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Are Individuals Optimizing Their Wage Path?

An Analysis Using Linked Employer-Employee Data*

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Abstract

This paper examines employer-to-employer mobility by describing the individual wage trajectories along the working career. The model, which is designed to introduce optimal between-firm mobility, is based on the search, the matching, and the human capital theory. It is emphasized that hopping from one wage trajectory to another by mobility may be accompanied with wage losses. An empirical review of the model extracts information on whether the between-firm mobility wage trajectory exceeds the within-firm wage path. The results are in line with the optimal employer-to-employer mobility model derived in this paper. Furthermore, it is shown that downward mobility as well as upward mobility is very common in reality, and that both types of mobility are shown to cause wage losses.

JEL-Classification: J30, J31, J62

Keywords: Employer-to-employer mobility, wage trajectories, wage loss

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1 Introduction

A variety of studies show that worker turnover is frequent in many countries (Burgess et. al. 2000, OECD 1997). Hence, labor market mobility is still actual, and recent literature is concerned about labor mobility in heterogeneous labor markets. Nosal and Rupert (2002) analyzed the mobility pattern of workers not being laid off. They show that, while most of the mobile workers move to jobs offering higher wages than the wages in the previous job, a substantial fraction of these mobile workers change into jobs that exhibit lower wages. Moreover, the authors show that about 8% of these workers realize neither a wage markup nor a wage reduction by mobility.

Therefore, the present analysis focuses on individual employer-to-employer mobility and especially spotlights the wage trajectories during an individual's working career. More specifically, the focus is on examining individual profits/ losses induced by mobility along the working career. The innovation of this paper is to derive a model where continuous wage profiles -in the sense of mobility without wage markups/ reductions- are optimal. Moreover, a German linked employer-employee dataset is used to examine the main aspects of the model.

Borjas (1981) emphasizes that the earnings profile of an individual is discontinuous across jobs because job mobility results, on average, in a wage markup. Upward mobility is empirically affirmed by several authors (e.g., Topel and Ward 1992, Smith and Vavrichek 1992). Other studies mention that downward mobility has recently become a problem (e.g., Smith, 1994). Hence, numerous wage reductions are induced by mobility. One explanatory approach is derived by Connolly and Gottschalk (2008). The authors mention that these wage reductions are accepted by mobile individuals because of larger wage growth in the new job. Therefore, the downward mobility can be justified as an investment in the future wage growth. Together, both sets of findings provide evidence for discontinuous wage profiles over a working career.

In this paper, it is assumed that either the upward or the downward mobility is induced by the non-optimal ('*suboptimal*') mobility decisions of individuals, and, therefore, discontinuous wage profiles in combination with wage losses are prevalent. In the sense of this paper, reference to '*discontinuous wage profiles*' refers to hopping from one wage trajectory to another one. Hopping from one wage trajectory to another one is analyzed in Borjas (1981) or Smith (1994). Therefore, this phenomenon is under special investigation because it is hypothesized that this type of mobility is suboptimal. Moreover, it is hypothesized that continuous wage profiles are optimal for rationally acting workers seeking to maximize their wages.

This paper picks up the empirical findings about wage markups and wage reductions induced by mobility and introduces an optimal employer-to-employer mobility strategy for workers. This strategy is based on an isolated wage maximization problem between two employers. Moreover, it illustrates that discontinuous wage profiles may be accompanied by wage losses.

Bingley and Westergard-Nielsen (2005) illustrated the workers' careers as different wage trajectories across different employment relationships. The wage trajectories can be viewed as the main benchmark in this analysis. Here, it is assumed that wages increase primarily by the accumulation of human capital (e.g., Becker 1993), and, therefore, by the time spent in the labor force. Moreover, wage growth is different across different employers (Ruhm 1990, Altonji and Shakotko 1987). Orlowski and Riphahn (2007) deliver evidence that returns to experience are more substantially than returns to tenure in Germany. Therefore, this analysis is focusing on the reward to experience. Furthermore, it is expected that employers differ in rewarding labor market experience. The bonus to experience and the accumulation of human capital is emphasized in Kim (1999). She presents evidence that quits are less likely if the wage increase is large, and, because of this result, a close link between job turnover and the monetary reward of experience is expected. The loyalty of employees to a company is to be essentially ignored in the model derived here. This is in

line with Skuterud (2005), who argues that workers today identify themselves to the largest extent by their particular abilities and skills, rather than being identified in terms of the firms that they work for.

