The Rural/ Urban Wage Premium, Backwater and Firm-Size Effects – A Microdata Cohort Analysis for Germany

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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 wage differential. Choosing a cohort of workers from a large panel micro data set we find a raw urban wage premium of 15 percent. Controlling for firm size lowers the premium by 1/3. Evidence on migrants implies that the effects of rural/ urban migration are dominated by the effects of changing the firm size category. Therefore, we suggest that the urban wage premium is strongly interrelated with the firm-size wage differential.

Keywords:

Urban- rural migration, firm-size mobility, wage growth, urban wage premium, firm-size wage premium.

JEL-classification: J61, R23

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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, 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)].[1] 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. Thirdly, the concentration of purchasing power in agglomerations causes higher demand. The New Economic Geography (NEG, see Fujita, Krugman, Venables (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.

[1] 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).

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, which increases 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. Rauch (1993), Lucas (2001)].

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. 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.[2] A second reason for the attractiveness of cities might be their amenities (possibilities of consumption, cultural activities), which cater those with high incomes. 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.[3] 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 do 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, Idson (1999) distinguish between

[2] See Peri (2001) for a formal model.
[3] Beside Glaeser and Maré (2001) also Wheaton and Lewis (2002) find that firms in dense areas pay more for equivalent workers than in rural areas. Möller and Haas (2004) present similar results for West Germany.

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[4]. Brown, Medoff (1997) 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.[5]

There are several similarities in the explanation of the urban and the firm size wage differential. In both cases one can distinguish between more productivity and more ability related hypotheses. 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 can argue that the large firm benefits 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. Following the approach of Glaeser, Maré (2001) 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 to not only to consider regional mobility, but also to shed light in the "black box" firm size mobility.

[4] The increased capital/ labor ratio leads to an advanced adoption of new technologies.
[5] An alternative survey of possible explanations for the size- wage premium is given by Troske (1999).

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 3 presents some descriptive evidence. Section 4 introduces our econometric model and section 5 concludes.

2 Data and basic definitions

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). 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. We consider all workers aged 16 to 70 years who were employed at the 30th of June of each year. 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 A1*). The data also includes information about firm size which is crucial for our purpose. In the

following we differentiate between small firms (1-50 workers), firms of medium size (51- 500 workers) and large firms with more than 500 workers (see appendix, *table A2*).

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 A3* for data selection).

2.2 Basic definitions and methods

Throughout the paper we investigate two different aspects of mobility. The first, regional mobility of employed workers, is defined *as a change in the region where the workplace is located*. The second aspect of mobility is related to firm size. Firm-size mobility is defined as a change of the firm size category where a person has his or her workplace. We are interested in wage growth effects accruing from a change of region and firm size, respectively. To this aim we concentrate on a cohort of workers. Based on the observation for the 1990 and 1991 we divided the cohort into stayers and movers with respect to the two forms of mobility defined above.[6] We only select workers who were observed in all of the years 1990 to 1997 and did neither show regional and firm-size mobility after 1992. Workers who had their work place in 1991 in a different (the same) region than in 1990 are addressed as *regional movers* (or *stayers*, respectively). Correspondingly, we differentiate between *firm size movers* and *firm size stayers*. *Table 1* gives some information on the number of observations for movers and stayers in our sample. In total, we have 62,785 persons in the cohort. Within the total 1,777, or 2.8 percent, regional movers can be identified. The group of *firm size movers* comprises 2,961 persons or 4.7 percent. The group of persons who changed the region of the workplace *and* the firm-size category of the employer consists of 880 workers (1.4 percent).

[6] 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 1984/ 85 to 1989/ 90. These results are not documented here and are available from the authors on request.

3 Firm size and region types: Some descriptive evidence

Table 2 shows that 58 percent (36,525 workers) of all workers in the cohort are employed in urban areas. The share of workers within the smallest firm-size category is about 24 percent, while 31 percent of all individuals with urban status are occupied in firms of medium size and 45 percent in large firms. The share of workers in these firm-size categories is markedly different in rural areas: 77 percent are employed in firms of small and medium size while the share of workers in large firms is only one half of that in urban areas. These results give evidence that workers in large firms are clearly over-represented in cities and under-represented in rural areas.

