0.47**	3.62	1.23	1.88
	2002	**2.86**	11.96	**0.77**	4.26	**1.62**	2.53
	2003	**3.33**	13.13	**1.08**	4.96	**1.99**	3.12
	2004	**3.31**	12.28	**1.04**	4.22	**2.02**	3.08
	2005	**3.53**	12.71	**1.14**	4.23	**2.12**	3.17
10–19 years	2000	**0.71**	4.75	–	–	–0.21	–0.56
	2001	**1.44**	8.87	**0.59**	6.03	0.43	1.16
	2002	**1.70**	9.92	**0.71**	5.09	0.61	1.63
	2003	**2.19**	12.09	**1.32**	7.83	**1.25**	3.22
	2004	**2.09**	10.96	**1.13**	5.86	**1.09**	2.83
	2005	**2.07**	10.59	**1.06**	5.01	**1.07**	2.81
20–40 years	2000	**0.01**	0.09	–	–	–0.30	–1.49
	2001	**0.76**	6.50	**0.54**	7.24	0.26	1.30
	2002	**1.04**	8.45	**0.71**	6.62	**0.45**	2.21
	2003	**1.41**	10.92	**1.14**	8.80	**0.87**	4.16
	2004	**1.42**	10.27	**1.04**	7.05	**0.84**	4.06
	2005	**1.37**	9.56	**0.95**	5.80	**0.78**	3.72

Notes: All results are based on a 50 percent random sample of the base sample to reduce computation time. All specifications include all control variables listed in *Table A4.2b*. Coefficients are multiplied by 100. Coefficients significant at least at the 5 percent level are in bold. t-statistics for Ind and match diff are based on robust asymptotic standard errors, t-values for ind+District and Ind+Estab are based on bootstrap standard errors (clustered by individuals). Coefficient estimates corresponding to year 2000 cannot be estimated using the within job match differences estimator.

Legend: Ind: fixed individual effects estimates.
Ind+District: fixed individual and district effects.
match diff: OLS based on within-job match differences.
Ind+Estab: fixed individual and establishment effects estimates.

Source: Authors' own calculations using IAB data.

115 For example, the returns to mobility for 2005 are 3.4, 2.1 and 1.3 percentage points for the respective experience groups.

4.5 Summary and conclusion

Comparing region-type movers and establishment movers (who remain in the same district) we find clear evidence for additional effects of interregional mobility beyond job mobility. Similarly to the results obtained by Yankow (2003) for the US, this premium becomes fully effective with a lag of three to four years. Adding fixed establishment effects to the standard fixed individual effects models suggests that search gains amount to about half of the returns to mobility and the rest may be explained by human capital.

These results for the pooled sample are supplemented by investigations at the more disaggregate level. We start by considering different age groups and find that there are marked differences. Young workers with a potential work experience of less than ten years benefit more from region-type mobility than older workers. For the latter group, contemporaneous returns to region-type mobility are even negative. However, for this group, too, steeper wage growth paths are observed than for the reference group of older establishment movers. This leads to a small positive effect in the medium run.

Pronounced heterogeneity emerges especially when we analyse mobility conditional on the region type. Compared with non-migratory establishment movers in the region of origin, the short-term wage growth is statistically significantly negative in metropolitan areas while the opposite is true in central cities and rural areas. Regarding the long-term effects for workers leaving the most agglomerated areas, it emerges that the negative wage growth differential declines in the succeeding years, but is still slightly negative in 2005. For the other region types, the long-term wage growth differential is positive and amounts to 3–4 percent.

More specific information on the outcomes of regional mobility is obtained after partitioning the sample further by the region of destination. We find that the results presented for the region types of origin are still compositions of quite heterogeneous destination-specific effects. Generally, it turns out that the wage growth returns are much higher, the less densely populated the region type of origin and the more densely populated the region type of destination. These results corroborate theoretical considerations: movers to more densely populated areas benefit from an overall higher wage level and workers who leave the densely populated areas lose at least part of the urban wage premium.[116] Looking into the reasons for an urban wage premium, one can distinguish between short- and long-term effects. On the one hand, immediately after migration individuals should be

116 There is empirical evidence that the urban wage premium is not entirely lost when leaving the cities. For example, Glaeser and Maré (2001) point out that the proportion of the urban wage premium which is taken away is higher the more human capital is transferable between urban and rural areas.

compensated for high urban price levels; on the other hand the long-term wage growth should be higher, for instance due to wage-enhancing factors such as knowledge spillovers, which lead to workers' increasing ability over time.[117] Our results indicate that price level effects do not play a dominant role in explaining the wage growth effects of region-type mobility. Actually, finding pronounced long-term wage growth effects, we are quite confident that wage growth differentials are mainly due to externalities operating in the urban environment. This interpretation is supported by the important observation that the returns to mobility are insensitive to the inclusion of fixed district effects. More specifically, we find that half of the wage growth effect can be attributed to human capital accumulation while the other component of the additional effect of regional migration can be traced back to enhanced search and match possibilities in non-local labour markets.

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117 We are aware that the urban wage premium is also a result of numerous other aspects. These are discussed in more detail by Lehmer and Möller (2008).

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Appendix

Table A4.1: Regional Classification Scheme Based on BBR-Classification

Structural region type	District type (BBR-Classification)	Term used in the paper	Description of region type (BBR)
Regions with large agglomerations	BBR1	metropolitan areas	Core cities
	BBR2	RT1	Highly urbanized districts in regions with large agglomerations
	BBR3	metropolitan surroundings	Urbanized districts in regions with large agglomerations
	BBR4	RT2	Rural districts in regions with large agglomerations
Regions with features of conurbation	BBR5	central cities	Central cities in regions with intermediate agglomerations
	BBR6	RT3	Urbanized districts in regions with intermediate agglomerations
	BBR7	rural areas	Rural districts in regions with intermediate agglomerations
Regions of rural character	BBR8	RT4	Urbanized districts in rural regions
	BBR9		Rural districts in rural regions

Table A4.2a: A Description of the Variables for the Multinomial Logit Estimates

Name of Variable	Description
Low-skilled (ref.)	Individuals with no occupational qualification regardless of their schooling level.
Skill missing	Individuals with missing information on skill level.
Skilled	Individuals with an occupational qualification (completed apprenticeship) regardless of their schooling level.
Highly-skilled	Individuals with upper secondary education holding a degree from university or university of applied sciences.
Experience category: 0–9 years (ref.)	Categories of potential work experience in years, measured as age minus average duration of education minus 6. For low-skilled workers without upper secondary education we assume 10 years as the average educational period, for low-skilled workers with upper secondary education 13 years, for skilled workers 12.5 and 15 years respectively, for highly-skilled workers holding a degree from a university of applied sciences 16 years and for highly-skilled university graduates 18 years.
experience category: 10–19 years	
Experience category: >= 40 years	
Tenure category: 0 years (ref.)	Tenure categories, measured in years.
Tenure category: 1–5 years	
Tenure category: 6–10 years	
Tenure category: > 10 years	
Log market size	Logarithm of the number of individuals with the same skill category working in the same region and industry in a given year.
Log establishment size	Logarithm of the number of individuals working in the same establishment (plant size information).
Aggregated federal state "North" (ref.)	The aggregated federal state "North" covers Schleswig-Holstein, Hamburg, Lower-Saxony and Bremen. Some aggregation is appropriate here, since we observe pronounced commuting streams between the city states Hamburg and Bremen and their hinterland which is located in Schleswig-Holstein and Lower-Saxony, respectively.
North Rhine-Westphalia	
Hesse	
Rhineland-Palatinate	
Baden-Württemberg	
Bavaria	
Saarland	
No change of region in the last five years (ref.)	Categories of former mobility history are generated (for every worker) by counting the number of district changes in the five years before 1999.
One change of region in the last five years	
More than one change of region in the last five years	

Table A4.2b: A Description of the Variables for the Fixed-Effects Estimates

Name of Variable	Description
log wage	Logarithm of gross daily earnings, calculated as average over the observed employment period for each person.
Dummy indicator: wage effect of region-type movers relative to stayers	Effect of region-type mobility, base outcome: stayers.
Dummy indicator: wage effect of region-type movers relative to stayers	Effect of region-type mobility, base outcome: stayers.
Dummy indicator: wage effect of region-type movers relative to establishment movers	Effect of region-type mobility, base outcome: establishment movers. Referred to as additional effect of regional migration.
Experience squared	Potential work experience in years, measured as age minus average duration of education minus 6. For the sample of skilled workers the average educational period is assumed to be 12.5 years (without upper secondary education or 15 years (with upper secondary education), respectively.
Experience cubic	
Tenure	Tenure is measured in years. Since the biographies of workers date back to the year 1975 the maximum tenure is 30 years in 2005. Therefore, we include a variable Dummy high tenure to account for this.
Tenure squared	
Dummy high tenure	
Establishment size	Besides the linear and quadratic establishment size controls we additionally introduce interaction effects which account for the fact that wage growth within the firm and between firms might differ. For instance, the variable *Establishment size: between * neg* includes the supplementary effect for those workers moving to a smaller firm. By contrast, the variable *Establishment size: within* pos* covers the effect for an increase in firm size (for stayers).
Establishment size squared	
Establishment size: within * pos	
Establishment size: within * pos squared	
Establishment size: between * neg	
Establishment size: between * neg squared	
Establishment size: between * pos	
Establishment size: between * pos squared	
Log market size	Logarithm of the number of individuals with the same skill category working in the same region and industry in a given year.
Log aggregated market size	Logarithm of the number of individuals with the same skill category working in the same region in a given year.
Share of high-skilled	Share of high-skilled workers in the same establishment.
Share of female	Share of female workers in the same establishment.
Time dummies	Calendar year dummies 2000–2005
Industry dummies	14 industry dummies (agriculture omitted)
Federal state dummies	6 federal state dummies (aggregated federal state "North" omitted; for a description see *Table A4.2a*)

Notes: The fixed effects estimates are restricted to workers of the intermediate skill category (completed apprenticeship). In contrast to *Table A4.2a*, skill categories are therefore not included in the list of variables.

Table A4.3: Results of the Fixed-Effects Estimates: Long-Term Wage Growth Analysis

		Establishment movers vs. stayers		Region-type movers vs. stayers		Region-type movers vs. establishment movers	
Variable		Coef.	t-statistics	Coef.	t-statistics	Coef.	t-statistics
Dummy indicator: wage effect of establishment movers relative to stayers	2000	**4.51**	123.65				
	2001	**3.69**	108.70				
	2002	**3.78**	110.77				
	2003	**3.51**	101.69				
	2004	**3.47**	98.83				
	2005	**3.57**	99.61				
Dummy indicator: wage effect of region-type movers relative to stayers	2000			**4.92**	97.84		
	2001			**5.02**	105.13		
	2002			**5.43**	111.92		
	2003			**5.61**	113.55		
	2004			**5.57**	110.85		
	2005			**5.68**	111.04		
Dummy indicator: wage effect of region-type movers relative to establishment movers	2000					**0.39**	6.64
	2001					**1.19**	19.87
	2002					**1.45**	23.89
	2003					**1.84**	29.78
	2004					**1.80**	28.72
	2005					**1.79**	28.05
Experience squared		**–0.07**	–159.96	**–0.06**	–138.37	**–0.06**	–85.97
Experience cubic		**0.00**	58.98	**0.00**	50.38	**0.00**	6.30
Est. size		**2.46**	114.29	**2.31**	90.43	**2.14**	76.67
Est. size squared		**–0.10**	–44.05	**–0.08**	–29.39	**–0.08**	–26.53
Est. size: within * pos		**0.11**	15.71	**0.16**	21.24	**–0.11**	–7.60
Est. size: within * pos squared		0.00	1.22	**–0.01**	–6.89	**0.05**	19.43
Est. size: between * neg		**–0.36**	–21.71	**–0.20**	–9.04	**–0.35**	–15.53
Est. size: between * neg squared		**0.05**	19.8	**0.03**	8.28	**0.05**	14.80
Est. size: between * pos		**–0.49**	–30.84	**–0.43**	–22.37	**–0.35**	–16.94
Est. size: between * pos squared		**0.03**	10.80	**0.02**	5.23	0.00	1.49
ln(market size)		**0.69**	32.23	**0.69**	29.35	**0.53**	19.28
ln(aggregated market size)		**–1.01**	–39.87	**–0.56**	–20.81	**–0.28**	–8.70
Share of high-skilled in establ.		**0.12**	110.86	**0.13**	105.81	**0.13**	87.50
Share of female in establ.		**–0.04**	–64.55	**–0.04**	–51.02	**–0.04**	–51.30

Table A4.3 (continued):						
Tenure	**0.24**	60.39	**0.19**	44.00	**0.59**	60.37
Tenure squared	**–0.01**	–37.35	**–0.01**	–30.26	**–0.02**	–30.62
Dummy high tenure	**0.13**	2.95	0.07	1.72	**0.93**	4.74
Constant	**469.34**	1608.56	**464.57**	1477.83	**454.50**	1245.44
Time dummies, industry dummies and dummies for (partly aggregated) federal states	included					
	Test statistics					
Number of individuals	832,107		650,205		386,088	
F(832106, 4278981)	38.65					
F(650204, 3343389)			40.98			
F(386087, 1975223)					28.08	

Notes: All coefficients are multiplied by 100. Estimated coefficients significant at least at the 5 percent level are in bold.

Source: Authors' own calculations using IAB data.

Table A4.4: Estimated Dummy Indicators of the Fixed-Effects Estimates: Long-Term Wage Growth Analysis for Establishment Movers Relative to Stayers by Region Type

year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
	RT1		RT2		RT3		RT4	
2000	**5,00**	86,12	**5,14**	41,31	**4,35**	66,21	**3,26**	42,86
2001	**4,13**	76,38	**3,80**	32,51	**3,63**	59,69	**2,48**	35,43
2002	**4,37**	80,41	**4,18**	35,63	**3,49**	56,93	**2,43**	34,36
2003	**3,99**	72,35	**4,03**	33,87	**3,23**	52,27	**2,34**	32,90
2004	**4,00**	71,40	**3,80**	31,47	**3,15**	50,17	**2,25**	31,21
2005	**4,06**	71,03	**3,72**	30,23	**3,35**	52,25	**2,33**	31,56

Notes: All coefficients are multiplied by 100. Estimated coefficients significant at least at the 5 percent level are in bold.
Legend: RT1 stands for "metropolitan areas".
RT2 is equivalent to "metropolitan surroundings".
RT3 is "central cities"; RT4 stands for "rural areas".
For a more detailed explanation of the region types see *Table A4.1.*

Source: Authors' own calculations using IAB data.

Table A4.5: Extensions of the Fixed Individual Effects Models

year	Ind	t-stat.	Ind+ District	t-stat.	match diff	t-stat.	Ind+ Estab	t-stat.
2000	**0.35**	2.59	**0.26**	2.00	-	-	–0.49	–1.60
2001	**1.14**	7.73	**1.05**	7.32	**0.58**	6.37	0.12	0.39
2002	**1.54**	9.82	**1.45**	10.19	**0.85**	6.53	0.45	1.41
2003	**1.73**	10.50	**1.61**	10.60	**1.12**	7.09	**0.74**	2.38
2004	**1.74**	9.89	**1.61**	10.27	**1.04**	5.77	**0.73**	2.30
2005	**1.78**	9.82	**1.67**	9.93	**1.01**	5.10	**0.72**	2.25

Notes: All results are based on a 25 percent random sample of the base sample to reduce computation time. All coefficients are multiplied by 100. Estimated coefficients significant at least at the 5 percent level are in bold. t-statistics for Ind and match diff are based on robust asymptotic standard errors, t-values for ind+District and Ind+Estab are based on bootstrap standard errors (clustered by individuals). Coefficient estimates corresponding to year 2000 cannot be estimated using the within job match differences estimator.

Legend: Ind: fixed individual effects estimates.
Ind+District: fixed individual and district effects.
match diff: OLS based on within-job match differences.
Ind+Estab: fixed individual and establishment effects estimates.

Source: Authors' own calculations using IAB data.

5 The Additional Wage Growth Effect of Regional Mobility: Sector-Specific Differences

Abstract

Using administrative data for West Germany, this paper extensively analyzes the additional effect of regional migration compared to local job-to-job mobility for different sectors. After eliminating regional price level differentials the results show that mobility wage growth effects differ substantially on the sector level. In the first year after migration, the extra return is most pronounced in *business services* and *construction 2*. By contrast, the effect is negative in *energy* and *raw materials*. In succeeding years we observe wage growth effects in all sectors which results in significant long-term extra effects in 11 of 13 sectors. The effect ranges between 4.9 percent in *household services* and –0.7 percent in *raw materials*. We investigate several possible explanations for the heterogeneity between sectors. Specifically, we find that in *food, beverages & tobacco* and *business services* the extra effects are mainly related to sector mobility itself and that long-distance mobility accounts for a substantial part of the premium in *transport & communication* and *household services*. However, since the explanatory power of several checks is still limited, we conclude that differences in matching processes and human capital accumulation can still be seen as a major explanation for sector specific heterogeneity.

Keywords: Interregional migration, job mobility, contemporaneous returns, industry-specific mobility wage growth differentials.
JEL classification: J61, J62, R23.

5.1 Introduction

In chapter 4 we identify the additional effect of regional migration compared to job mobility within a region. While the extra return – which is measured as wage growth differential – is zero in the short run, it increases up to 2 percent after 3–4 years. We can show how the success of migration is influenced by the characteristics of both, the region of origin and the region of destination. The results show that the gains of regional migration are highest for those workers who move from rural low-wage areas to metropolitan high-wage areas. On an *aggregated level*, however, we interestingly find that regional price level differences play only a minor role for the explanation of the mobility wage growth premium.

This paper considers wage growth differentials separately according to sectors. In so doing, we adopt an approach of eliminating regional price level differentials

for sector-specific analyses. More precisely, we observe movers between regions which are roughly of the same type. That is, holding the characteristics of the region (or the type of the region) constant, this restriction is mentioned to eliminate price level differentials to a large extent. Then, we use a classification scheme which differentiates between 15 sectors and analyze how the extra return to regional mobility differs in this respect. Finding considerable heterogeneity of the mobility wage growth differentials across sectors, we proceed to investigate possible explanations for the observed heterogeneity. Firstly, we inspect the role of sector mobility. Secondly, we investigate whether regional mobility is systematically related to long-distance moves in some sectors and short-distance moves in other sectors. Since one can argue that wage effects of mobility are more pronounced for long-distance movers, this could help explain sector-specific differences. Thirdly, we consider the age structure on a sector level because it is obvious that the success of migration differs for young and old workers.

The remainder of the paper is organized as follows: section 5.2 deals with a description of our data source, methodological issues and basic definitions. It also includes some empirical evidence regarding the differences of characteristics of regional movers, (non-migratory) establishment movers and stayers in the different sectors. Section 5.3 discusses the estimation approach in more detail and presents the results. Furthermore, it includes the described checks which are mentioned to give an idea of the sources of heterogeneity between sectors. Section 5.4 provides some conclusions.

5.2 Data, basic definitions and some descriptive evidence

5.2.1 Data

For our empirical work (which considers the period 1999–2005) we use the employment register data 1975–2005 of the German Federal Employment Services.[118] This data set covers nearly 80 percent of the German workforce, excluding only the self-employed, civil servants, individuals in (compulsory) military service, and individuals in so-called `marginal part-time jobs' (jobs with no more than 15 hours per week or temporary jobs that last no longer than 6 weeks).[119] Furthermore it contains important personal characteristics (sex, age, education, job status) as well as information on occupation, industry, establishment identifiers and wages. The regional information refers to the location of the firm/workplace at NUTS3 (district)

118 The data contains complete biographies in spell form. In order to simplify data processing, however, we extract spells at cut-off dates (30.6) in every year.