This analysis is based on the assumption that individuals have information on different employers' wage offers given the accumulated human capital. Hence, individuals are able to decide for which employer they are likely to work by considering the isolated wage offers across different employers. Therefore, both time dimensions, examined by Rosenfeld (1992), are combined in the present study: (1) the time spent in a certain firm and (2) the time spent in the labor force. This combination becomes necessary, as the optimal career path of individuals across firms is under investigation. Moreover, both aspects are combined in the concept of task-specific human capital (Gibbons and Waldman, 2004). Schönberg and Gathmann (2007) show that task-specific human capital is (partially) portable when individuals move to similar occupations with similar tasks.

The present analysis is an enhancement of the existing literature by describing employer-to-employer mobility by wage trajectories, defined as wage-experience working contracts. A further enhancement of this particular study is that the procedure applied here extracts information on whether the between-firm mobility wage trajectory exceeds the within-firm wage path. In the setting derived in the next section, a change of the employer becomes suboptimal as individual wage profiles become discontinuous. Furthermore, this paper investigates the wage trajectories of German employees, and it verifies empirically whether mobility causes discontinuous wage trajectories and whether the optimal wage path is evident.

The paper proceeds as follows: Section 2 derives the theoretical model, its assumptions, and illustrates the scope of the model. The data set and the empirical procedure is shown in section 3. Section 4 presents the main results and section 5 concludes.

2 The Model

2.1 The Model

Based on the findings of Nosal and Rupert (2002), this paper derives a model where changing employers without wage markups or wage reductions is optimal. Specifically, this paper tests whether individuals avoid mobility losses by calculating the wage trajectories of different employers given their accumulated human capital. If a certain wage-experience trajectory exceeds other wage trajectories at all times, the worker has no incentive to change the employer because he/ she will choose this wage trajectory from the beginning to the end of his/ her working career. This special case is not specifically excluded by Borjas (1981), Smith (1994), and among many others. In this model, this special case will be excluded by assumption. Therefore, only if the wage-experience trajectories of different employers intersect each others will the employee have an incentive to change employer. Hence, if workers are able to calculate wage trajectories with respect to experience, mobility decisions -in the range of a whole working career- should not lead to discontinuous wage profiles across employers. Therefore, mobility takes place when the mobility markup is zero, as the literature suggests (e.g., Nosal and Rupert, 2002). Hence, optimal mobility occurs at the intersection point of different wage trajectories[1]. For this reason, this paper upgrades the recent perspectives by analyzing individual employer-to-employer transitions with respect to the continuity of wage trajectories given the individual's labor market experience.

The following assumptions are imposed to derive an optimal employer-to-employer mobility strategy for workers:

- This model is designed to address search-theoretic approaches, in which, wage-maximizing individuals search most efficiently for the highest wage

[1]It is a necessary to recognize that wage trajectories are not allowed to feature a changing slope after reaching a maximum (minimum) during a working career. Therefore, during a career horizon, it is assumed that the wage monotonically increases (decreases) in experience at employer f.

in each period. No costs arise from searching for new employers. Therefore, individuals are assumed to send an infinite number of applications to different employers in each period of their working career.

- Employers reply to applications immediately after receiving them and offer a wage with respect to the experience of individual *i*. Therefore, given the labor market experience of each worker, wages are predictable in each period. Wage-experience contracts are following a function F subject to employer f.

$$w_{i,f,t} = F_f(exp_{i,t}) \tag{1}$$

$$\frac{\partial w_{i,f,t}}{\partial exp_{i,t}} \overset{(\leq)}{\geq} 0 \tag{2}$$

$$\frac{\partial^2 w_{i,f,t}}{\partial exp_{i,t}^2} \overset{(\geq)}{\leq} 0 \tag{3}$$

where $w_{i,f,t}$ characterizes the wage offered by a certain employer f to individual i in period t. Wages are assumed to increase (decrease) monotonically.