Table 3 shows differences in the average skill levels of male and female workers in urban and rural areas. High-skilled workers are obviously concentrated in urban areas. The share of high-skilled male employees in cities is more than double the value for rural areas. The same is true for female workers of the same skill category.[7] Most interestingly, however, the share of low-skilled workers in rural and urban areas turns out to be more or less comparable. Differences are found for the intermediate skill category. Male workers of this category are over-represented in rural areas while the corresponding share of their female counterparts is somewhat higher in urban areas.

Comparing the same categories across small, medium and large firms yields the results shown in *table 4*. For males the share of low-skilled and high-skilled workers increases with firm size while the share of workers of the intermediate category is almost constant. By contrast, the share of skilled female workers markedly decreases with firm size. The share of females of this skill category is twice as high in small firms compared to large firms.

Some basic facts on mobility are given in *table 5*. The main part of regional mobility affects moves within region types. From the total of 1,777 regional movers we identify 620 workers who change the region type of their workplace. In the years 1990/ 91, a net outflow of mobile workers from cities can be observed (334 workers leave dense areas while only 286 move into such areas). The migration to

[7] Note that only employees with no interruptions in their employment spells were selected here. Since female workers typically exhibit more unstable employment patterns, the females are somewhat underrepresented in the sample.

rural areas was associated with a change of firm size in 43 percent of all cases. More than half of these firm size movers switched to a smaller firm than before.

Contrary to that, the likelihood to change firm size is distinctly higher for rural- urban movers (60 percent). About 77 percent of the individuals who meet both aspects of mobility are occupied in a larger firm than the year before. This descriptive result shows that firm size mobility is strongly associated with regional mobility which is especially true in the case of migration into cities.

4 Econometric estimates

4.1 Outline of the estimation approach

In order to investigate the wage (growth) effects being associated with a change of region or firm size we estimate Mincer-type wage equations[8] extended by (0,1)-dummy variables in order to capture the effects of mobility at the beginning of our observation period. In our first approach we concentrated on the effects of regional mobility only. Subsequently we additionally included firm size and firm size mobility. More specifically, our estimation approach assumes a linear relationship between log earnings[9] and several explanatory variables measuring skill, (potential) experience and other characteristics of the worker and the employer. The workers´ potential on-the job experience is measured in years as age minus average duration of education[10] minus six. Potential experience enters the wage equation in linear and quadratic form to model the typical non-linear (concave) wage/ experience profile. Differentiating by gender and skill we obtain six categories of workers. The skill/ gender effect is measured by corresponding dummy variables using low-skilled males as a reference category. In addition, our estimation approach includes three separate (0,1)-dummy variables for the urban status differentiating by skill. Hence we allow the urban wage premium to differ between low-skilled, skilled and high-skilled workers. Accordingly, interaction variables of regional migration and skill levels are included. Urban- rural and rural- urban migration are captured by two further (0,1)-

[8] See Mincer (1974).

[9] Wages in our data source are daily gross earnings calculated as average over the observed employment period for each person. The concepts wages and earnings are used interchangeably throughout this paper.

[10] 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.

dummies. Finally, we introduce interaction effects between the workers´ experience with gender and qualification[11]. Hence the equation to be estimated is given as

$$\begin{aligned}\ln w_i = {} & \alpha_0 + \alpha_1 EXP_i + \alpha_2 EXP_i^2 + \sum_{n=2}^{6} \alpha_{3,n} DSKILL_{n,i} \\ & + \alpha_4 CITY^{enter}{}_i + \alpha_5 CITY^{exit}{}_i \\ & + \text{interactions of regional migration with skill categories} \\ & + \text{interactions of urban status with skill categories} \\ & + \text{interactions of experience and experience squared} \\ & \text{with gender and qualification} + u_i .\end{aligned} \tag{1}$$

The dependent variable w_i stands for earnings of individual i, *EXP* denotes potential experience. The (0,1)-dummy variables $DSKILL_n$ ($n = 1,\ldots,3$) indicate male workers with low, intermediate and high skills, respectively, and $DSKILL_n$ ($n = 4,\ldots,6$) the corresponding three skill categories of female workers. The dummy variable $CITY^{enter}$ takes the value of one if a worker migrates from a rural into an urban area while $CITY^{exit}$ denotes the opposite direction of regional migration. The error term u_i is assumed to be identically and independently distributed. The data is censored (top-coded) because of an upper ceiling in earnings which is relevant for the contributions to the social security system in Germany. Hence we use the Tobit estimation method.