119 For a detailed description of the data set see Bender et al. (2000) or Bender et al. (1996). A more commonly used data set in Germany is the IABS, which is a 2 percent random sample of the data set we use.

level. A classification scheme of the Federal Office for Building and Regional Planning (*Bundesamt für Bauwesen und Raumordnung* – BBR) differentiates several types of region according to their centrality and population density. We aggregate this information to some extent and differentiate between "metropolitan areas" (RT1), "metropolitan surroundings" (RT2), "central cities" (RT3) and "rural areas" (RT4). For a schematic overview see Appendix, *Table A5.1*. Altogether the data (especially because of its large size) is well-suited for our analysis.

However, though the data source is highly reliable in general, it suffers from two limitations. Firstly, working time is only reported in three classes: full-time, part-time with at least 50 percent of full-time working hours and part-time with less than 50 percent. To avoid bias due to imprecise working time information, we restrict our analysis to full-time working individuals who are between 20 and 60 years old. Secondly, wages in the data are censored at the social security threshold. Although censoring is moderate (about 10–15 percent, slightly changing from year to year) for the entire sample, problems can arise for the highly qualified males (university and other higher education graduates), where more than 50 percent of wage observations are censored. Since this would call into question all of the results obtained from the highly qualified sub-sample, we restrict the analysis to the medium qualification group.

Moreover, to increase the homogeneity of the sample we restrict the analysis to male workers in western Germany, who are employed in consecutive years.[120] Reasons for these restrictions are given by still ongoing differences in the economic adjustment process after re-unification and by remarkable gender-specific differences in determinants and outcomes of migration.[121]

5.2.2 Basic definitions

In order to analyze the extra return to interregional mobility compared to job mobility, we define three groups of workers. Regional movers are defined as (migratory) job movers who change their workplace to a different region of the same type between two consecutive cut-off dates (30th June) in the years 1999 and 2000. In contrast to chapter 4 we choose this definition since we are interested in sector-specific differentials. The restriction of region of origin and destination being of the same type

120 Specifically, we merge information on unemployment duration from the German unemployment register (LEH) with the employment register data and exclude observations with unemployment spells lasting longer than 30 days between 30th June of two consecutive years.

121 Family migration issues are examined in – for instance – the studies of Astrom and Westerlund (2006), Nivalainen (2005), Boyle et al. (2001), Cooke (2001), Smits (1999), van Ommeren et al. (1999) and Jacobsen and Levin (1997).

ensures that influences of regional characteristics can be neglected in this analysis.[122] The reference group of establishment movers contains workers *moving between establishments remaining in the same region* in this one-year period. Comparisons of wage growth paths of the first and the second group identify the additional effect of regional mobility.[123] To determine the effects of (non-migratory) establishment mobility we additionally observe a third group of stayers which comprises all individuals who are completely immobile in the one-year period.

5.2.3 Basic information on the samples of regional movers, establishment movers and stayers

Table 5.1 contrasts the means of some explanatory variables for the different groups of workers at the two cut-off dates 1999 and 2000 and gives information on the median wage and the number of observations in our sample.[124] For computational reasons, we draw a 10 % random sample of stayers which still contains about 550,000 observations in the years 1999 and 2000. About 280,000 individuals move to a different establishment within the same region, and the number of regional movers (moving to an identical region type) is about 140,000.[125]

Table 5.1: Some Descriptive Evidence on the Characteristics and Numbers of Stayers, Establishment Movers and Regional Movers (1999/2000)

	Stayers		Establishment movers		Regional movers	
	1999	2000	1999	2000	1999	2000
Median wage	90.33	92.88	85.06	89.14	85.66	91.18
Mean establishment size	1,302.18	1,372.19	553.25	430.97	688.53	839.26
Mean experience	21.30	22.29	18.71	19.70	17.37	18.35
Mean high-skilled-share	6.38	6.49	6.43	6.82	6.24	7.37
Mean female-share	24.99	25.08	24.53	24.26	25.63	26.04
Mean market-size	5,861.88	5,865.73	6,230.10	6,306.04	6,191.78	6,307.81
Mean aggregated market size	38,336.71	38,260.33	41,815.52	41,721.80	41,853.46	42,060.96
Number of observations	548,043	548,043	283,995	283,995	138,835	138,835

Source: BEH, own calculations.

122 For the characteristics of the regions we use the classification scheme, which differentiates between four types of the region. That means the regional movers in our sample are those individuals who move – for instance – from metropolitan areas to metropolitan areas in the one year period in the years 1999 and 2000. The definition entails that we drop all individuals who move to a region which is of a different region type. Since we are not interested in the effects of establishment relocations, we additionally drop all observations for individuals moving to a different region together with their firm.

123 This approach of comparing regional movers with non-migratory job movers was originally proposed by Yankow (2003).

124 A description of the variables is given in *Table A5.2* in the Appendix.

125 Please note that the definition of the three groups is based on valid observations for employed workers on both cut-off dates in the one year period 1999 to 2000. Therefore, the sample is balanced in the years 1999 and 2000. Afterwards, however, we abandon this restriction and observe an unbalanced panel in the years 2001 to 2005.

It is evident from *Table 5.1* that the three groups differ in several respects. In 1999, the median wage[126] is 90.33 € for the group of stayers, 85.06 € for prospective establishment movers and 85.66 € for prospective regional movers. This indicates that both, prospective establishment movers and regional movers have a notable wage disadvantage compared to their immobile counterparts. One year later, the median wage of regional movers increases up to 91.18 €, the corresponding values for stayers and establishment movers are 92.88 € and 89.14 €, respectively. Hence, one can conclude that (migratory and non-migratory establishment) mobility results in an improvement of the relative wage position.

Lower median wages before mobility takes place and higher wage growth after a move might be explained by differences in the characteristics. Therefore we take a short look on the means of the explanatory variables. As a consequence of the sample selection, the groups do not differ with respect to gender and skill. Pronounced differences can be observed with respect to age. While mean experience of stayers is 21.30 years in 1999, the corresponding value for establishment movers is 18.71, indicating that the latter are distinctly younger. Regional movers are even less experienced. Turning to the establishment level it is obvious that establishment and regional movers work in smaller firms than stayers do. While an average regional mover changes to a larger firm, the opposite is true for establishment movers. Since wages typically increase with experience (see, for instance, Mincer, 1974) and firm size (see, for instance, Oi and Idson, 1999) these two variables add to explain the negative differential before a move. Further explanatory variables on the firm level are the share of high-skilled workers and the share of female workers. The descriptive evidence suggests that workers move to firms with a higher share of high-skilled workers. With respect to the share of women within a firm, no prominent differences emerge. Further information can be obtained by investigating the variable market size. This variable is computed by counting the number of individuals working in the same region x skill x sector cell in a given year. It turns out that in denser labour markets mobility is more likely to occur and that regional movers change their workplaces into even denser labour markets in the succeeding year. In the year 2000, the mean market-size is 6,307 for regional movers while it is 5,865 for stayers, only. Roughly the same is observable for the variable aggregated market size which neglects the industry differentiation. Since wages are typically higher in denser regions, this might additionally explain a part of the higher wage growth of regional movers.

Altogether, the descriptive evidence suggests that there are important differences between the groups whereas the differences are minor between regional movers

126 More specifically, the data entails daily wages which are calculated as average over the observed employment period for each person.

and establishment movers on the one hand and larger between (migratory and non-migratory) movers and stayers on the other hand.

Since we are interested in the effects of sector affiliation on mobility wage growth premia, further descriptive evidence is presented here. *Table 5.2* considers the numbers of observation for each group within the 15 sectors. In 1999, 5,719 individuals (or 0.59 percent) in our sample are working in the *primary sector*. Thereby, the number of stayers is 3,228, the number of establishment movers is 1,838 and the number of regional movers is 653. The italic letters in the table represents the shares of the specific group within a sector relative to the group in total. It turns out that all three groups are similarly distributed within the *primary sector*. However, since the number of regional movers will be lowered substantially if we conduct several robustness checks (presented below) we exclude this sector from our analysis. Turning to the *energy* sector, it is evident that regional movers (2.84 percent) and (predominantly) establishment movers (4.61 percent) are clearly over-represented compared with a share of 1.82 percent for the group of stayers. Furthermore, an over-representation of regional movers can be observed in the following sectors: *mining, trade, transport & communication, business services* and *household services*. Contrarily, regional movers are under-represented in the sectors: *raw materials, production of investment goods, production of consumption goods, public services* and *public corporations*. For establishment movers a distinctly higher than the average share can be observed for *construction 2, transport & communication* and *business services* whereas the opposite is true for *mining, raw materials, production of consumption goods, public services* and *public corporations*. Altogether, this makes clear that the three groups are not evenly distributed over the 15 sectors.

Table 5.2: Numbers of Stayers, Establishment Movers and Regional Movers by Sector Affiliation (1999)

Sector	Stayers	Establishment movers	Regional movers	Total
Primary sector	3,228	1,838	653	5,719
	0.59	*0.65*	*0.47*	*0.59*
Energy	9,963	13,080	3,938	26,981
	1.82	*4.61*	*2.84*	*2.78*
Mining	3,827	1,110	3,725	8,662
	0.70	*0.39*	*2.68*	*0.89*
Raw materials	45,275	17,179	6,029	68,483
	8.26	*6.05*	*4.34*	*7.05*
Production of investment goods	149,163	72,504	26,738	248,405
	27.22	*25.53*	*19.26*	*25.59*

Table 5.2 (continued):				
Production of consumption goods	44,231 *8.07*	19,237 *6.77*	6,153 *4.43*	69,621 *7.17*
Food, beverages, tobacco (Genussmittel)	15,276 *2.79*	6,299 *2.22*	2,955 *2.13*	24,530 *2.53*
Construction 1 (Bauhauptgewerbe)	28,452 *5.19*	14,825 *5.22*	6,929 *4.99*	50,206 *5.17*
Construction 2 (Ausbaugewerbe)	24,718 *4.51*	15,606 *5.50*	6,065 *4.37*	46,389 *4.78*
Trade	66,181 *12.08*	38,303 *13.49*	27,215 *19.60*	131,699 *13.57*
Transport & communication	30,674 *5.60*	20,548 *7.24*	13,168 *9.48*	64,390 *6.63*
Business services	52,397 *9.56*	38,093 *13.41*	23,828 *17.16*	114,318 *11.77*
Household services	9,524 *1.74*	5,085 *1.79*	3,086 *2.22*	17,695 *1.82*
Public services	34,263 *6.25*	11,575 *4.08*	4,910 *3.54*	50,748 *5.23*
Public corporations	30,871 *5.63*	8,713 *3.07*	3,443 *2.48*	43,027 *4.43*
Total	548,043 *100.00*	283,995 *100.00*	138,835 *100.00*	970,873 *100.00*

Source: BEH, own calculations.

More specific information on the differences between sectors and the sector-specific differences between the three groups of workers can be obtained from *Table 5.3*.[127] Since the pioneering work of Krueger and Summers (1988) inter-industry wage differentials are an established fact in the literature.

According to Abowd et al. (1999, p. 251) the bulk of this differential can be explained by individual-specific differences. Though the probably most important wage-affecting person-specific differences (skill and gender) are eliminated yet by the selection of our sample, we still observe large differences of median wages

127 Besides the exclusion of the primary sector, we additionally drop the mining sector. This is essential because it turns out that due to the locational concentration of this sector in specific areas, regional movers predominantly stay in a labour market area. In a robustness check (presented below for the remaining 13 sectors) we exclude all regional movers with a distance of less than 1 hour driving time between the old and the new workplace. This restriction lowers the number of movers from 3,715 individuals to a number of 159 individuals!

between the industries.[128] The highest median wage (documented for stayers since this group is fairly representative for the corresponding sector) in 1999 is 109.80 € in the *business services* sector, the lowest value (77.50 €) can be observed for the sector *construction 2*. These two sectors differ in several respects. Establishments in *business services* (for instance, bank and assurance companies)[129] are typically much larger than those in *construction 2* (for instance, plumbing firms and electric installation firms). Moreover, the first employ a higher share of high-skilled individuals (10.28 percent compared to 1.31 percent), they are located in more agglomerated areas (the mean aggregated market size is 54,168 compared to 35,662) and their employees are more experienced (21.17 years compared to 18.65 years).

Besides the large differences between sectors, prominent differentials between regional movers, establishment movers and stayers emerge within sectors. For instance, the negative (median) wage differential of (prospective) regional movers relative to stayers being observed for the aggregate sample in 1999 (see *Table 5.1*), turns out to be a composition of industry-specific wage differentials. While the differential is relatively high in *household services* (median wage for regional movers is 71.66 € compared to 86.64 € for stayers), (prospective) regional movers earn even more than stayers in the sectors *energy* and *construction 1*. Considering the means of the explanatory variables on a more disaggregated level, one observes that the stylized facts presented for the aggregate sample are not universally valid within the sectors. For instance, contrary to the observation that regional movers change their workplaces to larger establishments, the mean establishment size decreases in the sector *raw materials*. Further examples can be found for most of the other variables. All this suggests that valuable insights can be gained by analyzing the mobility wage premia separately for sectors.

128 However, Abowd et al. (1999) point to the fact that unobservable ability is even more important. This argumentation follows Murphy and Topel (1987, 1990) who state that sorting of worker into industries by unobserved ability can be seen as primary explanation for industry wage differentials. However, other empirical studies (see Blackburn and Neumark, 1992 or Gibbons and Katz, 1992) contradict this. From a theoretical point of view, inter-industry wage differentials are consistent with efficiency wage models (Katz, 1986 or Dickens and Katz, 1987). This relationship is analyzed, by depth, empirically (see Chen and Edin, 2002 for an overview). Other explanation for inter-industry wage differentials are industry-specific differences with regard to compensating wage differentials, rent sharing, market competitiveness or union bargaining power (for an exploration see, for instance, Kahn, 1998, Groshen, 1991, Dorman and Hagstrom, 1998). However, it is clearly beyond the scope of this paper to explore the inter-industry wage differential.

129 However, ***business services*** is very heterogeneous. Besides financial services, assurance services or consulting it includes also low-wage sectors like the temporary work sector or security services.

Table 5.3: Sector-Specific Differences in Characteristics of Stayers, Establishment Movers and Regional Movers (1999/2000)

	Stayer		Establishment movers		Regional movers	
	1999	2000	1999	2000	1999	2000
	Energy					
Median Wage	108.12	110.84	114.35	123.43	117.90	121.41
Mean Establishment Size	851.36	836.07	785.52	519.87	396.52	592.38
Mean Experience	22.64	23.64	21.32	22.32	20.81	21.80
Mean High-skilled-Share	8.57	8.61	8.44	7.64	8.77	11.60
Mean Female-Share	16.03	16.18	12.99	12.26	12.32	14.90
Mean Market-Size	1,111.05	1,119.58	1,155.47	2,249.15	833.87	1,969.49
Mean aggregated Market Size	43,452.07	43,333.13	36,164.71	35,983.87	30,639.40	36,405.84
	Raw materials					
Median Wage	95.26	98.24	89.31	93.61	89.03	91.66
Mean Establishment Size	3,547.21	3,511.68	1,383.84	545.30	1,966.92	1,293.35
Mean Experience	21.23	22.23	19.36	20.35	18.58	19.56
Mean High-skilled-Share	7.07	7.23	8.76	8.61	6.49	7.65
Mean Female-Share	15.01	15.05	16.97	17.47	15.82	19.66
Mean Market-Size	4,750.10	4,758.21	3,548.03	4,754.99	4,015.97	5,386.52
Mean aggregated Market Size	33,650.97	33,603.29	39,437.90	39,377.75	34,624.14	36,603.04
	Production of investment goods					
Median Wage	95.82	99.24	90.64	94.98	93.52	98.66
Mean Establishment Size	2,775.17	3,033.30	997.38	697.91	1,867.93	2,050.90
Mean Experience	20.94	21.94	19.30	20.29	17.54	18.51
Mean High-skilled-Share	8.00	8.08	9.69	9.78	9.48	9.93
Mean Female-Share	16.66	16.64	17.70	18.28	16.89	19.00
Mean Market-Size	10,315.92	10,303.32	10,597.45	9,035.00	11,405.58	8,792.15
Mean aggregated Market Size	35,578.93	35,523.15	37,536.76	37,482.66	42,437.84	40,236.86
	Consumption goods					
Median Wage	85.41	87.76	78.72	82.05	79.52	85.13
Mean Establishment Size	314.22	317.69	212.68	246.61	176.86	360.21
Mean Experience	20.82	21.82	18.11	19.10	15.74	16.73
Mean High-skilled-Share	3.10	3.16	2.66	3.82	2.93	4.49
Mean Female-Share	23.48	23.54	23.73	23.51	25.03	25.36
Mean Market-Size	2,610.34	2,611.42	2,776.33	3,419.55	2,202.58	3,693.59
Mean aggregated Market Size	27,774.85	27,728.72	29,689.39	29,646.50	28,028.41	30,041.05
	Food, beverages, tobacco					
Median Wage	82.92	85.05	74.07	77.05	76.07	79.26
Mean Establishment Size	271.28	273.43	231.07	247.09	165.90	231.52
Mean Experience	21.00	22.00	18.05	19.05	16.49	17.47
Mean High-skilled-Share	2.74	2.80	2.42	2.89	1.95	3.11
Mean Female-Share	35.32	35.44	38.83	35.67	39.24	35.63
Mean Market-Size	921.15	945.49	995.95	2,175.06	786.84	3,131.56
Mean aggregated Market Size	30,800.14	30,743.29	29,256.64	29,218.79	29,684.48	32,843.09

Table 5.3 (continued):

	Stayers		Establishment movers		Regional movers	
	1999	2000	1999	2000	1999	2000
	Construction 1					
Median Wage	83.74	84.66	80.89	81.62	85.17	85.19
Mean Establishment Size	106.37	103.89	85.08	118.59	165.59	251.58
Mean Experience	21.30	22.30	17.79	18.78	18.52	19.50
Mean High-skilled-Share	3.38	3.51	3.42	3.82	6.38	6.28
Mean Female-Share	7.65	7.90	8.19	11.25	8.34	11.78
Mean Market-Size	1,708.01	1,681.93	1,831.93	2,630.26	1,909.14	3,391.69
Mean aggregated Market Size	31,436.75	31,379.99	34,066.29	34,024.59	41,446.45	39,987.73
	Construction 2					
Median Wage	77.50	78.70	72.98	75.66	73.65	78.12
Mean Establishment Size	40.46	40.80	28.29	177.73	43.10	288.45
Mean Experience	18.65	19.65	14.90	15.89	14.42	15.39
Mean High-skilled-Share	1.31	1.36	1.29	2.76	1.85	3.94
Mean Female-Share	12.47	12.66	12.13	15.92	12.14	17.02
Mean Market-Size	1,648.14	1,622.62	1,706.86	3,209.42	1,526.18	3,925.36
Mean aggregated Market Size	35,662.43	35,597.77	36,818.17	36,747.30	33,530.11	35,863.48
	Trade					
Median Wage	84.79	87.39	78.33	83.23	84.10	91.00
Mean Establishment Size	170.75	171.07	178.40	217.18	165.68	352.50
Mean Experience	20.96	21.96	18.20	19.19	17.15	18.12
Mean High-skilled-Share	3.19	3.22	2.92	3.77	3.61	5.02
Mean Female-Share	32.38	32.48	33.37	30.00	33.85	31.76
Mean Market-Size	5,940.82	5,893.85	6,323.80	6,601.44	6,181.85	6,552.22
Mean aggregated Market Size	41,339.28	41,243.75	44,186.68	44,094.32	42,255.47	42,641.46
	Transport & communication					
Median Wage	85.39	86.82	83.82	87.83	79.95	84.45
Mean Establishment Size	791.38	814.88	415.94	346.76	346.00	374.55
Mean Experience	21.58	22.58	19.70	20.69	18.11	19.08
Mean High-skilled-Share	2.04	2.10	2.13	2.97	1.83	4.50
Mean Female-Share	19.10	19.33	18.27	19.01	21.40	22.53
Mean Market-Size	4,796.29	4,819.63	4,364.01	5,378.29	3,692.61	5,239.97
Mean aggregated Market Size	50,538.27	50,454.22	48,140.61	47,974.86	44,109.84	47,939.17
	Business services					
Median Wage	109.80	113.95	94.92	102.97	93.96	105.15
Mean Establishment Size	490.52	500.14	437.67	474.99	349.92	540.60
Mean Experience	21.17	22.17	17.91	18.91	16.93	17.91
Mean High-skilled-Share	10.28	10.44	9.10	9.43	9.99	10.71
Mean Female-Share	37.52	37.71	35.95	34.86	33.80	32.54
Mean Market-Size	9,752.28	9,881.69	10,779.43	10,424.69	9,835.09	9,292.95
Mean aggregated Market Size	54,168.91	54,058.33	59,008.57	58,860.53	53,262.61	51,174.23