4.2 Estimation results

Table 6 contains the results of the Tobit estimates for the years 1991, 1993, 1995 and 1997. The Pseudo-R^2 ranges between 0.39 in 1991 and 0.32 in 1997. The standard error is about 0.30 in all cases. A significant influence of the explanatory variables at a very high significance level is indicated by the Likelihood-Ratio Tests. The number of observations is 62,785 whereof between 8,704 (1997) and 9,483 (1993) observations are right-censored.

The estimated coefficients being connected with the skill/ gender categories are subject to some variation. Compared with the reference category of low-skilled male workers, the skill premium for

[11] 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.

males in the intermediate category increases from 7.2 percent in 1991 to 11.8 percent in 1997 while for high-skilled males it increases from 58 percent to 68 percent.[12] All skill premia are distinctly lower for female workers.

The estimated coefficients for the interaction *urban status / skill category* show that the urban wage premium tends to increase with qualification.[13] Low-skilled workers in urban areas obtain a premium of 12 percent, whereas those for skilled and high- skilled workers are slightly above. This can be compared with an estimate excluding control variables, yielding a raw urban wage premium of about 15 percent. By contrast, the raw urban wage premium found by Glaeser and Maré (2001) is roughly 33 percent for the US. Hence there is some indication that the urban/ rural wage differential is somewhat lower in Germany compared to the US. One should note, however, that to some extent this difference in the urban wage premia might be due to our broader definition of urban and rural areas. [14]

Sign and magnitude of the coefficients for experience (squared) and the interaction dummies correspond to theoretical expectations. In every year there is a marked positive interaction effect with qualification while the interaction of experience and gender is statistically significant in all cases. Hence the results indicate that experience rating increases with the skill level and is substantially lower for female workers. For the latter, note that we do not have information on actual experience, but only on *potential* experience in our data set. Employment interruptions that are more likely for female than for male workers might explain at least some of the differences.

With respect to the estimated coefficients for the interaction *regional mobility / skill category* we are unable to identify a positive general effect of moving. Only in the years 1993 and 1995 one can observe a statistically significant positive impact of regional mobility on wages of skilled workers. Besides this overall effect of regional mobility our approach allows us to differentiate between rural-urban and urban- rural migration. In the year immediately after migration, the estimated coefficient for rural- urban mobility is significantly negative amounting to 6.6 percent. The effect somewhat diminishes over subsequent years and becomes statistically insignificant in 1997. These results

[12] Throughout the paper we use log percentage or log percentage points, respectively.
[13] Following the recent contribution by Gould (2005) living in cities can be regarded as investment in human capital. This investment is more valuable for white-collar workers.
[14] According to Di Addario and Patacchini (2004), the urban wage premium in Italy is even lower and amounts to only 2-3 percent.

indicate that workers moving from rural areas into cities are unable to appropriate the full urban wage premium immediately. This indicates the existence of a temporary "backwater"- effect which seems to characterize individuals from rural areas. According to these results, the effect fades away after some years.

For urban-rural movers the estimated coefficients confirm some predictions of migration models which state that a large fraction of the urban wage premium persists even after leaving a dense area.[15] In all observed years the wage advantage compared to rural stayers is significantly positive and amounts to 5 percent.

Up to now we neglected the roles of firm size and firm size mobility. In the next section we investigate the robustness of the results if these further aspects are introduced.

4.3 Firm size effects

The effect of firm size on earnings is captured by firm-size (0,1)-dummy variables taking the smallest category (1-50 workers) as reference. We additionally include the term

$$...+\alpha_6 FSIZE\_M_i + \alpha_7 FSIZE\_L_i + ... \qquad (2)$$

in the estimation approach described above, where $FSIZE\_M$ and $FSIZE\_L$ indicate the medium and large firm-size category, respectively.

The results are contained in *table 7*. Note that the Pseudo-R^2 is increased by about 10 percentage points compared to our first approach. This corroborates the hypothesis that firm size has an important impact on wages. Except for the estimated coefficients related to mobility we observe quite similar results for all years.

The estimated coefficients for the firm size variables reflect the often documented finding that wages are higher in larger firms. The raw firm size differential in our sample is 33 percent for large firms. Using our estimation approach with a battery of control variables, this differential is reduced to 25 percent, but is still significant. For medium size firms we obtain a wage differential amounting to 18

[15] 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.

percent. These results are similar with those of Brown et al. (1990) for the U.S. who found a firm size differential of 35 percent when comparing firms with more than 500 workers to those having less than 25 employees.