Table 5.3 (continued):

	Household services					
Median Wage	86.64	89.23	68.45	74.35	71.66	78.81
Mean Establishment Size	347.31	351.30	117.23	174.24	125.32	220.97
Mean Experience	21.81	22.81	16.96	17.94	14.37	15.35
Mean High-skilled-Share	6.52	6.59	3.64	4.33	3.66	4.64
Mean Female-Share	46.98	47.29	49.13	46.71	47.19	45.83
Mean Market-Size	1,872.89	1,865.18	1,955.64	3,963.70	1,515.61	3,650.19
Mean aggregated Market Size	54,818.95	54,661.44	56,167.21	56,002.05	49,033.13	51,781.01
	Public services					
Median Wage	90.18	92.49	83.82	87.19	81.98	87.08
Mean Establishment Size	619.02	618.09	420.96	479.10	355.03	384.20
Mean Experience	22.90	23.90	20.20	21.19	17.18	18.14
Mean High-skilled-Share	13.15	13.37	10.28	9.92	10.57	9.62
Mean Female-Share	51.91	52.03	49.21	47.06	50.60	45.81
Mean Market-Size	2,646.26	2,663.96	3,032.74	3,766.41	2,478.75	3,384.19
Mean aggregated Market Size	39,276.05	39,168.66	44,056.59	43,923.71	38,020.71	37,760.16
	Public corporations					
Median Wage	86.97	88.89	85.36	88.77	85.76	90.60
Mean Establishment Size	484.43	476.95	474.09	334.02	260.84	330.64
Mean Experience	24.58	25.58	22.00	23.00	18.90	19.88
Mean High-skilled-Share	7.66	7.86	8.42	8.15	5.88	6.59
Mean Female-Share	41.30	41.46	38.69	36.34	41.71	40.89
Mean Market-Size	1,873.18	1,887.32	2,157.36	2,842.86	1,765.77	2,635.69
Mean aggregated Market Size	34,443.31	34,349.98	40,239.71	40,162.29	32,555.29	34,787.08

Source: BEH, own calculations.

5.3 Econometric estimates

5.3.1 Outline of the estimation approach

In order to do so, we estimate fixed effects wage equations separately for each sector. This approach reveals the wage growth differentials between specific groups of workers and is most compelling for our analysis since it controls for the time-invariant part of unobserved heterogeneity. The estimated fixed effects wage equation can be formulated as

$$\ln w_{it} = X_{it}\beta + P_{it}\gamma_t + \nu_i + \varepsilon_{it} \qquad (5.1)$$

where $\ln w_{it}$[130] stands for the logarithm of gross daily earnings for person i in period t and X_{it} is a vector of individual and establishment level control variables. Specifically, we include tenure (also squared and dummy for high tenure), establishment size, market size and aggregated market size controls as well as the share of high-skilled and female workers within an establishment.[131] The vector P_{it} entails dummies capturing the interaction effects of type of mobility and time. Hence, the parameter vector γ_t represents the time-varying returns to the different types of migration up to the year 2005. The error term is split into the individual-specific time invariant component v_i which may be correlated with X_{it} and P_{it}, and the random component ε_{it}.

This fixed effects wage equation is estimated separately for each of the remaining thirteen sectors. As described above (see subsection 5.2.2) we are primarily interested in the additional effect of regional mobility compared to non-migratory job mobility. Nevertheless, we also depict the effects of regional mobility and job mobility in relation to an absolutely immobile reference group. Thus the results presented in the next subsection comprise a total of 13 x 3 = 39 regressions.

This analysis answers the question whether short- and long-term effects of job mobility and regional mobility differ between sectors. Anticipating one of the main results we actually find that the extra return to migration – which is measured as wage growth differential of regional movers over establishment movers – substantially differs across sectors. Several explanations for varying wage growth differentials between sectors can be supposed. Firstly, human capital accumulation may lead to increasing wages over time; the importance of this accumulation effect might presumably be different across sectors. Secondly, the likelihood of a good match between employer and employee might differ as well. Thirdly, one could argue that several types of mobility are highly correlated with each other. If individuals who change employers and regions, systematically move from low-wage sectors to high-wage sectors and the reference group of establishment movers does not, then the extra return to migration might be (at least partly) due to sector mobility. Fourthly, economic activities are not evenly distributed over regions; therefore, one can suppose that regional mobility is related to long-distance moves in some sectors and short-distance moves in others. Due to higher

130 In the case of censoring, wages are imputed on the basis of Tobit estimates. The explanatory variables capture linear and quadratic terms of potential work experience, share of high-skilled workers, share of female workers, log establishment size as well as industry and regional dummies. Additionally, we add an error term drawn from a truncated normal distribution (with a standard deviation equal to the estimated residual standard deviation from the Tobit regression) to the predicted values. The results of these Tobit estimates are available from the authors on request.

131 The explanatory variables are described in *Table A5.2* in the Appendix.

costs of migration for long-distance movers, outcomes should also be higher.[132] Fifthly, age-specific differences between and within sectors may play a role since one can find higher returns to migration for young persons.

In a second stage of analysis we try to figure out which of these hypotheses contributes to explain at least a fraction of sector-specific differences. Besides this, from investigating sources of heterogeneity we could hopefully learn something about the "nature" of the additional effect of regional migration. Since hypotheses 1 and 2 are discussed in depth in the literature, we concentrate here on the latter three.

Specifically, the first check excludes all individuals who change the sector from the first to the second year of the observation period. Repeating the estimates, it gives evidence whether the extra return is influenced by sector mobility itself. The second check excludes commuters in order to check how our results are driven by this group. High shares of long-distance movers together with large wage growth rates for long-distance movers in specific sectors would contribute to explain the heterogeneity across sectors. The last check considers young workers. Following the same rationale as for long-distance movers, the sample is restricted here to all individuals with a potential work experience of less than ten years.

5.3.2 Estimation results

Both, short-term and long-term effects of changing the job and changing the region are contained in *Table 5.4*. It is evident, that the effects are quite heterogeneous. The short-term wage growth differential for (non-migratory) job movers relative to stayers ranges from 2.60 percent in *public corporations* to 7.98 percent in *business services.* In succeeding years, for most sectors one can observe that the wage growth differential remains almost constant or decreases. The major exception is the *household services* sector where the long-term wage growth differential slightly increases up to 6.58 percent. One should note, however, that in this sector the negative pre-move wage differential was – by far – highest (see *Table 5.3*).

132 In the preceding chapter we demonstrate that gains of regional mobility increase with distance (especially for young workers).

Table 5.4: Estimated Dummy-Indicators of the Fixed Effect Estimates: Short-Term and Long-Term Wage Growth Differentials by Sector Affiliation

	year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
		Energy		Raw materials		Production of investment goods		Consumption goods		Food, beverages and tobacco		Construction 1		Construction 2	
Dummy-indicator: wage effect of establishment movers relative to stayers	2000	**6.97**	28.14	**5.64**	41.68	**5.13**	69.27	**5.65**	43.44	**4.85**	21.54	**3.22**	22.11	**4.50**	30.13
	2001	**5.24**	22.96	**4.32**	34.31	**4.63**	68.21	**4.05**	33.73	**4.14**	19.80	**1.46**	10.57	**3.09**	22.03
	2002	**5.56**	24.69	**4.25**	33.65	**4.06**	59.76	**3.93**	32.43	**3.89**	18.58	**1.40**	9.96	**3.34**	23.56
	2003	**2.31**	10.25	**4.65**	36.48	**3.67**	53.82	**3.75**	30.52	**3.02**	14.38	**1.11**	7.85	**3.45**	24.20
	2004	**2.10**	9.28	**4.60**	35.60	**3.36**	48.62	**3.50**	28.06	**2.93**	13.70	**1.41**	9.73	**3.86**	26.65
	2005	**3.62**	15.73	**3.81**	29.14	**2.98**	42.47	**3.64**	28.61	**3.50**	15.99	**2.15**	14.46	**4.60**	30.98
Dummy-indicator: wage effect of regional movers relative to stayers	2000	**1.98**	6.61	**2.55**	13.31	**4.97**	49.05	**6.61**	34.95	**5.50**	19.01	**3.53**	18.73	**5.85**	29.11
	2001	**3.41**	11.96	**2.72**	14.80	**5.60**	58.78	**6.67**	37.08	**4.86**	17.80	**1.76**	9.68	**4.66**	24.24
	2002	**2.70**	9.36	**3.81**	20.16	**5.62**	58.32	**7.08**	38.62	**5.39**	19.55	**2.33**	12.49	**5.77**	29.60
	2003	**0.54**	1.86	**3.81**	19.96	**6.07**	62.78	**6.94**	37.43	**4.64**	16.75	**1.49**	7.87	**6.11**	31.18
	2004	**1.09**	3.76	**3.53**	18.27	**5.71**	58.32	**7.02**	37.33	**5.01**	17.77	**2.30**	11.85	**6.78**	34.13
	2005	**2.91**	9.81	**2.91**	14.83	**5.83**	58.64	**7.73**	40.36	**5.12**	17.77	**2.94**	14.84	**7.60**	37.44
Dummy-indicator: wage effect of regional movers relative to establishment movers	2000	**−1.17**	−3.74	**−2.91**	−12.21	−0.08	−0.69	**0.96**	4.28	0.25	0.71	0.14	0.65	**1.35**	5.95
	2001	−0.07	−0.21	**−1.72**	−7.02	**1.02**	8.63	**2.50**	10.82	**0.78**	2.18	0.18	0.78	**1.59**	6.78
	2002	**−1.27**	−3.92	**−0.50**	−1.97	**1.63**	13.58	**3.01**	12.75	**1.57**	4.30	**0.87**	3.65	**2.43**	10.19
	2003	**−1.18**	−3.65	**−0.80**	−3.12	**2.31**	19.06	**3.06**	12.79	**1.48**	4.00	0.32	1.31	**2.49**	10.27
	2004	−0.01	−0.03	**−0.90**	−3.46	**2.34**	19.10	**3.39**	14.02	**1.99**	5.34	**0.85**	3.44	**2.77**	11.27
	2005	0.54	1.62	**−0.74**	−2.84	**2.87**	23.14	**3.91**	15.90	**1.56**	4.10	**0.76**	3.03	**2.84**	11.37

Table 5.4 (continued):

	year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
		Trade		Transport & communication		Business services		Household services		Public services		Public corporations	
Dummy-indicator: wage effect of establishment movers relative to stayers	2000	**5.11**	46.47	**4.41**	32.28	**7.98**	59.43	**5.65**	17.92	**3.92**	28.27	**2.60**	21.82
	2001	**5.08**	49.08	**4.59**	36.08	**8.46**	67.77	**6.51**	21.91	**4.32**	34.05	**3.66**	33.58
	2002	**5.31**	50.93	**4.51**	35.38	**8.61**	68.27	**7.03**	23.15	**4.00**	31.10	**3.56**	32.48
	2003	**4.96**	46.89	**4.79**	36.84	**7.68**	59.89	**6.31**	20.64	**3.60**	27.58	**3.35**	30.23
	2004	**5.04**	46.87	**4.65**	35.13	**7.86**	60.18	**6.54**	20.86	**3.29**	24.75	**3.04**	27.02
	2005	**5.06**	46.12	**4.94**	36.57	**8.05**	60.22	**6.58**	20.08	**3.17**	23.31	**2.65**	23.17
Dummy-indicator: wage effect of regional movers relative to stayers	2000	**6.11**	48.94	**4.91**	31.58	**9.25**	59.25	**6.67**	17.93	**5.68**	30.64	**3.09**	19.21
	2001	**6.66**	56.88	**5.44**	37.26	**10.20**	70.07	**9.00**	25.71	**6.69**	38.09	**4.58**	30.01
	2002	**7.16**	60.37	**6.08**	41.18	**10.30**	69.63	**10.38**	28.95	**7.24**	40.58	**5.59**	36.21
	2003	**7.48**	62.11	**6.60**	43.39	**9.99**	66.32	**10.39**	28.56	**6.44**	35.57	**5.66**	36.22
	2004	**7.95**	64.96	**6.78**	43.75	**10.09**	65.71	**11.07**	29.81	**6.62**	35.89	**5.12**	32.40
	2005	**7.71**	61.74	**7.30**	46.13	**9.96**	63.39	**11.64**	30.26	**6.81**	36.23	**5.51**	34.42
Dummy-indicator: wage effect of regional movers relative to establishment movers	2000	**0.75**	5.47	0.12	0.72	**1.00**	6.37	0.44	1.02	**0.99**	4.03	0.32	1.46
	2001	**1.39**	9.85	**0.64**	3.69	**1.52**	9.39	**2.09**	4.66	**2.07**	8.12	**0.86**	3.78
	2002	**1.66**	11.59	**1.36**	7.73	**1.47**	8.92	**2.98**	6.49	**3.02**	11.61	**2.00**	8.66
	2003	**2.35**	16.12	**1.65**	9.10	**2.11**	12.56	**3.82**	8.13	**2.63**	9.98	**2.23**	9.57
	2004	**2.74**	18.54	**1.95**	10.62	**2.02**	11.85	**4.28**	8.98	**3.15**	11.76	**2.03**	8.61
	2005	**2.49**	16.60	**2.25**	12.05	**1.69**	9.74	**4.89**	9.94	**3.47**	12.75	**2.82**	11.82

Notes: All coefficients are multiplied by 100. Estimated coefficients significant at least at the 5 percent level are in bold.
Source: BEH, own calculations.

Comparing the wage growth of regional movers and stayers in the short run, it turns out that the differential varies between 1.98 percent in the *energy* sector and 9.25 percent in *business services*. Thus, as for non-migratory establishment movers we observe positive returns in the first year, which are roughly at the same range. Contrary to the results for establishment movers, the long-term effect increases in 11 of 13 sectors (exceptions are *food, beverages & tobacco* and *construction 1)*. One can already conclude that the long-term wage growth effect after mobility is much more pronounced if the mobility corresponds to a change of region rather than to a local change of job.

This becomes especially clear by comparing the wage growth paths of regional movers and establishment movers directly. The approach is more compelling since it eliminates a fraction of heterogeneity between the groups.[133] In the first year after a move, the wage growth differential lies between –2.91 percent (*raw materials*) and +1.35 percent (*construction 2*). On an aggregate level, however, this effect is close to zero (see *Figure A5.1* in the Appendix). Hence, we are able to show that mobility effects differ on the sector level substantially. In the short run, a migratory change of establishment also pays in *consumption goods, trade, business services* and *public services.* In other sectors (*production of investment goods, food, beverages & tobacco, construction 1, transport & communication, household services* and *public corporations*) the short-term returns for regional movers and establishment movers are exactly the same. And in further sectors (*energy* and *raw materials*) individuals on average benefit more from non-migratory changes of establishment.

Turning to the long run, we observe a substantial wage growth effect in all sectors, resulting in statistically significant and positive long-term wage growth differentials in 11 of 13 sectors. The two exceptions are *raw materials* with a long-term differential of –0.74 percent and *energy* where the effect becomes insignificant over time. On the opposite, the long-term wage growth differential is most pronounced in *household services* (4.89 percent) and *consumption goods* (3.91 percent).

Check 1: the role of sector mobility

A comparison of *Figures A5.1* and *A5.2* in the Appendix shows for the aggregate samples of both, establishment and regional movers decreased wage growth

133 For instance, tenure is zero in the second year of the observation period for both, regional movers and establishment movers.

differentials compared with stayers after excluding sector movers.[134] This corroborates the theoretical expectation that positive outcomes of movers are affected by changes from low-wage to high-wage sectors. The base line indicates, however, that the additional effect of regional mobility compared to establishment mobility remains almost unaffected. Since the aggregate result is likely to be a mix of differing effects on a sector level, we investigate wage growth differentials more deeply on the sector level. Then, we look into the data to find out whether persons systematically leave low-wage sectors and whether there are differences between regional movers and establishment movers or not.

Starting with the wage growth differentials between regional movers and stayers, *Table 5.5* shows decreased values in eleven of thirteen sectors (exceptions are *energy* and *production of investment goods*). Similar results are obtained for the wage growth differentials of establishment movers versus stayers. The values decrease in ten sectors; the remaining three sectors are *energy, raw materials* and *production of investment goods*. At first glance, one might argue that the exclusion of sector movers affects both groups, regional and establishment movers in exact the same way. Hence, sector mobility should not contribute to explain differing extra returns to mobility on the sector level. However, *Table A5.3* of the Appendix demonstrates that the restriction excludes more than 40 percent of regional movers, but only 34 percent of establishment movers. Hence, sector mobility is more related to a migratory job change than to a local job change and further analyses seem appropriate.

134 Please note again, that we exclude sector movers from the first to the second year of the observation period only. In succeeding years, we continue to observe an unbalanced panel without further selections.