The introduction of firm size affects some of the coefficients in the original estimation approach. A noticeable difference appears with respect to the interaction *urban status / skill category,* where all coefficients are distinctly lower in the extended approach. The urban wage premium for skilled workers is now 8.5 percent instead of 13.2 percent which was obtained by neglecting firm size. The results indicate that one third of the raw urban wage premium can be can be explained by the firm-size controls.

Contrary to our first approach, the estimated coefficients for the interaction *regional mobility / skill category* now exhibit a positive general effect of moving for the group of skilled workers irrespective of their region of destination. Skilled male and female workers who changed the region of their workplace from 1990 to 1991 experienced a wage gain in comparison to stayers in the amount of 2.2 percent in 1991 which accrues to about 4 percent in the years 1993 to 1997. The results indicate, however, that low-skilled workers do not benefit from moving to this extent. Also for high-skilled movers we do not find a significant effect. However, for this group the number of observations may be too low to give statistically significant results.[16]

Taking firm size effects into account, the estimated coefficient of the rural- urban mobility dummy is even higher in absolute value than in our first approach (– 7.6 percent). Again, the effect decreases over the following years but remains non negligible and statistically significant in 1997 (– 4.4 percent). These results confirm the "backwater"-effect described above. However, they do not imply that rural- urban movers are worse off than rural stayers. For example, skilled rural- urban movers earn 3.1 percent[17] more than nonurban stayers, whereas skilled urban stayers earn 8.5 percent more. Moreover, the wage growth of skilled movers follows a steeper path than that of skilled rural stayers. The wage advantage compared to rural stayers is +6.9 percent in 1993, +7.5 percent in 1995 and +8.4

[16] Results not documented here show that the coefficient for high-skilled movers is significantly positive and between 5 and 8 percent when the number of observation is higher because part-time workers are included.
[17] This is calculated with the following coefficients: Interaction urban status / skilled (+8.5 percent) + Interaction regional migration / skilled (+2.2 percent) + Rural- urban migration (-7.6 percent) = 3.1 percent.

percent in 1997, thus supporting the hypothesis of a marked urban wage growth effect as stated by Glaeser and Maré (2001). In 1997 the urban wage premium of skilled movers is still slightly below the 9 percent for the incumbent urban workforce. This indicates that the "backwater"-effect is quite persistent.

Contrary to the results of *table 6*, the estimated coefficients for urban-rural movers now suggest that this group looses its urban wage premium without compensation.[18] However, according to our analysis there still exists a wage advantage for skilled urban-rural movers over rural stayers which is due to the general effect of moving mentioned above.

4.4 Mobility between firm size categories

In order to analyze the role of mobility between firm size categories, we additionally include six (0,1)-dummy- variables in the estimation approach. Hence the equation to be estimated is augmented by the following terms:

$$\begin{aligned} &... + \alpha_8 FMOB\_SL_i + \alpha_9 FMOB\_ML_i + \alpha_{10} FMOB\_SM_i + \alpha_{11} FMOB\_LM_i \\ &+ \alpha_{12} FMOB\_MS_i + \alpha_{13} FMOB\_LS_i \; ... \end{aligned} \tag{3}$$

where $FMOB\_IJ$ stands for a (0,1)-dummy variable taking the value of unity if a change from firm-size category I to firms-size category J $\left(I, J = \{S(mall), M(edium), L(\arg e)\}\right)$ occurs and zero elsewhere.

The results for the estimates of this equation are contained in *table 8*. The coefficients indicating a move to bigger firms are all highly significant and negative. Firm size movers who were employed in a small firm in 1990 and entered a large firm in 1991 only obtain roughly one half of the 25 percent premium earned by the average employee in a large firm. The wage reduction of 12.6 percent in 1991 diminishes to about 9 percent in 1993 and persists at this level for the rest of the observation period. Moves from small to medium firms and from medium to large firms exhibit similar effects although

[18] In 1993 and 1995 the coefficients are positive amounting to 3 percent, but significant at the 10 percent level only.

these are somewhat lower in magnitude. Our results suggest that movers to larger firms experience some kind of "stigma" being associated with the former occupation in a smaller firm.

Firm size movers switching from medium to small firms are able to keep a significant fraction of their former firm- size premium, i.e. about 7 percentage points of the 18 percent premium. For the two remaining variables the estimated coefficients are positive, but predominantly not significant at the 5 percent level.

After introducing firm size mobility it is crucial to reconsider the estimation results for the remaining variables. The coefficients which are not related to regional mobility are coinciding with those of *table 7*. The general effect of moving for skilled employees has increased slightly. It is obvious from *table 8* that the estimated coefficient for rural- urban mobility is lower in magnitude. Disregarding the general effect of moving, migrants into cities earn 5.7 percent less than the incumbent workforce in 1991. This means that the wage reduction is 2 percentage points less than in *table 7*. Moreover, the duration of the effect is restricted to a shorter time period (until 1995). This change in the estimated coefficients has an important impact. Taking the general effect into account, movers into urban areas earn only 2 percent less than equivalent incumbent urban workers in the first year after migration. This is considerably lower than the 5.4 percent reduction as predicted without controlling for firm size mobility. Until 1993 and 1995 the negative earnings differential of urban movers over stayers has turned into a positive one (+1 percent). Two years later, skilled movers to urban areas earn about 5 percent more than their immobile counterparts.

5 Discussion of the results and conclusions

To sum up the main results we find clear evidence for the existence of an urban wage premium in Germany which slightly varies for different skill levels. Introducing personal characteristics reduces the raw premium of roughly 15 percent to approximately 12 percent. Controlling for firm size categories additionally lowers the magnitude of the urban wage premium by one third. Hence firm size differences at rural and urban levels explain a substantial part of the interregional wage differential. On the one hand these findings suggest an important interaction of agglomeration and firm-size

effects. On the other hand, since the urban wage does not completely vanish after including firm size controls, one has to conclude that agglomeration effects work not only through firm size effects.

Without controlling for firm size, our results basically support the findings of Glaeser, Maré (2001). Rural- urban movers undergo a certain wage disadvantage compared to the incumbent urban workforce. According to Glaeser, Maré (2001) this "backwater"- effect is explainable by faster accumulation of human capital in cities leading to a rise in the urban wage premium over time (the so-called *wage growth effect*). Our finding that urban- rural movers keep a fraction of the former urban wage advantage also complements the hypothesis of faster human capital accumulation in dense areas. Controlling for firm size categories leads to several new insights. The firm size wage differential of large firms is roughly 25 percent when controls for personal characteristics like skill, gender and experience are included. Hence, the firm size effects clearly dominate the spatial wage differences between cities and non-urban areas.

Using the approach augmented by firm size variables we are able to identify a positive general effect of moving for the group of skilled workers irrespective of the region of destination. At the same time, we observe that the "human capital bonus" for urban- rural movers compared to rural stayers disappears while the backwater effect for movers in the other direction increases. Within the observation period for the chosen cohort rural- urban movers do not completely catch up with the incumbent workforce.

In analogy to the backwater effect we find that movers from a smaller to a larger firm experience a wage penalty compared to their incumbent colleagues. In our comprehensive mobility approach we found that the "stigma-effect" for workers who enter larger firms even dominates the backwater-effect. The latter is observable in the year immediately after migration only. Hence one can conclude that the dip newcomers to the city experience relative to the incumbent urban workforce seems to be more related to the move into larger firms than to the change in the regional status. Additionally, the results indicate that the urban wage premium does not hold for workers leaving cities. In fact only a fraction of the firm size wage differential that persists. This supports the view that workers acquire skills in large firms and are able to transfer them. Such a transfer of knowledge takes place irrespective of the

region of destination. Hence it seems that transferability of skills and knowledge between types of firms may be more important than between types of regions.

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Table A1: 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
	BBR 6	rural	Urbanized districts in regions with intermediate agglomerations
	BBR 7	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 A2: Classification of the Firm Size

Category of firm size	Categories used in the paper	Number of workers
FS1	Small Firm Size	1-5 workers
FS2	Small Firm Size	6-20 workers
FS3	Small Firm Size	21-50 workers
FS4	Medium Firm Size	51-100 workers
FS5	Medium Firm Size	101-250 workers
FS6	Medium Firm Size	251-500 workers
FS7	Large Firm Size	501-1000 workers
FS8	Large Firm Size	More than 1000 workers

Table A3: 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	944,177
part-timer workers excluded	828,267
Observations used in our sample	828,267

Table 1: Absolute Number and Share of Movers and Stayers in the Cohort (1991-1997)

total	62,785
stayers	61,008
percent of total	*97.2*
movers	1,777
percent of total	*2.8*
firm size stayers	59,824
percent of total	*95.3*
firm size movers	2,961
percent of total	*4.7*
firm size- and regional movers	880
percent of total	*1.4*

Source: Own calculations using IAB-REG data.