Table 5.5: Estimated Dummy-Indicators of the Fixed Effect Estimates: Short-Term and Long-Term Wage Growth Differentials by Sector Affiliation Excluding All Individuals Changing the Sector between 1999/2000

	year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
		Energy		Raw materials		Production of investment goods		Consumption goods		Food, beverages and tobacco		Construction 1		Construction 2	
Dummy-indicator: wage effect of establishment movers relative to stayers	2000	**8.12**	30.57	**6.14**	38.87	**5.67**	70.32	**5.41**	36.70	**4.67**	18.19	**4.21**	25.77	**3.98**	23.81
	2001	**5.81**	23.77	**3.37**	22.57	**4.62**	62.67	**3.08**	22.27	**3.74**	15.59	**1.52**	9.76	**2.15**	13.75
	2002	**6.92**	28.73	**3.17**	21.08	**3.83**	51.68	**2.54**	18.05	**3.21**	13.32	**1.31**	8.25	**1.86**	11.65
	2003	**3.06**	12.64	**4.08**	26.87	**3.50**	46.92	**2.13**	14.91	**2.63**	10.79	**0.57**	3.55	**1.48**	9.20
	2004	**3.26**	13.45	**4.59**	29.84	**3.24**	42.81	**1.59**	11.00	**2.35**	9.45	**0.57**	3.47	**1.42**	8.65
	2005	**5.32**	21.60	**3.63**	23.33	**2.78**	36.15	**1.47**	9.98	**2.55**	10.06	**0.75**	4.40	**1.51**	8.97
Dummy-indicator: wage effect of regional movers relative to stayers	2000	**3.18**	9.93	−0.18	−0.65	**5.79**	47.47	**7.08**	27.89	**4.65**	12.78	**5.10**	23.22	**5.27**	20.77
	2001	**4.47**	14.55	**−0.82**	−3.10	**5.81**	49.92	**5.55**	22.15	**2.99**	8.51	**2.29**	10.60	**3.48**	13.92
	2002	**4.33**	13.85	**0.97**	3.47	**5.67**	48.20	**5.58**	21.74	**3.28**	9.13	**2.26**	10.12	**3.43**	13.45
	2003	**1.67**	5.33	**1.06**	3.76	**6.04**	50.96	**4.96**	19.11	**2.50**	6.86	**1.24**	5.43	**3.21**	12.32
	2004	**1.80**	5.69	**1.36**	4.75	**5.79**	48.30	**4.85**	18.40	**2.36**	6.36	**1.78**	7.61	**2.71**	10.24
	2005	**4.35**	13.48	**0.62**	2.13	**5.82**	47.93	**4.65**	17.35	**2.08**	5.49	**1.95**	8.15	**2.86**	10.49
Dummy-indicator: wage effect of regional movers relative to establishment movers	2000	**−1.06**	−2.92	**−5.18**	−15.34	0.05	0.35	**1.34**	4.36	−0.63	−1.39	**0.87**	3.15	**1.12**	3.77
	2001	0.11	0.31	**−3.89**	−11.20	**1.05**	7.20	**2.19**	6.90	−0.56	−1.21	**0.83**	2.90	**1.20**	3.85
	2002	**−1.15**	−3.06	**−1.79**	−4.93	**1.76**	11.91	**2.78**	8.55	0.30	0.63	**1.06**	3.58	**1.46**	4.60
	2003	−0.63	−1.68	**−2.63**	−7.16	**2.37**	15.88	**2.71**	8.23	−0.08	−0.16	**0.66**	2.18	**1.62**	4.98
	2004	−0.27	−0.71	**−2.37**	−6.34	**2.50**	16.59	**3.16**	9.47	0.17	0.36	**1.19**	3.81	**1.21**	3.68
	2005	0.68	1.76	**−2.48**	−6.59	**3.05**	20.00	**3.03**	8.91	−0.34	−0.68	**1.18**	3.72	**1.24**	3.67

Table 5.5 (continued):

	year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
		Trade		Transport & communication		Business services		Household services		Public services		Public corporations	
Dummy-indicator: wage effect of establishment movers relative to stayers	2000	**4.57**	35.86	**3.15**	21.02	**5.79**	38.51	**4.16**	11.77	**3.08**	20.33	**1.62**	12.59
	2001	**4.44**	36.76	**3.35**	23.85	**7.10**	50.29	**4.84**	14.47	**3.36**	23.80	**2.50**	20.78
	2002	**4.21**	34.46	**3.14**	22.30	**7.65**	53.72	**5.28**	15.39	**2.83**	19.71	**2.47**	20.32
	2003	**3.96**	32.04	**3.45**	23.87	**6.82**	47.18	**4.32**	12.39	**2.27**	15.58	**2.21**	17.97
	2004	**3.88**	30.78	**3.31**	22.52	**7.52**	51.18	**4.42**	12.35	**1.86**	12.57	**1.66**	13.30
	2005	**3.78**	29.37	**3.60**	24.01	**7.92**	52.83	**4.72**	12.52	**1.41**	9.32	**1.37**	10.85
Dummy-indicator: wage effect of regional movers relative to stayers	2000	**5.88**	40.79	**3.35**	19.89	**5.58**	31.46	**4.83**	11.42	**4.07**	19.24	**2.60**	15.17
	2001	**6.19**	45.08	**3.93**	24.62	**7.36**	43.73	**7.42**	18.43	**4.31**	21.06	**3.62**	22.11
	2002	**6.28**	45.08	**4.35**	26.92	**7.81**	45.76	**8.55**	20.64	**4.79**	23.00	**4.78**	28.89
	2003	**6.56**	46.32	**4.92**	29.33	**7.83**	45.03	**8.87**	20.93	**4.04**	19.09	**4.87**	29.05
	2004	**7.00**	48.66	**5.13**	30.01	**8.36**	47.22	**9.88**	22.89	**4.08**	18.90	**4.18**	24.64
	2005	**6.57**	44.85	**5.56**	31.78	**8.39**	46.47	**10.93**	24.40	**4.05**	18.39	**4.60**	26.84
Dummy-indicator: wage effect of regional movers relative to establishment movers	2000	**0.97**	5.56	−0.10	−0.50	−0.31	−1.60	0.28	0.53	0.27	0.95	**0.84**	3.89
	2001	**1.54**	8.61	**0.39**	1.96	0.20	0.99	**2.21**	3.95	**0.61**	2.10	**1.05**	4.77
	2002	**1.87**	10.24	**1.03**	5.06	0.08	0.40	**2.88**	4.99	**1.69**	5.73	**2.26**	10.16
	2003	**2.40**	12.91	**1.29**	6.11	**0.95**	4.56	**4.19**	7.12	**1.51**	5.01	**2.54**	11.28
	2004	**2.91**	15.44	**1.64**	7.66	**0.77**	3.63	**5.11**	8.52	**1.97**	6.43	**2.44**	10.71
	2005	**2.60**	13.58	**1.83**	8.38	0.38	1.79	**5.95**	9.56	**2.42**	7.78	**3.15**	13.71

Notes: All coefficients are multiplied by 100. Estimated coefficients significant at least at the 5 percent level are in bold.
Source: BEH, own calculations.

Observing the sample of regional movers, a relatively high number of sector movers are employed in *raw materials*, *construction 2* and *consumption goods* in the first year. Reconsidering *Table 5.3* reveals that *construction 2* and *consumption goods* are sectors where wages are relatively low. By contrast, this is not true for *raw materials*. Hence, one can not conclude that sector mobility is related to changes from low-wage sectors to high-wage sectors, only. This is corroborated by the observation that the share of sector movers is also relatively low in the low-wage sector *household services*. For establishment movers the restriction predominantly affects the same sectors, but the share of remaining persons is generally much higher than in the regional movers sample.[135]

Considering the extra return to regional mobility directly, a significant decrease is obtained in *raw materials, food, beverages & tobacco, construction 2, business services* and *public services*. For *food, beverages & tobacco* and *business services* the extra return even becomes statistically insignificant. This indicates that sector movers are completely responsible for the extra return in both sectors. Sector mobility is also of crucial importance in *construction 2* where wages are below average and the share of sector movers is high. Though the share of sector movers is relatively low in *public services*, this group contributes to explain the premium. However, the contribution is lower than in the former three sectors. The results for *raw materials* suggest that regional movers who change the sector have higher wage growths effects than those who remain within the sector. Since the extra return was negative before, however, one can not conclude that sector mobility explains the extra effect of regional mobility.

For some of the remaining sectors, we even observe increasing extra returns after excluding sector movers. This is especially true for *household services*, where the extra return was largest (see *Table 5.4*).

To sum up, we find that sector mobility plays a crucial role for the explanation of the mobility wage growth premium in three of thirteen sectors and a minor important role in *public services*. Since the explanation content is not evident in other sectors we proceed with investigating the role of distance.

Check 2: the role of long-distance migration

From theoretical expectations one can suspect that the extra return increases if one restricts the sample to long-distance movers. *Figure A5.3* in the Appendix gives evidence that this is true for the aggregate. On a more disaggregated sector

135 An exception is *public corporations*. Here, the sector mobility is more pronounced in the group of establishment movers. Presumably, individuals who are not willing to migrate after being posted from the employer prefer to change the sector in order to find a job in the local labour market.

level, one can suspect that both, the relevance and the effects of long-distance migration differ.

Our analysis clearly corroborates this guess. *Table 5.6* shows that the additional effect for long-distance movers has increased considerably in nine sectors (*energy*, *raw materials*, *consumption goods*, *food*, *beverages & tobacco*, *construction 2*, *transport & communication*, *household services*, *public services* and *public corporations*) and is equal or even lower in four sectors (*production of investment goods*, *construction 1*, *trade* and *business services*). The relevance of long-distance movers within a sector can be seen from *Table A5.3*. It is especially high for *trade*, *transport & communication*, *household services* and *business services.* Relating both information, it follows that long-distance mobility explain a significant fraction of the extra return in *household services* (32 percent long-distance movers with long-term extra effect of 9.08 percent) and *transport & communication* (29 percent long-distance movers with long-term extra effect of 3.63 percent). In other sectors they contribute at least to explain a small fraction (*energy*, *raw materials*, *consumption goods*, *food*, *beverages & tobacco*, *construction 2*, *public services* and *public corporations*) and in the remaining sectors (*production of investment goods*, *construction 1*, *trade and business services*) they do not add to explain the differential. The results rather support the view that in specific sectors – namely *business services* – long-distance movers are a negative selection compared with movers to closer destinations.

Table 5.6: Estimated Dummy-Indicators of the Fixed Effect Estimates: Short-Term and Long-Term Wage Growth Differentials by Sector Affiliation Excluding Commuters

	year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
		Energy		Raw materials		Production of investment goods		Consumption goods		Food, beverages and tobacco		Construction 1		Construction 2	
Dummy-indicator: wage effect of establishment movers relative to stayers	2000	**6.97**	28.14	**5.64**	41.68	**5.13**	69.27	**5.65**	43.44	**4.85**	21.54	**3.22**	22.11	**4.50**	30.13
	2001	**5.24**	22.96	**4.32**	34.31	**4.63**	68.21	**4.05**	33.73	**4.14**	19.80	**1.46**	10.57	**3.09**	22.03
	2002	**5.56**	24.69	**4.25**	33.65	**4.06**	59.76	**3.93**	32.43	**3.89**	18.58	**1.40**	9.96	**3.34**	23.56
	2003	**2.31**	10.25	**4.65**	36.48	**3.67**	53.82	**3.75**	30.52	**3.02**	14.38	**1.11**	7.85	**3.45**	24.20
	2004	**2.10**	9.28	**4.60**	35.60	**3.36**	48.62	**3.50**	28.06	**2.93**	13.70	**1.41**	9.73	**3.86**	26.65
	2005	**3.62**	15.73	**3.81**	29.14	**2.98**	42.47	**3.64**	28.61	**3.50**	15.99	**2.15**	14.46	**4.60**	30.98
Dummy-indicator: wage effect of regional movers relative to stayers	2000	**0.58**	1.02	**6.12**	16.90	**4.55**	24.88	**6.46**	17.89	**6.82**	13.52	**0.62**	1.97	**6.44**	14.59
	2001	**4.19**	7.35	**5.12**	14.05	**4.98**	27.34	**7.06**	19.38	**5.71**	11.24	−0.59	−1.81	**5.09**	11.31
	2002	**4.08**	7.04	**6.49**	17.33	**4.90**	26.49	**7.52**	20.15	**6.37**	12.38	0.63	1.88	**7.35**	16.04
	2003	**1.72**	2.96	**6.58**	17.36	**6.13**	32.68	**8.11**	21.50	**7.01**	13.45	0.43	1.26	**7.01**	15.02
	2004	**3.26**	5.52	**5.72**	14.94	**6.04**	31.65	**8.31**	21.73	**8.52**	16.08	**1.44**	4.08	**7.84**	16.62
	2005	**4.18**	6.94	**4.81**	12.40	**5.42**	27.97	**8.50**	21.86	**7.82**	14.38	**1.47**	4.09	**8.23**	16.97
Dummy-indicator: wage effect of regional movers relative to establishment movers	2000	**−1.91**	−2.76	0.38	0.83	−0.12	−0.54	**1.03**	2.33	**1.78**	2.86	**−2.22**	−5.75	**2.55**	4.73
	2001	**1.47**	2.06	**0.93**	2.00	0.60	2.72	**3.04**	6.67	**1.65**	2.54	**−1.95**	−4.79	**2.50**	4.45
	2002	0.38	0.52	**2.34**	4.88	1.04	4.62	**3.54**	7.59	**2.47**	3.76	−0.64	−1.50	**4.49**	7.83
	2003	−0.03	−0.04	**1.99**	4.09	**2.36**	10.33	**4.31**	9.12	**3.82**	5.72	−0.67	−1.54	**3.60**	6.13
	2004	**2.17**	2.93	**1.25**	2.54	**2.62**	11.28	**4.74**	9.90	**5.53**	8.14	0.06	0.13	**4.04**	6.81
	2005	**2.28**	3.03	**1.16**	2.34	**2.41**	10.22	**4.72**	9.70	**4.31**	6.21	−0.63	−1.40	**3.70**	6.06

Table 5.6 (continued):

	year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
		Trade		Transport & communication		Business services		Household services		Public services		Public corporations	
Dummy-indicator: wage effect of establishment movers relative to stayers	2000	**5.11**	46.47	**4.41**	32.28	**7.98**	59.43	**5.65**	17.92	**3.92**	28.27	**2.60**	21.82
	2001	**5.08**	49.08	**4.59**	36.08	**8.46**	67.77	**6.51**	21.91	**4.32**	34.05	**3.66**	33.58
	2002	**5.31**	50.93	**4.51**	35.38	**8.61**	68.27	**7.03**	23.15	**4.00**	31.10	**3.56**	32.48
	2003	4.96	46.89	**4.79**	36.84	**7.68**	59.89	**6.31**	20.64	**3.60**	27.58	**3.35**	30.23
	2004	**5.04**	46.87	**4.65**	35.13	**7.86**	60.18	**6.54**	20.86	**3.29**	24.75	**3.04**	27.02
	2005	**5.06**	46.12	**4.94**	36.57	**8.05**	60.22	**6.58**	20.08	**3.17**	23.31	**2.65**	23.17
Dummy-indicator: wage effect of regional movers relative to stayers	2000	**5.82**	31.12	**5.22**	22.71	**7.01**	29.75	**7.12**	13.17	**6.77**	21.43	**4.70**	14.94
	2001	**5.93**	32.56	**6.32**	28.11	**8.05**	35.11	**11.15**	21.10	**7.93**	24.87	**6.48**	20.55
	2002	**6.12**	32.99	**6.80**	29.69	**8.08**	34.46	**12.75**	23.43	**8.17**	25.03	**7.42**	23.25
	2003	**7.56**	40.02	**8.14**	34.08	**8.44**	35.25	**13.79**	24.76	**8.39**	25.26	**8.46**	26.06
	2004	**8.03**	41.88	**8.44**	34.56	**8.31**	34.04	**15.27**	26.94	**8.66**	25.65	**8.14**	24.75
	2005	**7.49**	38.29	**8.62**	34.74	**8.13**	32.65	**15.74**	26.91	**8.64**	25.12	**8.10**	24.33
Dummy-indicator: wage effect of regional movers relative to establishment movers	2000	**0.95**	4.54	**0.62**	2.40	**–0.67**	–2.73	**1.62**	2.52	**2.47**	5.81	**1.84**	4.21
	2001	**0.90**	4.15	**1.56**	5.81	–0.23	–0.89	**4.50**	6.68	**3.46**	7.79	**2.60**	5.78
	2002	**0.87**	3.93	**2.10**	7.66	–0.36	–1.39	**5.60**	8.07	**4.05**	8.91	**3.66**	8.03
	2003	**2.65**	11.82	**3.30**	11.57	**0.93**	3.47	**7.31**	10.29	**4.69**	10.13	**4.93**	10.65
	2004	**3.04**	13.39	**3.71**	12.76	**0.60**	2.23	**8.56**	11.87	**5.28**	11.22	**4.97**	10.61
	2005	**2.47**	10.66	**3.63**	12.33	0.13	0.48	**9.08**	12.23	**5.35**	11.18	**5.36**	11.30

Notes: All coefficients are multiplied by 100. Estimated coefficients significant at least at the 5 percent level are in bold.
Source: BEH, own calculations.

Check 3: the role of the age structure

In the aggregate, mobility wage premia are higher for young workers (see *Figure A5.4* in the Appendix).[136] *Table 5.7* gives evidence that in some sectors, young workers benefit more from a regional change of workplace than the medium or high age category and in others not. In *raw materials*, *production of investment goods*, *consumption goods*, the both *construction sectors*, *trade* and *business services*, the extra return to migration has increased (compared with *Table 5.4*). In the remaining sectors (*energy, food, beverages & tobacco, transport & communication, household services, public services* and *public corporations*) the extra return is roughly the same as in *Table 5.4* or even smaller. Given these differences of the extra return, one could argue that the age structure explains some of the heterogeneity across sectors. Again, *Table A5.3* gives information on the relevance of the effect. In the aggregate, the share of individuals with a potential work experience of less than ten years is somewhat higher for regional movers (24.3 percent) than for establishment movers (21.1 percent).[137] On sector level, the share of young workers is by far highest in *construction 2* and *household services*. For the latter, one observes a more moderate over-representation for establishment movers. However, since the extra return for young workers in this sector is not higher than for older workers one can not argue that the high share of young individuals adds significantly to explain the extra return. Altogether, the results suggest that the explanatory power of the age structure is of minor importance.

136 A discussion of this result is given in chapter 4.

137 For the sake of completeness, the shares for stayers (the corresponding aggregate value is 13.9 percent) are also included in *Table A5.3*. It turns out (as discussed above) that stayers tend to be older.