Table 2: Absolute Number and Share of Workers by Firm Size Category and Region Type (1997)

	Urban areas		Rural areas	
	Number of observations	Share in %	Number of observations	Share in %
small firm size	8,648	23.68	10,346	39.40
medium firm size	11,339	31.04	9,981	38.01
large firm size	16,538	45.28	5,933	22.59
total	36,525	100	26,260	100

Table 3: Absolute Number and Share of Workers by Region Type and Skill/ Gender Category

	Urban areas		Rural areas	
	Number of observations	Share	Number of observations	Share
low-skilled male	4,208	11.52	3,030	11.54
skilled male	19,563	53.56	15,529	59.14
high-skilled male	2,716	7.44	912	3.47
low-skilled female	2,063	5.65	1,681	6.40
skilled female	7,562	20.70	4,999	19.04
high-skilled female	413	1.13	109	0.42
total	36,525	100	26,260	100

Table 4: Absolute Number and Share of Workers by Firm Size Category and Skill/ Gender Category

	small firms		medium firms		large firms	
	Number of observations	Share	Number of observations	Share	Number of observations	Share
low-skilled male	1,544	8.13	2,532	11.88	3,162	14.07
skilled male	10,678	56.22	11,963	56.11	12,451	55.41
high-skilled male	485	2.55	1,076	5.05	2,067	9.20
low-skilled female	823	4.33	1,513	7.1	1,408	6.27
skilled female	5,324	28.03	4,064	19.06	3,173	14.12
high-skilled female	140	0.74	172	0.81	210	0.93
total	18,994	100	21,320	100	22,471	100

Table 5: Absolute Number and Share of Urban- Rural and Rural- Urban Movers

	Urban - rural movers		Rural- urban movers	
	Number of observations	Share	Number of observations	Share
total	334		286	
without change of firm size category	189	0.566	113	0.395
with change of firm size category	145	0.434	173	0.605
thereof move to larger firm size category	66	0.455	134	0.775
thereof move to smaller firm size category	79	0.545	39	0.225

Table 6:
Results of the Basic Wage Equation Estimates for the Cohort 1990 to 1997

Variable	1991 Coef.	Std. Err.	1993 Coef.	Std. Err.	1995 Coef.	Std. Err.	1997 Coef.	Std. Err.
Low-skilled male (ref.)								
Skilled male	**0.072**	0.017	**0.095**	0.020	**0.101**	0.025	**0.118**	0.030
High-skilled male	**0.580**	0.021	**0.640**	0.024	**0.654**	0.027	**0.680**	0.032
Low-skilled female	**-0.091**	0.013	**-0.030**	0.015	**0.010**	0.017	**0.042**	0.021
Skilled female	**-0.076**	0.020	**0.003**	0.024	**0.048**	0.029	**0.090**	0.036
High-skilled female	**0.373**	0.027	**0.453**	0.030	**0.501**	0.034	**0.556**	0.040
Interaction urban status / low-skilled	**0.117**	0.006	**0.115**	0.006	**0.120**	0.006	**0.124**	0.006
Interaction urban status / skilled	**0.132**	0.003	**0.131**	0.003	**0.136**	0.003	**0.139**	0.003
Interaction urban status / high-skilled	**0.134**	0.014	**0.139**	0.014	**0.145**	0.014	**0.144**	0.014
Experience	**0.026**	0.002	**0.024**	0.002	**0.022**	0.002	**0.023**	0.002
Experience squared	**-0.046**	0.003	**-0.040**	0.003	**-0.036**	0.003	**-0.037**	0.004
Interaction exp. / fem.	**-0.013**	0.001	**-0.015**	0.001	**-0.016**	0.001	**-0.016**	0.002
Interaction exp. squared / fem.	**0.020**	0.003	**0.020**	0.003	**0.021**	0.003	**0.020**	0.003
Interaction exp. /qual.	**0.007**	0.002	**0.006**	0.002	**0.005**	0.002	**0.004**	0.002
Interaction exp. squared/qual.	**-0.011**	0.004	**-0.008**	0.004	**-0.008**	0.004	-0.006	0.004
Interaction reg. migrat. / low-skilled	-0.038	0.022	-0.030	0.022	-0.014	0.023	-0.022	0.024
Interaction reg. migrat / skilled	0.002	0.010	**0.022**	0.010	**0.025**	0.010	0.017	0.011
Interaction reg. migrat / high-skilled	-0.002	0.030	0.005	0.031	0.026	0.032	0.014	0.033
Rural- urban migration	**-0.066**	0.021	**-0.048**	0.021	**-0.049**	0.021	-0.033	0.022
Urban- rural migration	**0.045**	0.020	**0.049**	0.020	**0.049**	0.020	**0.049**	0.021
Constant	**9.128**	0.016	**9.208**	0.020	**9.265**	0.024	**9.258**	0.029
Test statistics								
N	62,785		62,785		62,785		62,785	
(thereof censored)	9,466		9,483		9,224		8,704	
Pseudo R2	0.395		0.383		0.365		0.323	
LR [chi2(19)]	27295.6		26022.0		25039.5		23002.2	
_s.e.	0.308		0.308		0.314		0.329	