Table 5.7: Estimated Dummy-Indicators of the Fixed Effect Estimates: Short-Term and Long-Term Wage Growth Differentials by Sector Affiliation Excluding all Persons with Potential Work Experience of More than Ten Years (in 1999)

	year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
		Energy		Raw materials		Production of investment goods		Consumption goods		Food, beverages and tobacco		Construction 1		Construction 2	
Dummy-indicator: wage effect of establishment movers relative to stayers	2000	**4.31**	6.33	**5.26**	15.72	**5.55**	31.80	**5.07**	16.43	**6.14**	11.32	**3.46**	9.79	**4.53**	15.38
	2001	**3.36**	5.27	**4.65**	14.94	**4.86**	30.00	**4.02**	14.01	**5.28**	10.27	**1.82**	5.35	**2.49**	8.84
	2002	**4.15**	6.57	**4.55**	14.59	**4.18**	25.70	**3.72**	12.80	**5.06**	9.85	**1.22**	3.53	**2.39**	8.38
	2003	**1.70**	2.68	**4.74**	15.08	**3.58**	21.97	**3.23**	10.93	**4.27**	8.22	**0.73**	2.08	**2.57**	8.95
	2004	−0.41	−0.64	**4.51**	14.17	**3.15**	19.05	**2.97**	9.91	**3.94**	7.44	0.53	1.48	**2.44**	8.33
	2005	**1.31**	2.00	**3.71**	11.43	**2.51**	14.86	**3.09**	10.07	**4.25**	7.78	**1.34**	3.67	**3.20**	10.64
Dummy-indicator: wage effect of regional movers relative to stayers	2000	1.02	1.19	**4.92**	10.93	**5.93**	26.35	**6.97**	16.75	**6.91**	10.23	**3.85**	8.36	**6.28**	16.38
	2001	**3.80**	4.76	**6.34**	14.93	**6.73**	31.77	**6.95**	17.66	**5.61**	8.82	**3.28**	7.34	**4.28**	11.61
	2002	1.17	1.46	**6.64**	15.54	**6.32**	29.52	**7.22**	17.92	**6.54**	10.12	**2.96**	6.51	**5.00**	13.41
	2003	−0.65	−0.81	**6.35**	14.72	**6.24**	29.13	**6.92**	17.02	**5.94**	9.06	**2.70**	5.88	**5.27**	14.13
	2004	−1.53	−1.91	**6.29**	14.36	**5.94**	27.39	**6.52**	15.89	**5.81**	8.73	**3.27**	7.00	**5.67**	15.00
	2005	−0.28	−0.34	**6.06**	13.63	**5.85**	26.55	**7.57**	18.10	**5.55**	8.08	**3.99**	8.32	**6.40**	16.54
Dummy-indicator: wage effect of regional movers relative to establishment movers	2000	−1.29	−1.62	−0.01	−0.02	**0.69**	2.82	**2.13**	4.74	0.37	0.51	0.51	1.05	**1.93**	4.97
	2001	**1.68**	2.11	**1.67**	3.11	**1.96**	7.87	**3.03**	6.53	0.27	0.36	**1.56**	3.04	**2.00**	4.97
	2002	**−1.95**	−2.44	**2.11**	3.90	**2.18**	8.62	**3.53**	7.41	1.37	1.79	**1.79**	3.40	**2.75**	6.70
	2003	**−2.30**	−2.89	**1.63**	2.99	**2.75**	10.80	**3.70**	7.69	1.41	1.81	**2.02**	3.79	**2.68**	6.45
	2004	−0.72	−0.91	**1.81**	3.27	**2.88**	11.24	**3.49**	7.24	**1.69**	2.15	**2.77**	5.15	**3.16**	7.58
	2005	−1.00	−1.25	**2.37**	4.26	**3.41**	13.26	**4.35**	8.93	1.14	1.42	**2.65**	4.83	**3.09**	7.29

Table 5.7 (continued):

	year	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.	Coef.	t-stat.
		Trade		Transport & communication		Business services		Household services		Public services		Public corporations	
Dummy-indicator: wage effect of establishment movers relative to stayers	2000	**5.75**	21.57	**6.01**	15.12	**8.94**	30.34	**4.87**	6.25	**5.45**	12.27	**4.86**	11.15
	2001	**5.15**	20.33	**5.49**	14.53	**7.92**	28.53	**4.22**	5.59	**5.44**	13.15	**5.20**	12.88
	2002	**5.14**	20.15	**5.25**	13.82	**7.09**	25.30	**4.27**	5.53	**4.57**	10.85	**5.20**	12.90
	2003	**4.22**	16.29	**4.82**	12.51	**5.50**	19.31	**3.91**	4.96	**3.29**	7.70	**4.77**	11.73
	2004	**4.14**	15.71	**4.91**	12.53	**5.40**	18.63	**3.68**	4.55	**2.73**	6.22	**3.90**	9.44
	2005	**4.10**	15.20	**5.25**	13.09	**5.00**	16.87	**3.67**	4.28	**2.65**	5.88	**3.74**	8.91
Dummy-indicator: wage effect of regional movers relative to stayers	2000	**7.79**	26.43	**6.33**	15.11	**10.68**	32.11	**6.02**	6.89	**6.45**	12.49	**4.73**	9.77
	2001	**7.68**	27.60	**6.10**	15.35	**9.96**	31.87	**7.44**	8.83	**7.07**	14.54	**5.50**	12.10
	2002	**7.83**	27.84	**6.17**	15.42	**9.34**	29.57	**7.88**	9.09	**7.12**	14.39	**6.94**	15.20
	2003	**7.43**	25.92	**5.71**	14.02	**8.38**	26.12	**7.63**	8.59	**5.45**	10.86	**6.79**	14.67
	2004	**7.74**	26.53	**6.07**	14.65	**8.09**	24.79	**7.83**	8.63	**5.60**	10.95	**6.18**	13.22
	2005	**7.41**	24.85	**6.54**	15.43	**7.54**	22.59	**8.51**	8.91	**5.64**	10.76	**6.39**	13.52
Dummy-indicator: wage effect of regional movers relative to establishment movers	2000	**1.91**	6.54	0.38	0.90	**1.87**	6.23	1.42	1.76	1.06	1.71	0.24	0.38
	2001	**2.48**	8.25	0.74	1.69	**2.23**	7.23	**2.80**	3.28	**1.83**	2.85	0.38	0.60
	2002	**2.62**	8.59	**0.97**	2.20	**2.40**	7.63	**3.31**	3.75	**2.72**	4.12	**1.75**	2.70
	2003	**3.15**	10.18	**0.87**	1.95	**3.01**	9.46	**3.82**	4.25	**2.31**	3.45	**1.97**	3.03
	2004	3.55	11.35	**1.13**	2.49	**2.79**	8.72	**4.20**	4.62	**2.99**	4.42	**2.20**	3.36
	2005	**3.27**	10.34	**1.24**	2.69	**2.59**	7.97	**5.00**	5.27	**3.07**	4.48	**2.53**	3.86

Notes: All coefficients are multiplied by 100. Estimated coefficients significant at least at the 5 percent level are in bold.
Source: BEH, own calculations.

5.4 Summary of findings

This paper deeply analyzes the additional effect of regional migration over non-migratory job-mobility. The focus of this paper lies on sector-specific heterogeneity. Descriptive evidence suggests that sectors differ with respect to workers' wages and other dimensions like establishment size, workers' potential experience, market size, share of high-skilled within an establishment and so on. Moreover, we observe also on sector level that differences in characteristics are less pronounced between regional movers and (non-migratory) establishment movers than between regional movers and stayers. We take this as instruction to concentrate the analyses on the wage growth differentials of regional movers over establishment movers:

It turns out that the so-defined extra effects of regional mobility differ substantially on the sector level. While the short-term effect is zero in the aggregate, on a sector level it ranges from –2.91 percent in *raw materials* to +1.35 percent in *construction 2*. The long-term effects are even more dispersed. Though sector-specific wage growth paths of regional movers are generally steeper than those of establishment movers, the range six years after migration is between –0.74 percent in *raw materials* and +4.89 percent in *household services*. Further sectors with pronounced long-term extra effects are *consumption goods* (+3.91 percent) and *public services* (+3.47 percent).

We investigate several hypotheses for explaining sector-specific differences. Firstly, hypothesizing that differing extra effects might stem from systematical changes from low-wage to high-wage sectors, we explore the importance of sector mobility. We observe that sector mobility is not systematically related to changes from low-wage to high-wage sectors. However, results from restricted sample estimates suggest that sector mobility explains a large fraction of the premium in *food, beverages & tobacco* and *business services*. Moreover, it contributes significantly to the explanation of the additional effect in *construction 2* and has minor explanatory power in *public services*. For the remaining sectors, mobility between them plays no role for the results. Secondly, we examine the role of distance. For *household services* and *transport & communication* one observes high shares of long-distance movers together with large values for the extra returns when restricting on this group. Hence, contrary to other sectors, long-distance mobility explains a substantial fraction of the extra return in these two sectors. Investigating thirdly the sector-specific extra returns separately for young workers, the results suggest that the explanatory potential of the age structure is of minor importance.

Altogether, one can conclude from our results that sector mobility and distance are important sources for explaining the positive additional effect of regional migration in specific sectors. In other sectors both explanations are inappropriate.

We are quite sure therefore, that differences in both, human capital accumulation and quality of matches/search gains between employer and employee, can thus be seen as major explanation for sector-specific heterogeneity. Related to that, it is evident that human capital accumulation and job matching are highly important for explaining the wage growth effects after regional migration.

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Appendix

Table A5.1: Regional Classification Scheme based on BBR-Classification

Structural region type	District type (BBR-Classification)	Term used in the paper	Description of region type (BBR)
Regions with large agglomerations	BBR1	metropolitan areas RT1	Core cities
	BBR2		Highly urbanized districts in regions with large agglomerations
	BBR3	metropolitan surroundings RT2	Urbanized districts in regions with large agglomerations
	BBR4		Rural districts in regions with large agglomerations
Regions with features of conurbation	BBR5	central cities RT3	Central cities in regions with intermediate agglomerations
	BBR6		Urbanized districts in regions with intermediate agglomerations
	BBR7	rural areas RT4	Rural districts in regions with intermediate agglomerations
Regions of rural character	BBR8		Urbanized districts in rural regions
	BBR9		Rural districts in rural regions

Table A5.2: A Description of the Variables for the Fixed Effects Estimates

Name of Variable	Description
log wage	Logarithm of gross daily earnings, calculated as average over the observed employment period for each person.
Dummy-indicator: wage effect of establishment movers relative to stayers	Effect of establishment mobility, base outcome: stayers.
Dummy-indicator: wage effect of region type movers relative to stayers	Effect of region type mobility, base outcome: stayers.
Dummy-indicator: wage effect of region type movers relative to establishment movers	Effect of region type mobility, base outcome: establishment movers.
Establishment size	Besides the linear and quadratic establishment size controls we additionally introduce interaction effects which account for the fact that wage growth within the firm and between firms might differ. For instance, the variable *Establishment size: between * neg* entails the supplementary effect for those workers moving to a smaller firm. By contrast, the variable *Establishment size: within * pos* covers the effect for an increase of firm size (for stayers).
Establishment size squared	
Establishment size: within * pos	
Establishment size: within * pos squared	
Establishment size: between * neg	
Establishment size: between * neg squared	
Establishment size: between * pos	
Establishment size: between * pos squared	
ln (market size)	Logarithm of the number of individuals with the same skill category working in the same region and industry in a given year.
ln (aggregated market size)	Logarithm of the number of individuals with the same skill category working in the same region in a given year.
Share of high-skilled	Share of high-skilled workers in the same establishment.
Share of female	Share of female workers in the same establishment.
Tenure	Tenure is measured in years. Since the biographies of workers date back to the year 1975 the maximum tenure is 30 years in 2005. Therefore, we include a variable Dummy high tenure to account for this.
Tenure squared	
Dummy high tenure	
Experience squared	Experience is measured as age minus years of education minus 6 (years). In order to account for the panel structure of the data, we include the squared variable.

Table A5.3: Observation Figures of Various Samples by Sector Affiliation (1999)

	Sample 1 (without sector movers)				Sample 2 (long-distance movers)		Sample 3 (young persons only)					
	Est. movers		Reg. movers		Reg. movers		Stayers		Est. movers		Reg. movers	
Sector	number	share	number	share	number	share	number	share	number	share	number	share
Energy	10,148	77.58	3,028	76.89	602	15.29	852	8.55	1,375	10.51	508	12.90
Raw materials	9,862	57.41	2,465	40.89	1,252	20.77	5,896	13.02	3,301	19.22	1,305	21.65
Production of inv. goods	52,475	72.38	15,119	56.54	5,670	21.21	21,695	14.54	14,179	19.56	6,268	23.44
Production of cons. goods	11,797	61.32	2,726	44.30	1,233	20.04	6,663	15.06	4,399	22.87	1,712	27.82
Food, beverages, tobacco	3,715	58.98	1,432	48.46	649	21.96	2,250	14.73	1,464	23.24	771	26.09
Construction 1	9,298	62.72	4,046	58.39	1,659	23.94	4,208	14.79	3,462	23.35	1,468	21.19
Construction 2	8,988	57.59	2,661	43.87	756	12.46	5,494	22.23	5,556	35.60	2,181	35.96
Trade	22,272	58.15	15,935	58.55	8,012	29.44	10,028	15.15	8,761	22.87	6,628	24.35
Transport & communication	13,410	65.26	8,801	66.84	3,864	29.34	3,737	12.18	3,487	16.97	2,723	20.68
Business services	25,543	67.05	15,205	63.81	6,802	28.55	7,817	14.92	9,233	24.24	6,248	26.22
Household services	3,238	63.68	1,958	63.45	1,001	32.44	1,285	13.49	1,412	27.77	1,058	34.28
Public services	7,738	66.85	3,034	61.79	1,160	23.63	3,176	9.27	1,761	15.21	1,053	21.45
Public corporations	5,670	65.08	2,636	76.56	639	18.56	2,220	7.19	1,080	12.40	742	21.55
Total	184,154	65.52	79,046	58.79	33,299	24.77	75,321	13.92	59,470	21.16	32,665	24.29

Source: BEH, own calculations.

Figure A5.1: Wage Growth Effects of Mobility in the Aggregate (for Movers to a Different Region of the Same Type)

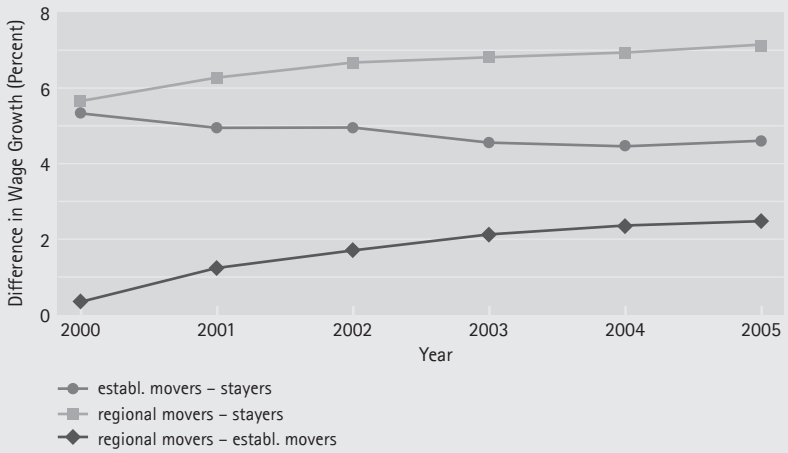


Figure A5.2: Wage Growth Effects of Mobility after Excluding All Individuals who Change the Sector from 1999 to 2000 (for Movers to a Different Region of the Same Type)

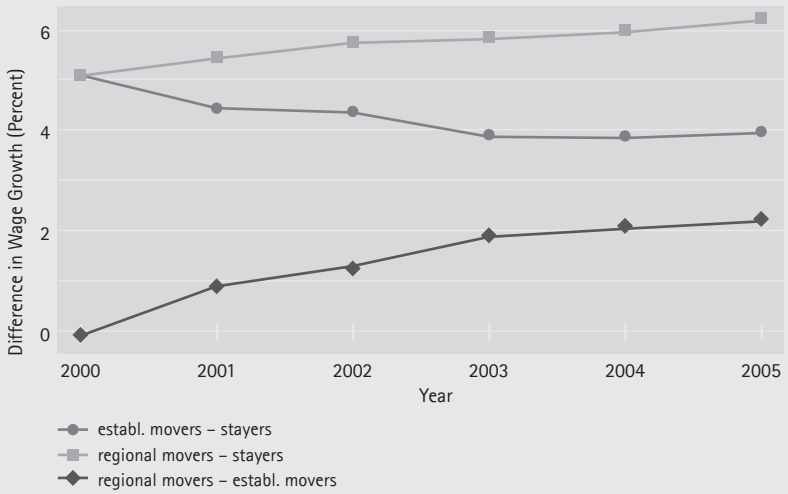


Figure A5.3: Wage Growth Effects of Mobility after Excluding Commuters (for Movers to a Different Region of the Same Type)

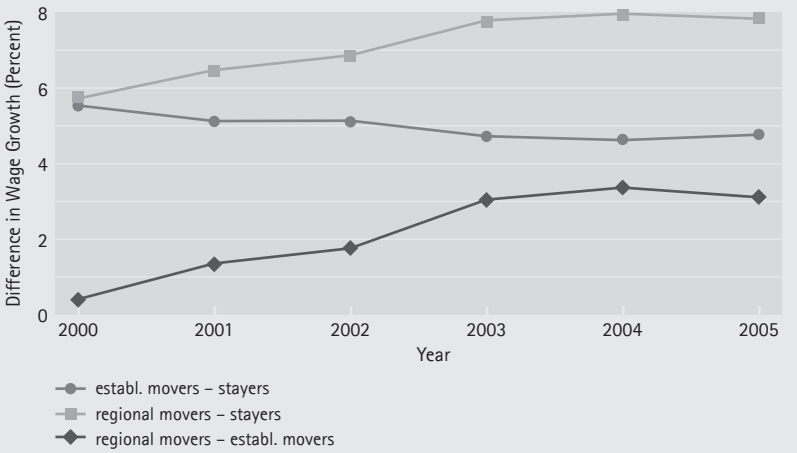
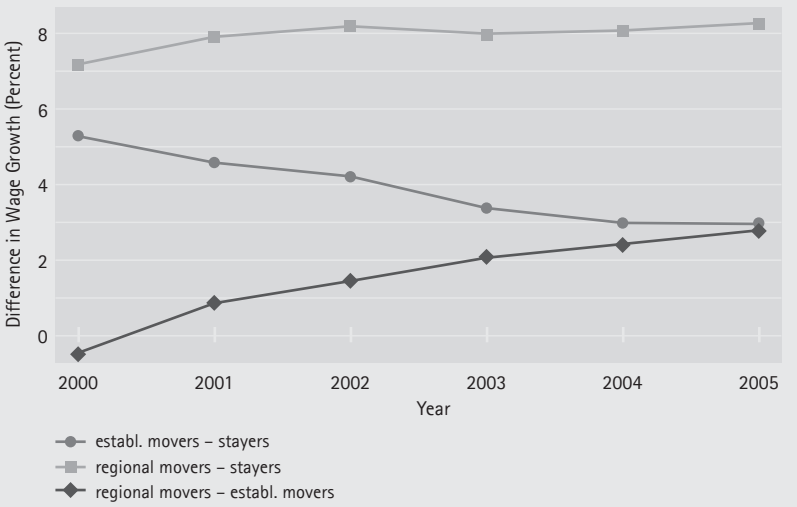


Figure A5.4: Wage Growth Effects of Mobility for Young Persons (for Movers to a Different Region of the Same Type)



6 Interrelations between the Urban Wage Premium and Firm-Size Wage Differentials – A Microdata Cohort Analysis for Germany

joint with Joachim MÖLLER

Abstract

At the interface of regional and labor economics, our paper deals with two central topics in the analysis of wage formation, the urban wage premium and the firm-size earnings differential. Choosing a cohort of workers from a large panel micro data set, we get an urban wage premium of 8 percent and a large firm premium of 11 percent. We find that large firms play a crucial role for explaining the higher productivity in urban areas. The wage growth in urban areas is not tied to the firm level. Hence our findings confirm the view that externalities are operating in the urban environment and not only within the firms.

Keywords: Urban wage premium, firm-size earnings differential, agglomeration economies, knowledge spillovers, urban-rural migration, firm-size mobility, wage level and wage growth effects.
JEL-classification: J24, J31, R23.

6.1 Introduction

At the interface of regional and labor economics, our paper deals with two central topics in the analysis of wage formation, the urban wage premium and the firm-size wage differential. The phenomenon of workers being better paid in agglomerations is an old theme in regional economics which dates back to Marshall (1890) and others. Recently, in the light of new micro data and modern econometric methods, several authors have taken a fresh look at the empirical evidence. In an important study for the U.S., for instance, Glaeser and Maré (2001) found that city workers are paid 33 percent more than in rural areas. Since the higher pay must be related to higher productivity, regional economists basically offer two alternative explanations for this observable fact. Either higher wages in agglomerations are a consequence of a selection mechanism which attracts the most able workers to cities, or it is the city environment that makes workers more productive. In the latter case, an equilibrating mechanism in the spirit of Harris and Todaro (1970) is required to hinder workers from flocking into urban areas because of the high wage. Agglomeration disadvantages include problems such as congestion, pollution and higher costs for non-tradables, in particular housing services.