Notes: Estimation method is Tobit; all coefficients 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 7:
Results of the Wage Equation Estimates for the Cohort 1990 to 1997 Including Firm Size

Variable	1991 Coef.	Std. Err.	1993 Coef.	Std. Err.	1995 Coef.	Std. Err.	1997 Coef.	Std. Err.
Low-skilled male (ref.)								
Skilled male	**0.084**	0.016	**0.107**	0.019	**0.112**	0.023	**0.123**	0.028
High-skilled male	**0.543**	0.019	**0.606**	0.022	**0.617**	0.026	**0.636**	0.031
Low-skilled female	**-0.113**	0.012	**-0.056**	0.014	**-0.022**	0.016	0.004	0.020
Skilled female	**-0.056**	0.019	0.017	0.023	0.056	0.027	**0.087**	0.034
High-skilled female	**0.357**	0.025	**0.433**	0.028	**0.475**	0.032	**0.519**	0.038
Firm size: 1- 50 workers (ref.)								
Firm size: 51-500 workers	**0.178**	0.003	**0.174**	0.003	**0.178**	0.003	**0.184**	0.003
Firm size: >=500 workers	**0.252**	0.003	**0.243**	0.003	**0.252**	0.003	**0.266**	0.003
Interaction urban status / low-skilled	**0.077**	0.006	**0.077**	0.006	**0.081**	0.006	**0.083**	0.006
Interaction urban status / skilled	**0.085**	0.003	**0.086**	0.003	**0.089**	0.003	**0.090**	0.003
Interaction urban status / high-skilled	**0.095**	0.013	**0.099**	0.013	**0.104**	0.013	**0.099**	0.014
Experience	**0.022**	0.001	**0.020**	0.002	**0.018**	0.002	**0.018**	0.002
Experience squared	**-0.038**	0.003	**-0.032**	0.003	**-0.029**	0.003	**-0.028**	0.003
Interaction exp. / fem.	**-0.011**	0.001	**-0.012**	0.001	**-0.013**	0.001	**-0.013**	0.002
Interaction exp. squared / fem.	**0.015**	0.003	**0.015**	0.003	**0.016**	0.003	**0.015**	0.003
Interaction exp. /qual.	**0.008**	0.002	**0.006**	0.002	**0.006**	0.002	**0.006**	0.002
Interaction exp. squared/qual.	**-0.013**	0.003	**-0.009**	0.003	**-0.009**	0.003	**-0.008**	0.004
Interaction reg. migrat. / low-skilled	-0.017	0.021	-0.008	0.021	0.009	0.021	0.005	0.022
Interaction reg. migrat / skilled	**0.022**	0.010	**0.041**	0.010	**0.045**	0.010	**0.038**	0.010
Interaction reg. migrat / high-skilled	0.014	0.028	0.021	0.029	0.041	0.030	0.031	0.031
Rural- urban migration	**-0.076**	0.020	**-0.058**	0.020	**-0.059**	0.020	**-0.044**	0.021
Urban- rural migration	0.027	0.019	0.032	0.019	0.031	0.019	0.031	0.020
Constant	**9.010**	0.016	**9.099**	0.019	**9.160**	0.022	**9.161**	0.027
Test statistics								
N	62,785		62,785		62,785		62,785	
(thereof censored)	9,466		9,483		9,224		8,704	
Pseudo R2	0.492		0.475		0.459		0.415	
LR [chi2(21)]	34037.7		32276.0		31540.6		29547.7	
_s.e.	0.290		0.291		0.296		0.310	

Notes: Estimation method is Tobit; all coefficients 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 8:
Results of the Wage Equation Estimates for the Cohort 1990 to 1997 Including Firm Size Mobility

Variable	1991 Coef.	Std. Err.	1993 Coef.	Std. Err.	1995 Coef.	Std. Err.	1997 Coef.	Std. Err.
Low-skilled male (ref.)								
Skilled male	**0.083**	0.016	**0.106**	0.019	**0.110**	0.023	**0.120**	0.028
High-skilled male	**0.540**	0.019	**0.603**	0.022	**0.613**	0.026	**0.631**	0.031
Low-skilled female	**-0.114**	0.012	**-0.057**	0.014	-0.023	0.016	0.002	0.020
Skilled female	**-0.057**	0.019	0.016	0.023	**0.054**	0.027	**0.083**	0.034
High-skilled female	**0.354**	0.025	**0.431**	0.028	**0.471**	0.032	**0.513**	0.038
Firm size: 1- 50 workers (ref.)								
Firm size: 51-500 workers	**0.184**	0.003	**0.179**	0.003	**0.183**	0.003	**0.189**	0.003
Firm size: >=500 workers	**0.259**	0.003	**0.249**	0.003	**0.258**	0.003	**0.272**	0.003
Interaction urban status / low-skilled	**0.076**	0.006	**0.077**	0.006	**0.081**	0.006	**0.082**	0.006
Interaction urban status / skilled	**0.084**	0.003	**0.085**	0.003	**0.088**	0.003	**0.089**	0.003
Interaction urban status / high-skilled	**0.095**	0.013	**0.099**	0.013	**0.104**	0.013	**0.099**	0.014
Experience	**0.022**	0.001	**0.020**	0.002	**0.018**	0.002	**0.018**	0.002
Experience squared	**-0.037**	0.003	**-0.032**	0.003	**-0.028**	0.003	**-0.027**	0.003
Interaction exp. / fem.	**-0.011**	0.001	**-0.012**	0.001	**-0.013**	0.001	**-0.013**	0.002
Interaction exp. squared / fem.	**0.015**	0.003	**0.015**	0.003	**0.016**	0.003	**0.015**	0.003
Interaction exp. /qual.	**0.008**	0.002	**0.007**	0.002	**0.006**	0.002	**0.006**	0.002
Interaction exp. squared/qual.	**-0.013**	0.003	**-0.009**	0.003	**-0.009**	0.003	**-0.008**	0.004
Interaction reg. migrat. / low-skilled	0.007	0.021	0.009	0.021	0.025	0.021	0.020	0.022
Interaction reg. migrat / skilled	**0.039**	0.010	**0.053**	0.010	**0.056**	0.010	**0.048**	0.011
Interaction reg. migrat / high-skilled	0.033	0.029	0.034	0.030	0.053	0.031	0.043	0.031
Rural- urban migration	**-0.057**	0.020	**-0.044**	0.020	**-0.044**	0.020	-0.029	0.021
Urban- rural migration	0.013	0.019	0.020	0.019	0.019	0.019	0.018	0.020
Firm size mob.: small - large	**-0.126**	0.017	**-0.088**	0.017	**-0.088**	0.017	**-0.089**	0.018
Firm size mob.: medium - large	**-0.083**	0.013	**-0.063**	0.013	**-0.072**	0.013	**-0.080**	0.013
Firm size mob.: small - medium	**-0.075**	0.010	**-0.064**	0.010	**-0.058**	0.010	**-0.061**	0.010
Firm size mob.: large - medium	0.002	0.016	0.010	0.016	0.010	0.016	0.021	0.017
Firm size mob.: medium - small	**0.071**	0.014	**0.067**	0.014	**0.066**	0.014	**0.077**	0.015
Firm size mob.: large - small	0.048	0.026	0.041	0.027	**0.061**	0.027	**0.064**	0.028
Constant	**9.011**	0.016	**9.100**	0.019	**9.162**	0.022	**9.164**	0.027
Test statistics								
N	62,785		62,785		62,785		62,785	
(thereof censored)	9,466		9,483		9,224		8,704	
Pseudo R2	0.495		0.477		0.461		0.417	
LR [chi2(27)]	34222.9		32396.6		31658.4		29674.7	
s.e.	0.290		0.291		0.295		0.310	

Notes: Estimation method is Tobit; all coefficients 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.