As a matter of fact, empirical studies typically find a strong and statistically significant positive relationship between density measures of economic activity and productivity [e.g. Ciccone and Hall (1996), Harris and Ioannides (2000), Ciccone (2002)].[138] Several "conventional" explanations can be given for this. Firstly, agglomerations provide specific advantages to firms because of their infrastructure and the access to other public goods they offer. Secondly, the sheer size of the labor market in cities leads to better matches between the worker and the work place.[139] Thirdly, the concentration of purchasing power in agglomerations causes higher demand. The New Economic Geography (NEG, see Fujita et al., 1999) contributes the following further arguments. The NEG theory stresses the interactions of increasing returns, transportation costs and market or demand effects. The advantages of clustering of firms arise because of the proximity of suppliers of intermediate goods, among others. There are two sources of cost reduction in supply-chain clusters. On the one hand, a higher number of "upstream" firms imply the availability of a greater variety of intermediate goods for a given firm *F* within the chain thereby increasing its productivity. On the other hand, a higher number of "downstream" firms boosts the demand for the goods it produces thereby lowering its unit costs because of scale effects. As a result, clustering leads to higher productivity of workers and hence higher wages. A further important line of argument is that agglomeration fosters knowledge spillovers between workers. Living in cities makes workers more productive because social interactions speed up the accumulation of human capital. Such human capital externalities are object of a voluminous literature [e.g. Moretti (2004), Rosenthal, Strange (2005), Rauch (1993), Lucas (2001)]. Despite the overwhelming evidence on the existence of human capital externalities, almost nothing is known whether human capital externalities are operating on the firm level or in the urban environment.

Concerning the selection hypothesis: Why should firms in agglomerations be pickier in recruiting their workers? One line of argument is that the agglomeration specifically attracts firms engaged in intensive research and development activities. These firms tend to profit from knowledge spillovers. If especially the most able workers are likely to increase their productivity by knowledge spillovers, it might pay out for the firm to establish sharper selection criteria for recruitment. A related hypothesis is based on a sorting argument: the more able workers are more likely to be attracted by cities. The study of Combes et al. (2003) states that this is the case for France where the bulk of interregional wage disparities is due to a

138 Previous studies focus on the positive effects of city population or industry employment on productivity (e.g Sveikauskas, 1975; Segal, 1976; Moomaw, 1981, 1985 and Henderson, 1986).

139 See Wheeler (2001) for a formal model.

geographically uneven distribution of skills. One reason for this could be that the more able workers anticipate the knowledge spillovers in the cities which could accelerate the process of human capital formation.[140] A second reason for the attractiveness of cities might be their amenities (possibilities of consumption, cultural activities), which cater those with high incomes.[141] As Glaeser and Maré (2001: 318) point out, the ability hypothesis implies that an urban wage premium exists, even after controlling for the local price level.

Empirically, there is strong support for the existence of an urban wage premium for observationally equivalent workers.[142] Using panel data methods it is possible to exclude unobserved heterogeneity of workers to explain the urban wage premium. Controlling for the local price level, however, turns out to be difficult because reliable data does not exist.

We now turn to the firm-size wage premium. Brown et al. (1990) report that hourly wages of workers in large firms are 35 percent higher than in small firms. Oi and Idson (1999) distinguish between behavioral explanations and a productivity hypothesis. The former are: (1) big firms decrease the costs of monitoring through matching of productive workers; (2) the likelihood of shirking is higher than in small firms and therefore large establishments have to pay efficiency wages and (3) big firms are more able to share rents because of greater market power and lower prices for non-labor inputs, among others. Furthermore, the so-called productivity hypothesis states that the required performance standards are higher in big firms which have to be compensated by higher wages and that more productive employees are needed to operate high-technology machines.[143] Brown and Medoff (2003) additionally points to the fact that large firms are also old firms which have higher survival rates. Therefore they invest more in training which results in more productive workers.[144]

There are several similarities in the explanation of the urban and the firm size wage differential. In both cases one can distinguish between hypotheses being related to productivity or ability. One can consider the large firm as an organizer of the value chain using internal and external sources. The large firm is able to internalize some of the advantages arising from backward and forward linkages already described in the context of localization and urbanization economics. From this point of view one

140 See Peri (2001) for a formal model.

141 Adamson et al. (2004) state that skilled workers are more influenced by urban amenities than by urban productivity.

142 Beside Glaeser and Maré (2001) a number of studies find that firms in dense areas pay more for equivalent workers than in rural areas. See, for instance, Rosenthal and Strange (2005) and Wheeler (2001) for the U.S., Haas and Möller (2003) for West Germany, Combes, Duranton and Gobillon (2003) for France, Di Addario and Pattacchini (2004) for Italy and Tabuchi and Yoshida (2000) for Japan. Moreover, for the U.S., Diamond and Simon (1990) and Wheaton and Lewis (2002) identify strong gains to specialization in urban areas.

143 The increased capital/labor ratio leads to an advanced adoption of new technologies.

144 An alternative survey of possible explanations for the size-wage premium is given by Troske (1999).

can argue that the large firm benefits more from agglomeration. Empirically it is a striking fact that the average firm size is significantly higher in dense regions. Hence the urban wage premium might at least to some extent be interrelated with firm size. To the best of our knowledge there exists no study combining these two aspects although both phenomena are well investigated separately.

The aim of our paper is to analyze how the urban wage premium is affected by taking into account that workers in large firms are clearly over-represented in agglomerated areas. Our method is to observe a cohort of workers over time and to study the effect of migration on the one hand and changing the firm size on the other. We then follow the approach of Glaeser and Maré (2001) insofar as we examine the development of wage patterns of rural-urban and urban-rural movers and ask whether the urban wage premium accrues over time and whether the premium persists if workers leave cities. It turns out to be of crucial importance not only to consider regional mobility, but also to shed light into the "black box" of firm-size mobility. This allows us to identify whether the urban premium primarily develops within or outside the firm.

The remainder of the paper is organized as follows: The next section deals with a description of our data source, methodological issues, basic definitions and descriptive evidence. Section 6.3 introduces our econometric model and presents the results. Section 6.4 concludes.

6.2 Data, basic definitions and some descriptive evidence

6.2.1 Data

The data used in this paper is a one percent random sample from the Employment Statistics of the Institute of Employment Research, Nuremberg (IABREG).[145] It includes all workers, employees and trainees with the obligation of paying social insurance contributions. Not included in the data are self-employed persons, civil servants, marginal employed persons and students enrolled in higher education. The employment register contains detailed histories for each worker's time in employment. Here we consider all persons aged 16 to 70 years who were employed on 30th June of each year. The key variable for our analysis is gross daily wages[146] being gathered in the register for administrative purposes. Due to legal sanctions for the employer in cases of misreporting, the variable can be considered highly reliable. Because of the contribution assessment ceiling in the German social

145 For a description of the data source please see Bender and Haas (2002).

146 The notions wages and earnings are used synonymously throughout this paper. Daily gross earnings are calculated as average over the observed employment period for each person.

security system, however, the earnings information is top coded. This concerns less than 10 percent of all observations. The likelihood of censoring increases with age and education. Moreover, the data set gives information on personal characteristics of workers like gender, age and education as well as some basic information about the employer (industry affiliation, location, firm size).

The qualification of the considered workers can be subdivided into three categories: (i) *low-skilled*: persons with no occupational qualification regardless of which schooling level, that means with or without upper secondary education (*Abitur*); (ii) *skilled*: persons with an occupational qualification whether they have an upper secondary education (*Abitur*) or not; (iii) *high-skilled*: persons with upper secondary education who are holding a degree for university or polytechnics type of higher education.

The data contains regional information which refers to the location of the firm respectively the work place and not the residence of a worker. In order to distinguish between urban and rural areas we use a classification scheme of the *Bundesanstalt für Bauwesen und Raumordnung* (BBR) that differentiates between nine types of regions according to centrality and population density. At NUTS3 (county) level the classification "urban" collects metropolitan core cities (BBR1) and highly urbanized districts in areas with large agglomerations (BBR2) as well as central cities in regions with intermediate agglomerations (BBR5) as urban areas. All other regions are classified as rural (see Appendix, *Table A5.1*). The data also includes information about firm size which is crucial for our purpose. In the following we differentiate between small firms (1–500 workers) and large firms with more than 500 workers.

Because there are still large structural differences in labor market and migration patterns between the eastern and the western part of Germany we constrict the analysis to workers in West Germany. We exclude part-time workers, workers, those in an apprenticeship or with more than one employment contract. Moreover, we drop all observations with no valid information on earnings, age, skills or the region of the workplace (see Appendix, *Table A6.2* for data selection).

6.2.2 Basic definitions and methods

In order to identify the urban wage premium and the firm size earnings differential in the panel data analysis later on, we investigate different aspects of mobility. First of all, mobility of an employed worker is related to the *change of the firm, where he or she is occupied.* Thereby the worker can choose an employer of either the same or a different firm-size category compared to the previous one. Therefore, a second aspect of workers' mobility concerns *a change in the firm-size category*

of the employer. Thirdly, mobility can have a spatial dimension as well, since it may require a change in the region where the workplace is located of employees and/or where the person lives. Here we concentrate on the former. Therefore we define regional mobility of employed workers *as a change in the region where the workplace is located*.

Basically we are interested in wage growth effects accruing from changing the firm, the firm-size category and/or the region, respectively.[147] To this aim, we analyze a cohort of workers. We first selected all workers in the data base who were employed at the cut-off date *in all years* from 1990 to 1997. Based on the observations for the two consecutive years 1990 and 1991, we divided the group into stayers and movers with respect to the three dimensions of worker's mobility as defined above.[148] The cohort consists of all employed workers who where possibly mobile between 1990 and 1991 but stayed with the same employer from 1992 onwards, hence not only persons with unemployment spells but also multiple movers were disregarded. As a consequence, we obtain a balanced panel for a cohort for which the selectivity problem is markedly reduced.

Table 6.1 gives some basic information on the number of observations for movers and stayers in our sample. In total, we have 58,112 persons in the cohort. Within the total, 3,666, or 6.3 percent, firm movers can be identified. In two thirds of all cases, inter-firm mobility takes place within the small firm-size category (2,353 observations). The number of workers moving between large firms is 400. The group of *firm-size movers* comprises 913 persons whereof the majority (555 individuals) moves from small firms to large ones. The group of firm movers who additionally changed the region of the workplace consists of 1,478 workers (2.5 percent). In the sample we have 268 workers changing their workplace from rural to urban areas and 251 movers in the opposite direction. Hence a small net inflow of mobile workers into cities can be observed at the beginning of the nineties.

147 We do not consider inter-regional mobility within the same firm, i.e. between different operating sites of the same firm. This aspect of workers' mobility has been investigated by Hunt (2004).

148 Throughout the paper we concentrate on a cohort starting in 1990/91. All documented results are fairly similar for other cohorts starting in the years 1985/86 to 1989/90. These results are not documented here and are available from the authors on request.

Table 6.1: Absolute Number and Share of Movers and Stayers in the Cohort (1991–1997)

total	58,112		
therof			
firm stayers		54,446	
percent of total		*93.7*	
firm movers		3,666	
percent of total		*6.3*	
thereof movers			
between small firms			2,353
from small to large firm			555
from large to small firm			358
between large firms			400
regional stayers		56,634	
percent of total		*97.5*	
regional movers		1,478	
percent of total		*2.5*	
thereof movers			
within urban areas			615
from urban to rural areas			251
from rural to urban areas			268
within rural areas			344

Source: Own calculations using IAB-REG data.

6.2.3 Firm size and region types: Some descriptive evidence

Table 6.2 shows that 58 percent (33,689 individuals) of all workers in the cohort are employed in urban areas. The share of workers with urban status in small versus large firms is 56 to 44 percent. The distribution across the two firm-size categories is markedly different in rural areas: Here more than three out of four workers (77 percent) are employed in the small firm-size category. This implies that in rural areas the share of workers in large firms is only half its size in urban areas. Hence workers with urban status are much more likely to work in larger firms than their counterparts outside the cities.

Table 6.2: Absolute Number and Share of Workers by Firm Size Category and Region Type (1990)

	Urban areas		Rural areas	
	Number of observations	Share in %	Number of observations	Share in %
small firm size	18,941	56.22	18,886	77.33
large firm size	14,748	43.78	5,537	22.67
total	33,689	100	24,423	100

Source: Own calculations using IAB-REG data.

Table 6.3 examines differences in the average skill levels of male and female workers in urban and rural areas. According to the human capital literature [e.g. Moretti (2004)], skill intensity should be higher in agglomerations. This is clearly confirmed by the evidence here, as in our cohort the share of high-skilled male and female employees in cities is more than double its value in rural areas.[149] Most interestingly, however, the share of low-skilled male workers in both types of regions turns out to be more or less comparable. Differences are found with respect to the intermediate skill category. Male workers of this category are under-represented in cities while their female counterpart is over-represented.

Table 6.3: Skill and Gender Composition of the Workforce by Region Type (1990)

	Rural areas		Urban areas		Difference
	Number of observations	Share in %	Number of observations	Share in %	urban vs rural in %
			all		
low-skilled	4,628	18.95	6,067	18.01	–0.94
skilled	18,855	77.20	24,748	73.46	–3.74
high -skilled	940	3.85	2,874	8.53	4.68
total	24,423	100	33,689	100	
			males		
low-skilled	2,981	16.40	4,085	16.71	0.31
skilled	14,363	79.02	17,858	73.03	–5.98
high-skilled	833	4.58	2,509	10.26	5.68
total	18,177	100	24,452	100	
			females		
low-skilled	1,647	26.37	1,982	21.46	–4.91
skilled	4,492	71.92	6,890	74.59	2.67
high-skilled	107	1.71	365	3.95	2.24
total	6,246	100	9,237	100	

Source: Own calculations using IAB-REG data.

Comparing the same categories across small and large firms yields the results shown in *Table 6.4*. For both gender, we see that the shares of low-skilled and high-skilled workers in larger firms exceed those in smaller firms. The intermediate skill category, however, is clearly under-represented in larger firms. In relative terms, the differences in the skill composition of the workforce are especially pronounced for the high-skilled. Compared to smaller firms, the share of this skill category is more than twice as high in larger firms. Moreover, we see that female workers tend to

149 Note that only employees with no interruptions in their employment spells were selected here. Since female workers typically exhibit more uns*table* employment patterns, the females are somewhat underrepresented in the sample.

be less skilled and that low-skilled females are markedly over-represented in large firms.

Table 6.4: Skill and Gender Composition of the Workforce by Firm Size (1990)

	Small firms		Large firms		Difference
	Number of observations	Share in %	Number of observations	Share in %	Large vs small in %
			all		
low-skilled	6,395	16.91	4,300	21.20	4.29
skilled	29,651	78.39	13,952	68.78	–9.61
high-skilled	1,781	4.71	2,033	10.02	5.31
total	37,827	100	20,285	100	
			males		
low-skilled	4,074	15.29	2,992	18.72	3.43
skilled	21,084	79.14	11,137	69.67	–9.47
high-skilled	1,485	5.57	1,857	11.62	6.04
total	26,643	100	15,986	100	
			females		
low-skilled	2,321	20.75	1,308	30.43	9.67
skilled	8,567	76.60	2,815	65.48	–11.12
high-skilled	296	2.65	176	4.09	1.45
total	11,184	100	4,299	100	

Source: Own calculations using IAB-REG data.

To summarize the descriptive evidence: High-skilled workers are more concentrated in both urban areas and large firms, while the intermediate skill category tends be relatively more frequent in rural areas and small firms. How wage differentials between specific groups of workers can be traced back to the uneven spatial distribution will be investigated in the next section.

6.3 Econometric estimates: the urban wage premium and the firm size earnings differential

6.3.1 Outline of the estimation approach

In order to determine the urban wage premium we estimate three variants of a Mincer-type wage equation.[150] More specifically, our first estimation approach assumes a linear relationship between log earnings and several explanatory variables measuring skill/gender and (potential) experience effects. The workers' potential

150 See Mincer (1974).

on-the job experience (*EXP*) is measured in years as age minus average duration of education minus six.[151] Potential experience enters the wage equation in linear and quadratic form to model the typical nonlinear (concave) wage/experience profile. We measure the effect of six skill/gender categories by corresponding (0,1)-dummy variables, where $DSKILL_n$ ($n = 1, \ldots, 3$) indicate male workers with low, intermediate and high skills, respectively, while $DSKILL_n$ ($n = 4, \ldots, 6$) stand for the corresponding three skill categories of female workers. In addition, our estimation approach includes interaction effects between the workers' experience with gender and qualification.[152] Finally, we introduce a separate (0,1)-dummy variable for the urban status (*D-URB*). Suppressing the time index, the equation to be estimated is hence given as

$$\ln w_i = \alpha_0 + \alpha_1 EXP_i + \alpha_2 EXP_i^2 + \sum_{n=2}^{6} \alpha_{3,n} D\text{-}SKILL_{n,i} + \alpha_4 D\text{-}URB_i + \text{interactions of experience and experience squared with gender and qualification} + u_i . \quad (6.1)$$

The dependent variable w_i stands for (daily) earnings of individual *i*. The error term u_i is assumed to be identically and independently distributed. To account for top coding in the data, we use the Tobit estimation method.

In order to control for the fact that the urban wage premium and the firm size wage differential might be interrelated, we additionally include the term

$$\ldots + \alpha_5 D\text{-}LFSIZE_i \ldots \quad (6.2)$$

in the estimation approach described above, where *D-LFSIZE* indicates a (0,1)-dummy variable for the large firm-size category. The third variant of the wage equation additionally uses a bulk of industry dummies because one can reasonably suspect a sizeable impact of industry structure on wages.[153] Hence, the ancillary term is

$$\ldots + \sum_{k=2}^{36} \alpha_{6,k} D\text{-}IND_{k,i} \ldots \quad (6.3)$$

where *D-IND* stands for a (0,1)-dummy variable taking the value of unity if an individual belongs to industry *k* and zero elsewhere.

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151 For low-skilled workers without an upper secondary education we impose 10 years as average time of education, for low-skilled workers with an upper secondary education 13 years, for skilled workers 12.5 and 15 years, respectively, for high-skilled workers holding a degree from a polytechnics type of higher education 16 years and for high-skilled university alumni 18 years.

152 All workers except for low-skilled male and female workers are considered as qualified. All interactions with experience are defined for the linear and quadratic experience variable.

153 Since the pioneering work of Krueger and Summers (1988), this relationship is well established in the literature.

6.3.2 Estimation results

Table 6.5 contains the results of the Tobit estimates for the year 1997. The number of observations is 58,112 whereof 8,299 observations or roughly 14 percent are right-censored. The Pseudo-R^2 is about 0.32 in the first specification and increases to 0.45 in the most comprehensive variant. The standard error is about 0.32 in all cases. A significant influence of the explanatory variables at a very high significance level is indicated by the Likelihood-Ratio Tests. Sign and magnitude of the coefficients being connected with skill/gender categories and experience rating correspond to theoretical expectations.

Table 6.5: Urban Wage Premium and Firm Size Wage Premium (1997)

	Specification					
	Variant (I)		Variant (II)		Variant (III)	
Variable	Coef.	t-statistics	Coef.	t-statistics	Coef.	t-statistics
Low-skilled male (ref.)						
Skilled male	**0.129**	4.19	**0.115**	3.82	**0.080**	2.81
High-skilled male	**0.691**	21.78	**0.656**	21.19	**0.596**	20.21
Low-skilled female	**0.052**	2.37	**0.050**	2.33	0.011	0.51
Skilled female	**0.121**	3.24	**0.113**	3.1	0.053	1.54
High-skilled female	**0.571**	14.09	**0.551**	13.95	**0.487**	12.94
Experience	**0.023**	10.38	**0.020**	9.19	**0.017**	8.3
Experience squared	**–0.037**	–9.73	**–0.031**	–8.32	**–0.026**	–7.52
Interaction exp./fem.	**–0.018**	–10.02	**–0.016**	–9.61	**–0.014**	–8.79
Interaction exp. squared/fem.	**0.023**	6.99	**0.021**	6.43	**0.018**	5.98
Interaction exp./qual.	**0.005**	1.98	**0.006**	2.74	**0.006**	3
Interaction exp. squared/qual.	–0.007	–1.68	**–0.009**	–2.23	**–0.008**	–2.25
Urban status	**0.135**	47.84	**0.101**	35.84	**0.086**	31.12
Firm size: large	-		**0.156**	52.62	**0.112**	35.37
Constant	**9.261**	310.9	**9.247**	318.44	**9.037**	286.1
industry controls	no		no		yes	
	Test statistics					
N	58,112		58,112		58,112	
(thereof censored)	8,299		8,299		8,299	
Pseudo-R^2	0.322		0.363		0.449	
LR [chi^2(12); (13); (48)]	21165.18		23876.07		29516.2	
s.e.	0.328		0.320		0.304	

Notes: Estimation method is Tobit; all coefficients significant at least at the 5 percent level are in bold; all coefficients related to the experience squared variable are multiplied by 100.

Source: Authors' own calculations using IAB-REG data.

The estimated coefficient for the *urban status* shows an agglomeration wage premium of about 13.5 percent in the first variant.[154] This can be compared with an estimate excluding control variables, yielding a raw urban wage premium of about 15.5 percent. Recall that urban regions in our paper comprise metropolitan and intermediate core cities and their surroundings, while all other regions are classified as rural although the later still includes some urbanized districts. Compared to a more restrictive definition of rural regions, our measure of the urban wage premium would tend to understate its value. Despite this fact, the identified urban wage premium is sizable.

Using a more restrictive central city definition, Glaeser and Maré (2001) find a raw urban wage premium of roughly 33 percent for the US. Hence there is some indication that the urban/rural wage differential in Germany is somewhat lower than in the US.[155]

Introducing the firm size control variable in the second variant of the specification yields two insights. First, the estimated coefficient for the large firm dummy variable in the amount of 15.6 percent reflects the often documented finding that wages are higher in larger firms. Using an approach without control variables yields a raw differential of 21 percent. This could be compared to the results of Brown et al. (1990) for the US who find a firm-size differential of 35 percent when comparing firms with more than 500 workers to those having less than 25 employees. Second, the introduction of a firm-size control variable leads to a drop in the urban wage premium of about 25 percent. Hence: one fourth of the urban wage premium can be explained by differences in the average firm-size for urban and rural regions. This result corroborates our expectation that – to some extent – the urban wage premium and the firm-size wage differential are interrelated.

The results of the third variant of the specification give evidence that the industry structure especially affects the firm-size differential. While the urban wage premium is lowered by 1.5 percentage points, only, the firm-size wage differential is reduced from 15.6 percent to 11.2 after controlling for the workers' industry affiliation.

Summing up the results so far, it is evident that controlling for differences in the skill/gender composition as well as in the industry structure tends to reduce both the urban wage premium and the firm-size wage differential. However, both premia survive in the most comprehensive specification with statistically highly significant values of about 9 and 11 percent, respectively (see *Table 6.5*).

154 Throughout the paper we use log percentage or log percentage points, respectively.

155 According to Di Addario and Patacchini (2004), the urban wage premium in Italy is even lower and amounts to only 2–3 percent.

6.3.3 Wage level versus wage growth effect

Having shown the existence of the premia we now turn to the explanation of their nature. Following Glaeser and Maré (2001), we might ask whether the corresponding wage differentials are the result of a *wage level* or a *wage growth effect*. If the urban wage premium is a *wage growth effect* due to a concentrated accumulation of human capital in cities, then it should be highest for older workers having stayed in cities for a longer time. In analogy, the same argument would be true for the firm-size wage premium. Hence, experience rating should be interrelated with urban and large firm status, respectively. Moreover, if knowledge spillovers contribute to the explanation of both premia, qualified workers should have an extra bonus for working in the city or in the large firm. In order to test these implications, we estimate the following model:

$$\begin{aligned} \ln w_i = {} & \alpha_0 + \sum_{n=2}^{5} \alpha_{1,n} D\text{-}EXPCAT_{n,i} + \sum_{m=2}^{3} \alpha_{2,m} D\text{-}SKILLCAT_{m,i} \\ & + \alpha_3 D\text{-}URB_i + \alpha_4 D\text{-}LFSIZE\_L_i + \sum_{k=2}^{36} \alpha_{7,k} D\text{-}IND_{k,i} \\ & + \text{interactions of D-EXPCAT with urban status and large firm status} \\ & + \text{interactions of D-SKILLCAT with urban status and large firm status} \\ & + \text{gender control} + u_i \,. \end{aligned} \tag{6.4}$$

Table 6.6 shows the results. It turns out that including cross effects as described, the basic urban wage premium declines substantially and is statistically not different from zero. By contrast, the estimated large-firm premium is about 13 percent and highly significant. The estimated cross effects show that experience rating is distinctly higher in urban areas. Urban employees with a potential work experience of more than twenty years earn a 6.5 percent premium relative to those with 0–5 years of experience. The bulk of shift in the urban experience premium occurs in passing from the 6–10 years of experience group to the 11–15 years group. This is in accordance with the results of Peri (1999) who finds for the US major wage gains due to urban experience for the group of 30–40 years old workers relative to the group of 20–30 years old workers. Peri (1999, p. 15) states that "... the experience premium seems to mirror a process of accumulation of useful skills that is very intense early in the working life of a person, and then, following a learning curve, declines."

Table 6.6: Interaction of Urban Status/Large Firm Status and Human Capital Variables (1991)

	No interaction		Interaction with urban status		Interaction with large firm status	
Variable	Coef.	t-statistics	Coef.	t-statistics	Coef.	t-statistics
Urban status	0.0140	1.26				
Large firm status	**0.1367**	11.68				
Skill categories						
Low-skilled	reference category					
Skilled	**0.1525**	29.65	**0.0297**	4.56	**–0.0217**	–3.26
High-skilled	**0.5969**	47.08	0.0165	1.13	**0.0437**	3.19
Experience categories						
0–5 years	reference category					
6–10 years	**0.0996**	11.9	0.0194	1.71	**–0.0364**	–3.06
11–15 years	**0.1625**	19.46	**0.0425**	3.77	**–0.0347**	–2.92
16–20 years	**0.2040**	24.35	**0.0540**	4.77	**–0.0239**	–2.00
More than 20 years	**0.2385**	32.2	**0.0652**	6.46	–0.0144	–1.34
Constant	**8.9450**	540.48				
Regression contains industry and gender dummies						
	Test statistics					
N	58,112					
(thereof censored)	9,071					
Pseudo-R^2	0.5079					
LR [$chi^2(56)$]	32115.32					
s.e.	0.2853					

Notes: Estimation method is Tobit; all coefficients significant at least at the 5 percent level are in bold; all coefficients related to the experience squared variable are multiplied by 100.

Source: Authors' own calculations using IAB-REG data.

Interestingly, we observe a cross effect of urban status for skilled[156] persons (+2.97 percent) but no effect for the group of high skilled. While there are strong reasons for arguing that the urban wage premium is due to a wage growth effect, this is not the case for the firm-size earnings differential. Relative to the reference group of young workers, individuals in large firms with 6–15 years of experience even have a wage *disadvantage* of 3.5 percent.[157] The result indicates both premia being generated in different ways. Although this drawback diminishes for older

156 Here we differentiate between three skill categories only in order to get a breakdown of interaction effects. Different from equation (1), the gender dummy is incorporated separately.

157 This result contradicts the implications of the theory regarding seniority wages (see, for instance, Lazear (1981)). According to this theory, young workers are paid below their marginal product of labour in the beginning of their career in a given firm (and above when they are older) in order to provide incentives to stay with the firm for a longer time.

individuals, the results point to the fact that the large firm premium predominantly is a *wage level effect*. Furthermore, we detect a negative cross effect with skilled individuals (–2 percent) and a positive one with the group of high-skilled (+4 percent). This supports the view that working in agglomerations fosters the accumulation of human capital, while the bonus of working in large firms is more related to the recruitment of young high-skilled individuals who are paid very well in the beginning of their career.

Up to now we neglected the role of unobserved heterogeneity. On the one hand, the selection of our cohort eliminates a good portion of the problems being related to heterogeneity issues. On the other hand if workers in urban and rural areas still differ in their career attitudes, motivation, working behaviour and other related factors that we cannot directly observe, the estimated urban wage premium would be biased. Through the panel structure in our data, it is possible to remove the time-invariant part of unobserved heterogeneity by employing a fixed-effects model. Using data from 1990 and biannual data from 1991, 1993, 1995 to 1997, we ran a fixed-effects version of the earnings-function approach described in section 6.3.1.[158] In order to capture the time-variable effects of the different dimension of mobility we introduced a complete set of interaction variables. Note that the wage patterns of *firm movers* and *regional movers* allow us to identify both, the firm-size and the urban wage premium, separately.

Table 6.7 contains the results. The first regression depicts the effects of changing the firm, the firm-size category, the region and the type of the region. According to our estimates, firm movers get an average wage bonus relative to firm stayers of more than 7 percent in the first year after moving. Over time, this bonus slightly varies but remains in the same order of magnitude. According to our specification, the general effect of firm mobility is identified by those workers who change their workplace within the small firm-size category. Firm movers between large firms additionally have an effect which is negative in the years 1991 and 1993 (–2.7 and –2.3 percent, respectively), insignificant in 1995 and becomes positive only in 1997 (+1.8 percent). This means that the firm related *wage level effect* is more pronounced for small firms. However, in large firms a *wage growth effect* can be identified which is absent for the small firm-size category.

158 In the case of censoring, wages are imputed on the basis of Tobit estimates of the distribution parameters. More precisely, we use an approach similar to the documented one in section 6.3.1 (the regional and the firm size variable comprise more categories than in equation (6.3)) for regional movers and stayers and impute the estimated wages in case of top coding. The results of these Tobit estimates are available from the authors on request.

Table 6.7: Results of the Fixed Effect Estimates (Using Biannual Data 1991 to 1997)

		Specification 1		Specification 2	
Variable		Coef.	t-statistics	Coef.	t-statistics
Regional mobility	1991	**–0.0152**	–2.70	**–0.0153**	–2.72
	1993	–0.0053	–0.94	–0.0055	–0.97
	1995	–0.0020	–0.35	–0.0022	–0.39
	1997	–0.0006	–0.11	–0.0007	–0.12
Rural-urban mobility	1991	**0.0284**	2.81	0.0098	0.75
	1993	**0.0456**	4.52	**0.0352**	2.71
	1995	**0.0467**	4.62	**0.0413**	3.18
	1997	**0.0633**	6.27	**0.0546**	4.21
Urban-rural mobility	1991	–0.0139	–1.34	–0.0010	–0.08
	1993	–0.0104	–1.01	–0.0030	–0.24
	1995	–0.0198	–1.92	–0.0072	–0.57
	1997	**–0.0321**	–3.11	**–0.0268**	–2.14
Firm mobility	1991	**0.0763**	21.20	**0.0767**	20.92
	1993	**0.0872**	24.20	**0.0874**	23.83
	1995	**0.0843**	23.38	**0.0839**	22.84
	1997	**0.0770**	21.32	**0.0772**	21.00
Large firm to small firm	1991	**–0.0685**	–8.26	**–0.0604**	–6.75
	1993	**–0.0613**	–7.39	**–0.0527**	–5.89
	1995	**–0.0556**	–6.71	**–0.0472**	–5.27
	1997	**–0.0461**	–5.56	**–0.0412**	–4.60
Small firm to large firm	1991	**0.0441**	6.33	**0.0443**	5.83
	1993	**0.0658**	9.43	**0.0665**	8.74
	1995	**0.0730**	10.47	**0.0770**	10.13
	1997	**0.0837**	12.00	**0.0860**	11.30
Large firm to large firm	1991	**–0.0270**	–3.42	**–0.0373**	–4.40
	1993	**–0.0229**	–2.90	**–0.0330**	–3.89
	1995	–0.0055	–0.69	–0.0138	–1.63
	1997	**0.0178**	2.26	0.0085	1.00
Interaction rural-urban. small-large	1991	–		0.0340	1.59
	1993	–		0.0159	0.74
	1995	–		–0.0020	–0.09
	1997	–		0.0024	0.11
Interaction rural-urban. large-small	1991	–		–0.0384	–0.95
	1993	–		–0.0530	–1.31
	1995	–		–0.0524	–1.30
	1997	–		–0.0158	–0.39

Table 6.7 (continued):

Variable		Specification 1 Coef.	t-statistics	Specification 2 Coef.	t-statistics
Interaction rural-urban. large-large	1991	–		**0.1198**	3.63
	1993	–		**0.0986**	2.99
	1995	–		**0.0968**	2.93
	1997	–		**0.0976**	2.96
Interaction urban-rural. small-large	1991	–		**–0.0842**	–2.44
	1993	–		**–0.0496**	–1.44
	1995	–		**–0.0756**	–2.19
	1997	–		–0.0438	–1.27
Interaction urban-rural. large-small	1991	–		**–0.0702**	–2.53
	1993	–		**–0.0655**	–2.36
	1995	–		**–0.0658**	–2.38
	1997	–		–0.0449	–1.62
Interaction urban-rural. large-large	1991	–		0.0377	1.25
	1993	–		0.0525	1.75
	1995	–		0.0295	0.98
	1997	–		0.0425	1.41
Constant		**10.0603**	666.3	**10.0603**	666.3
		Test statistics			
N (groups)		58 112		58 112	
F(58111, 232380); F(58111, 232356)		53.82		53.82	

Notes: All coefficients significant at least at the 5 percent level are in bold. In the case of censoring, wages are calculated in the framework of an imputation procedure using Tobit estimation method.

Source: Authors' own calculations using IAB-REG data.

Moving between firms of different size yields the expected results. Workers who move from small firms to large ones benefit from an additional wage bonus of 4.4 percent in the year after migration. Moreover, they enter a steeper wage growth path than workers in small firms. Leaving a large firm towards a small one gives negative coefficients (between –6.8 percent and –4.6 percent) indicating that this group of movers looses a part of their former firm-size wage premium.[159]

Turning to the regional dimension of mobility, it is evident from *Table 6.7* that only in the first year after moving the general effect of regional migration (changing firms between regions irrespective of the region type) is different from the general effect of firm mobility (changing firms within regions) (–1.5 percent). This effect of changing the region strongly depends on the migration patterns between more

159 Note that the effect of changing the firm is still positive for this group when the general positive effect of firm mobility is taken into account.

dense (i.e. high-wage areas) and less dense (i.e. low-wage areas) regions. For rural/urban migrants we observe significant wage gains. In the first year the wage premium relative to rural stayers is 2.8 percent, increasing monotonically during the observation period to an amount of 6.3 percent in 1997. By contrast, workers who leave dense urban areas do not experience significant losses in their earnings in the first years after their move. Only towards the end of the observation period a significantly negative effect occurs (–3.2 percent in 1997). This result confirms some predictions of migration models which state that a large fraction of the urban wage premium persists even after leaving a dense area.[160] However, the evidence here suggests that the wage growth path for workers in rural areas is somewhat flatter than in urban areas.

To sum up, our findings indicate that behind the urban wage premium of about 8.5 percent (see *Table 6.5*) we can identify a statistically significant *wage level effect* (2.8 percent) on the one hand as well as a statistically significant *wage growth effect* (up to 6.3 percent) on the other. The results suggest that unobserved time-invariant heterogeneity or workers does not play a crucial role in our cohort.

The same is true for the firm-size differential. Both the *wage level effect* and the *wage growth effect* are observable for movers from small to large firms. The losses being related to a change from a large firm to small one more or less compensate the general effects from moving in the first year after moving. Over time, the balance of the two effects becomes positive (in 1997: 7.70 – 4.61 = 3.09 percent). Hence the wage level effect is only slightly positive in this case and, again, the benefits from moving increase over time. In general, the results point to the fact that the firm-size *wage level effect* is more important than in the regional context.

In order to analyze the role of large firms for the development of the urban wage premium more deeply, we additionally include cross effects of regional migration and firm size mobility in the estimation approach. The results of specification 2 illustrate that more than one half of the cross effects are statistically not different from zero: neither we observe an extra bonus for those workers who change their workplace from small (large) rural firms to large (small) firms in urban areas, nor can we find an additional penalty for urban-rural movers within the large firm category. Interestingly, negative cross effects (between –5 percent and –8.4 percent) emerge for firm size movers leaving metropolitan areas. In the first year after moving, individuals switching between both categories earn about 7–8 percent less than urban-rural migrants who change within the size categories. This supports the

160 In these models the premium continues because of a selection bias. Mobile workers move to rural areas only if they expect high wages in the region of destination.

view that the transferability of acquired skills between types of regions is more pronounced within the size categories than between them. The effect fades away until the end of our observation period indicating that the long-time urban-rural wage growth is not affected by the change of firm-size categories.

A positive cross effect is apparent from *Table 6.7* for individuals changing their work place from large firms in rural areas to large firms in urban areas.[161] The rural-urban *wage level effect* for this group is about 12 percent. In the years 1993 to 1997 the effect is slightly reduced to an amount of roughly 10 percent. At the same time, the *wage level effect* for all groups of movers into metropolitan areas vanishes, signifying that the level effect documented in specification 1 is driven by this special group of migrants. The *wage growth effect* has slightly decreased relative to specification 1, but it is still highly significant.

All together, the results point out that the bulk of the urban wage premium is due to the *wage growth effect*. Generally, it is the urban environment with pronounced facilities of human capital accumulation which makes workers more productive. The *wage level effect* specifically differs for groups of movers. We conclude that the very high premium for movers to large urban firms stems from the fact that these establishments recruit the most productive workers by offering them attractive starting wages. Besides this, the results demonstrate that accumulation of skills does also take place in large firms.

6.4 Conclusions

Summing up the main results we find clear evidence for the existence of an urban wage premium in Germany. The raw premium of about 15.5 percent can be reduced by controlling for personal characteristics to approximately 13.5 percent. Introducing firm size categories in the econometric specification additionally lowers the magnitude of the urban wage premium by roughly one fourth. Hence firm-size differences between rural and urban areas explain a non negligible part of the interregional wage differential. Our findings suggest a certain relationship between agglomeration and firm-size effects. However, the urban wage premium does not completely vanish after including firm size controls. One has to conclude, therefore, that agglomeration effects work not only through firm-size effects. A further influence on the urban wage premium might stem from industry structure being specific to the region type. Controlling for these effects as well yields an urban wage premium of 8.6 percent.

161 Further analysis not documented in the paper give evidence that this cross effect is especially high (more than 20 percent) for skilled movers with a potential work experience of 10 to 15 years.

When it comes to the theoretical explanation for the existence of an urban wage premium Glaeser and Maré (2001) distinguish between the following hypotheses: firstly, the more productive workers might be over-represented in cities, which would imply an *ability bias* between urban and rural areas. Secondly, workers with identical characteristics might be more productive in cities, hence they benefit from a *wage level effect* when moving from rural to urban areas. Thirdly, the environment of the city might lead to dynamic external effects rendering workers more productive over time, i.e. a *wage growth effect* exists. This would be the case, for example, if knowledge spillovers are more likely in cities.

The descriptive evidence shows that the share of high-skilled workers is higher in urban areas. Nevertheless, the fact that the urban wage premium survives the inclusion of skill controls rejects the presumption that region-specific differences in human capital endowment explain the observed differences in earnings. An alternative explanation of the urban/rural wage differentials stresses *unobserved heterogeneity*. According to this view, the urban wage premium might accrue if – due to unobserved characteristics – urban workers exhibit a higher ability. However, after controlling for individual fixed effects we find that workers who change their work place from rural areas to cities gain from migration. Therefore, we are quite certain that the urban wage premium is not due to *omitted ability bias*.

Analyzing fixed-effects estimates, we do not observe wage penalties for urban-rural movers. Together with the wage gains of rural-urban movers accruing over time in the years following migration, this leads us to the conclusion that the *wage growth hypothesis* is the most plausible explanation. This is also corroborated by cross effects of urban status and experience indicating that experience rating is distinctly higher in cities.

Another main question in our paper is whether processes being responsible for urban wage growth take place within or outside large firms. To answer this question, we additionally analyze data on firm (size) movers. The firm size earnings differential of roughly 11 percent seems to be a result of both, a *wage level effect* and a *wage growth effect*. Workers being occupied in a small firm in 1990 and entering a large one thereafter, are observed to get a contemporaneous wage boost of approximately 4 percent. The benefits from working with the large firm increase over time and reach more than 8 percent by the end of our observation period.

Introducing cross effects of interregional and firm-size migration yields some new insights. On the one hand, the urban *wage level effect* can be attributed to workers being recruited by large firms. On the other hand, the urban *wage growth effect* can still be identified. Moreover, the cross effects demonstrate that transferability of human capital is more pronounced between firms of the same size category. All together, the results lead us to the conclusion that large firms play

a crucial role for explaining the higher productivity in urban areas. Nevertheless, there is overwhelming evidence that wage growth in urban areas is not tied to the firm level. Hence our findings confirm the view that externalities are operating in the urban environment and not only within the firms.

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Appendix

Table A6.1: Regional Classification Scheme based on BBR-Classification

Structural region type	District type (BBR-Classification)	Region types (RT) used in the paper	Description of region type (BBR)
Regions with large agglomerations	BBR1	urban	Core cities
	BBR2	urban	Highly urbanized districts in regions with large agglomerations
	BBR3	rural	Urbanized districts in regions with large agglomerations
	BBR4	rural	Rural districts in regions with large agglomerations
Regions with features of conurbation	BBR5	urban	Central cities in regions with intermediate agglomerations
	BBR6	rural	Urbanized districts in regions with intermediate agglomerations
	BBR7	rural	Rural districts in regions with intermediate agglomerations
Regions of rural character	BBR8	rural	Urbanized districts in rural regions
	BBR9	rural	Rural districts in rural regions

Table A6.2: Selection of Data (1990/91/93/95/97)

	number of cases
total number of individual observations	1,317,227
old laender only	1,131,290
multiple employed workers excluded	1,117,831
with valid earnings information	1,083,153
workers in an apprenticeship, volunteers, family workers excluded	1,019,969
with valid information about experience and place of work	942,823
part-timer workers excluded	826,913
Observations used in our sample	826,913

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7 Summary and Conclusions

The dissertation deeply investigates the effects of interregional migration on earnings of workers. Throughout the thesis we restrict the analysis on employed workers. Mobile workers are defined as persons who change the region type where the workplace is located from one year to the succeeding year. The definition stresses the role of the characteristics of regions for wage determination. By contrast, completely immobile persons in this one-year period are denoted as stayers.

In a first step we contrast the average earnings of movers and stayers before and after migration potentially occurs. We find that prospective movers have distinctly lower mean earnings than their immobile colleagues. After migration, the average mobile worker typically catches up with the average stayer in the region of destination or even experiences higher wages. This can be seen as first hint that mobility entails a positive effect on wage growth of workers. Before we turn to analyze the wage growth effects of interregional mobility, the thesis focuses – as starting point – on differences in characteristics between mobile and immobile workers and the effects on their remunerations.

Comparing movers in the year after migration with their immobile counterparts, one can observe that movers are typically more skilled than stayers and that male workers are over-represented in the group of movers. Applying Blinder/Oaxaca type decompositions at different levels of aggregation it turns out that both factors contribute to higher mean earnings of movers. A further positive impact is given by the regional distribution of workers after migration. We find that the share of movers in dense agglomerated (high-wage) areas is somewhat higher than the share of stayers. This is consistent with the observation that mobile workers choosing peripheral rural (low-wage) areas as region of destination are clearly under-represented. On the negative side, mobile workers are younger and they are more likely to work in smaller firms. Altogether, one can conclude from the results that movers tend to have less favourable (observable) characteristics than stayers. Hence, the positive raw wage differential of movers over stayers cannot be explained by observed characteristics.

On a disaggregated level, the evidence presented in chapter 2 indicates that the earnings differential of movers and stayers differs substantially for several groups of workers. For instance, while highly-skilled individuals with relatively low working experience choosing rural districts as destination region have on average a wage advantage of 11 percent relative to the incumbent reference groups (neglecting other dimensions like gender, firm size, ...), the corresponding value for low-skilled older workers who enter metropolitan areas is –7 percent. Thus, a

"general effect" of regional mobility has to be discussed very carefully against the background of heterogeneous workers.

This is clearly corroborated by the results of chapter 3, which supplements the analysis with respect to two further important dimensions of characteristics, i.e. firm size and gender. Young, highly-skilled male workers, who change their workplace to a small firm, get 5 percent higher wages than their reference group. By contrast, old low-skilled men entering large firms are worse off compared to their new colleagues (–8 percent). Besides age and skill differences, one can argue that further aspects like the firm-size wage differential and the urban wage premium plays a crucial role for understanding the mover-stayer wage differential. These results, namely the positive wage level differential for movers from urban to rural areas and from large firms to small ones, can be seen as first hint that transferability of former acquired premia play a crucial role for assessing the success of migration. Applying the decompositions for female movers and stayers, it is obvious that the positive post-migration wage level differential is distinctly higher in the aggregate than for male workers. To some amount this can be traced back to the overall characteristics effect for mobile female workers which is also negative, but less pronounced than for males. A major difference between genders was found in the strength of the experience effect. Since experience rating is lower for females, the wage penalty for young female workers who are more likely to move than older persons is lower. Interestingly the rewards effect for female movers is positive in the most comprehensive model. Although the magnitude of this effect is not excessive, one can conclude that changing the region type pays out more for female workers. One has to note, however, that this finding hold for the women selected in our sample. Since we do not discuss the problems associated with tied mobility we do not claim representativeness for the whole female population. Moreover, the analyses in papers 1 and 2 are based on a sub sample. Since the number of female movers is very limited here, some cells in a much disaggregated decomposition are barely filled.

The greatest drawback against cross-sectional comparisons of wage levels of movers and stayers is unobserved heterogeneity (i.e. self-selection or endogeneity, respectively). Therefore papers 1 and 2 should be taken as starting point for more elaborated analyses. Moreover, a more interesting research question is, whether persons who migrate are doing better than if they had stayed in the region of origin or the firm they were employed in, respectively. However, since the latter outcome is counterfactual, a more promising approach is to compare movers with a reference group which is observationally equivalent in their characteristics. Results of several variants of a propensity score matching approach (as robustness check entailed in chapter 2) reveal that regional mobility actually has a positive

effect. A further check employs a fixed effects model and corroborates the finding that the (one year) wage growth is higher for movers than for stayers. Since fixed effects models control for time-invariant unobserved heterogeneity, for instance differences between movers and stayers in their motivation, career attitudes or working behavior, they are fairly appropriate to analyze the effects of regional mobility on wages of workers.

Therefore we apply this approach in chapter 4 to investigate the returns to regional migration more thoroughly. Our empirical work is based on the employment register data 1999–2005 of the German Federal Employment Services which covers nearly 80 percent of the German workforce. We exploit the panel structure of the data and observe a cohort of workers for several years. Besides short-term effects, we are thus able to identify the long-term wage growth effects of regional mobility. In order to increase the homogeneity of the sample, we restrict the analyses on full-time working male employees of the medium qualification group. The results corroborate the finding of positive effects of regional mobility: The short-term wage growth differential relative to stayers is about 5 percent and it increases by 1.5 percentage points until the succeeding years. On this stage of analysis, however, one could claim that changing the region includes a change of employer. I.e, the effects of regional mobility being obtained by regional movers/stayers-comparisons might actually be due to the effects of job mobility. Therefore, we concentrate in the following on comparisons of regional movers and establishment movers (who remain in the same district). This allows the identification of the extra return to regional mobility compared to job mobility. Moreover, one can argue that self-selection issues should play a minor role than in the movers-stayers comparisons since both, regional and establishment movers decide to change jobs. Some indication for this hypothesis is obtained by the descriptive evidence which suggests that regional movers and establishment movers are more similar in their characteristics than it was the case for the former reference group of stayers. Discussing the theoretical background and the implied empirical approach, we come to the conclusion that endogeneity is actually of minor (or even no) importance.

The results points to the fact that the short-term extra effect is actually due to job mobility. In the long run, we find clear evidence of an additional effect of interregional mobility compared to local job-to-job mobility. Similarly to the results obtained by Yankow (2003) for the US, this premium becomes fully effective with a lag of three to four years. These results for the pooled sample are supplemented by investigations at the more disaggregate level. Considering different age groups we find that young workers with a potential work experience of less than ten years benefit more from region-type mobility than older workers. For the latter group, contemporaneous returns to region-type mobility are even negative. However, for

this group, too, steeper wage growth paths are observed than for the reference group of older establishment movers. This leads to a small positive effect in the medium run.

Pronounced heterogeneity emerges especially when we analyze mobility conditional on the region type. Compared with non-migratory establishment movers in the region of origin, the short-term wage growth is statistically significantly negative in metropolitan areas and metropolitan surroundings while the opposite is true in central cities and rural areas. Regarding the long-term effects for workers leaving the most agglomerated areas, it emerges that the negative wage growth differential declines in the succeeding years, but is still slightly negative in 2005. For the other region types, the long-term wage growth differential is positive and amounts to 3–4 percent.

More specific information on the outcomes of regional mobility is obtained after partitioning the sample further by the region of destination. We find that the results presented for the region types of origin are still compositions of quite heterogeneous destination-specific effects: for instance, while movers from metropolitan to rural areas exhibit significant wage growth losses, the long-term wage growth for movers to metropolitan surroundings coincides with the growth path of non-migratory metropolitan establishment movers. Generally, it turns out that the wage growth returns are much higher, the less densely populated the region type of origin and the more densely populated the region type of destination. These results corroborate theoretical considerations: movers to more densely populated areas benefit from an overall higher wage level and workers who leave the densely populated areas lose at least part of the urban wage premium. Looking into the reasons for an urban wage premium, one can distinguish between short- and long-term effects. On the one hand, immediately after migration individuals should be compensated for high urban price levels; on the other hand the long-term wage growth should be higher, for instance due to wage-enhancing factors such as knowledge spillovers, which lead to workers' increasing ability over time. Our results indicate that price level effects do not play a dominant role in explaining the wage growth effects of region-type mobility. Actually, finding pronounced wage growth effects, we are quite confident that externalities operating in the urban environment are an important determinant for the mobility wage growth premium.

From theoretical considerations, other determinants for the mobility wage growth premium might be search gains and employer-employee match quality. Actually, including fixed establishment effects in the wage equation reveals that search gains (i.e. moving to a better paying firm) are equally important for the explanation of the mobility wage growth differential as human capital accumulation.

Focusing on the within-job wage growth path of region type and establishment movers one can conclude that matching effects add a further positive component for young mobile workers.

The additional effect of regional migration over non-migratory job-mobility is also discussed in chapter 5. The focus lies here on sector-specific heterogeneity. To eliminate regional price level differential we observe movers between regions which are roughly of the same type. It turns out that the additional effect of regional mobility differs on the sector level to a large extent. While the short-term effect is zero in the aggregate, it ranges from –2.91 percent in *raw materials* to +1.35 percent in *construction 2*. The long-term effects are even more dispersed. Though sector-specific wage growth paths of regional movers are generally steeper than those of establishment movers the range six years after migration is between –0.74 percent in *raw materials* and +4.89 percent in *household services*. Further sectors with pronounced long-term extra-effects are *consumption goods* (+3.91 percent) and *public services* (+3.47 percent).

We investigate several hypotheses for explaining sector-specific differences. Firstly, hypothesizing that differing extra-effects might stem from systematical changes from low-wage to high-wage sectors, we explore the importance of sector mobility. We observe that sector mobility is not systematically related to changes from low-wage to high-wage sectors. However, results from restricted sample estimates suggest that sector mobility explains the whole premium in *food, beverages & tobacco* and *business services*. Moreover, it significantly contributes to the explanation of the additional effect in *construction 2* and has minor explanation content in *public services.* For the remaining sectors, mobility between them plays no role for the results. Secondly, we examine the role of distance. For *household services* and *transport & communication* one observes high shares of long-distance movers together with large values for the extra returns when restricting on this group. Hence, contrary to other sectors, long-distance mobility explains a substantial fraction of the extra return in these two sectors. Investigating thirdly the sector-specific extra returns of young workers separately, the results suggest that the explanation content of the age structure is of minor importance.

Altogether, one can conclude from our results that sector mobility and distance are important sources for explaining the positive additional effect of regional migration in specific sectors. In other sectors both explanations are inappropriate. We are quite sure therefore, that differences in both, human capital accumulation and quality of matches between employer and employee, further can be seen as major explanation for sector specific heterogeneity. Related to that, it is evident that human capital accumulation and job matching are highly important for explaining the wage growth effects after regional migration.

The last finding is discussed in depth in chapter 6 which analyzes the relationship between the urban wage premium and the firm size earnings differential. Wage patterns of regional movers and firm movers are observed to explore the nature of both premia. Specifically, we follow to some extent an approach of Glaeser and Maré (2001) and ask whether both premia result from wage level effects or from wage growth effects. Our findings indicate that behind the urban wage premium of 8.5 percent, we can identify both, statistically significant wage level and wage growth effects. The same is true for the large-firm size differential of about 11 percent. Analyzing the role of large firms for the development of the urban wage premium more deeply, we include cross effects of regional migration and firm size mobility. It turns out that the urban wage level effect is mostly driven by a special group of workers who change from large establishment in rural areas to large establishments in urban areas. An urban wage growth effect can still be identified. Altogether, the results lead us to the conclusion that large firms play a crucial role for explaining the higher productivity in urban areas. Nevertheless, there is overwhelming evidence that wage growth in urban areas is not tied to the firm level. Hence our findings confirm the view that externalities are operating in the urban environment and not only within the firms.

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Kurzfassung

Die Mobilität von Arbeitskräften gehört zu den wichtigsten Anpassungsprozessen auf dem Arbeitsmarkt. Vor dem Hintergrund relativ niedriger Mobilitätsraten in Deutschland im Vergleich zu den angelsächsischen Ländern, beschäftigt sich diese Dissertation mit der Verknüpfung von Löhnen und Mobilität. Im Mittelpunkt steht die auf Mikrodaten gestützte Analyse der Auswirkungen von interregionaler Mobilität auf die individuelle Entlohnung. Dabei wird explizit berücksichtigt, dass sich die Arbeitskräfte bezüglich beobachtbarer Charakteristika wie Qualifikation, Alter und Geschlecht und auch unbeobachtbarer Merkmale unterscheiden. Eine nach Altersgruppen differenzierte Analyse ergibt beispielsweise, dass die Lohneffekte räumlicher Mobilität für Personen mit niedriger Berufserfahrung am größten sind. Weiterhin ist es von zentraler Bedeutung, ob sich die Auswirkungen als Niveau- oder Wachstumseffekte zeigen. Durch einen Vergleich mit Personen, die innerhalb einer Region den Betrieb wechseln, lässt sich ferner ein zusätzlicher Effekt von räumlicher Mobilität im Vergleich zu betrieblicher Mobilität identifizieren.

Neben der Heterogenität der Arbeitskräfte steht die Heterogenität von Betrieben und Regionen im Fokus. So werden aufgrund von Agglomerationsvorteilen in urbanen Gebieten deutlich höhere Löhne gezahlt als in ländlichen Gebieten. Bei einer nach Regionstyp von Ursprungs- und Zielregion differenzierten Betrachtungsweise ergibt sich in der Tat ein Lohnwachstumseffekt, der umso größer ist, je geringer die Dichte der Ausgangsregion und je höher die Dichte der Zielregion ist. Dies spricht deutlich für einen Agglomerationseffekt, so wie er in der Neuen Regionalökonomie postuliert wird. Interessanterweise spielt die Kompensation für das höhere (Miet-) Preisniveau in der Agglomeration, die sich im Lohnniveaueffekt niederschlagen sollte, eine untergeordnete Rolle bei der Erklärung der Mobilitätsprämie. Viel stärker sind die dynamischen Effekte, hinter denen positive Externalitäten der Bevölkerungsdichte wie Lerneffekte vermutet werden können. Weitere Analysen zeigen, dass ein Teil dieser positiven Externalitäten auf die Überrepräsentation von großen Firmen in Agglomerationen zurückzuführen ist, darüber hinaus die Effekte aber auch im urbanen Umfeld wirksam sind.

Summary

Regional migration of workers plays a substantial role in the adjustment process in the labour market. In the light of relatively low rates of internal mobility in Germany compared to Anglo-Saxon countries, this thesis analyses the effects of interregional mobility on the earnings of workers. In so doing, the thesis highlights the workers' differences in observable characteristics like gender, age or skill category and unobservable characteristics like intelligence or motivation. Using employment register data of the German Federal Employment Services we find, for instance, the returns to interregional mobility to be largest for young workers. Moreover, exploiting the panel structure of the data, we are able to identify the long-term wage growth effects of regional mobility. And, comparing regional movers and non-migratory establishment movers identifies the additional effect of regional mobility compared to local job-to-job mobility.

Besides giving the best attention to the heterogeneity of workers, the empirical research on wage effects of mobility has to care about the heterogeneity of firms and regions. Among other analyses, we partition the sample of movers conditional on region of origin and destination and find that the wage growth returns are much higher, the less densely populated the region type of origin and the more densely populated the region type of destination. These results corroborate theoretical considerations: movers to more densely populated areas benefit from an overall higher wage level. Looking into the reasons for an urban wage premium, one can distinguish between short- and long-term effects. On the one hand, immediately after migration individuals should be compensated for high urban price levels; on the other hand the long-term wage growth should be higher, for instance due to wage-enhancing factors such as knowledge spillovers, which lead to workers' increasing ability over time. Our results indicate that price level effects do not play a role in explaining the wage growth effects of region-type mobility. Actually, finding pronounced wage growth effects, we are quite confident that externalities are an important determinant for the mobility wage growth premium. Further analyses confirm the view that these externalities are operating in the urban environment and not only within firms.

Regional migration of workers plays a substantial role in overcoming regional employment disparities and hence in reducing unemployment. Compared to Anglo-Saxon countries, however, rates of internal mobility are relatively low in Germany. One explanation for this might be an insufficient effect of migration on wages. Florian Lehmer therefore analyzes the short- and long-term effects of interregional mobility on the earnings of workers and identifies the groups who benefit most from the migration wage premium. Apart from the heterogeneity of workers, he devotes special attention to the heterogeneity of firms and regions. He finds that analyses of migration flows between rural and urban areas, in particular, give important insights into the nature of the agglomeration wage differential and its impact on the migration wage premium.

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