The variable $exp_{i,t}$ denotes the labor market experience of individual i in period t.

Wage offers of 0 are treated as 'non wage offers' and will never be accepted by individuals. Employers offer this wage when the applicant's skills do not match the needs of the firm[2].

Individuals are facing a wage-maximizing utility function of the set of firms f given their labor market experience in period t. Hence, wage-maximizing workers should realize the upper wage path as illustrated in Figure 1. The

[2]Nonresponse of the employer to the application can also be an interpretation for this wage-experience trajectory:

$$w_{i,f,t} = F_f(exp_{i,t}) = 0$$

maximization problem is described by:

$$\max_{f} w_{i,f,t} = F_f(exp_{i,t}) \tag{4}$$

The following is an isolated wage-maximizing problem. Individual i is willing to work at employer f if $\mathrm{F}_f(\exp_{i,t}) > \mathrm{F}_k(exp_{i,t})$ (for all $\mathrm{f} \neq \mathrm{k}$), as shown in Figure 1.

Insert Figure 1 about here

- Workers receive the wage offers immediately after finishing the application process. Moreover, they are able to take up an employment relationship with any employer at any time[3].

- Free entry and exit on the labor market is assumed for both firms and workers. Hence, unemployment spells are assumed to be voluntary as long as one wage-experience offer exceeds 0. Furthermore, workers are assumed to be homogeneous in terms of work time.

- Employees do not face any costs or penalties for leaving the firm they are currently employed[4].

- Employers are not allowed to force any employee to quit. Moreover, employers are not allowed to lay off workers. This analysis follows the argumentation of Borjas and Rosen (1980), who argue that a decomposition into voluntary and involuntary employer-to-employer transitions is artificial because, on the one hand, employees who anticipate a layoff in the near future will quit, while, on the other hand, firms lay off workers who are likely to quit. Hence, this analysis focuses on employer-to-employer mobility rather than distinguishing between quits and layoffs[5].

[3]This is in line with Skuterud (2005) who emphasizes that loyalty to firm is decreasing.

[4]Here, the assumption that no waste of any human capital is actual when changing the employer. Therefore, portable skills are assumed as described by task-specific human capital theory.

[5]The distinction of voluntary and involuntary mobility is an important one in Nosal and Rupert (2002) but is not of special interest in this particular analysis.

- The return to schooling is constant over the whole working career and among different employers.
- Both workers and employers are acting rationally in determining wages.

To recapitulate, the maximization problem can be expressed as an isolated examination of different wage offers given the individual's labor market experience:

$$\max_{f} U_{i,f,t} = F_f(exp_{i,t}) + \alpha(schooling_i) + \underbrace{C_{i,t}^{search}}_{=0} - \underbrace{C_{i,t}^{mobility}}_{=0} \tag{5}$$

The individual utility $U_{i,t}$ of any wage-maximizing individual in period t can be expressed by:

$$U_{i,t} = F_f(exp_{i,t}) + \alpha(schooling_i) - [F_k(exp_{i,t}) + \alpha(schooling_i)] > 0 \tag{6}$$

$$U_{i,t} = F_f(exp_{i,t}) - F_k(exp_{i,t}) > 0 \tag{7}$$

for all f $\neq$ k.

Therefore, the model reflects the fact that the decision of the individual worker i to work at firm f depends solely on the rate of reward for experience offered to that individual i in period t. Moreover, all rates of return for schooling, occupational level, or worktime are constant over different firms[6].

Under all the assumptions derived above, employees are able to calculate wage trajectories for their whole working career. In particular, individuals can calculate the wage profile for all firms at which they applied. Therefore, discontinuous wage profiles (defined as hopping from one wage trajectory to another one), as reviewed in recent literature, are suboptimal[7].

Even some of the assumptions are rather critical, the most crucial restriction of the model is that the reward to schooling remains constant over the whole working career. It is to be expected that the reward to schooling is different

[6]This is to impose that the wage trajectories are not saw blade formed in certain firms.

[7]It is to be assumed that full information about wage trajectories is a very critical assumption.

among different employers. Moreover, the model is facing a lack of any considerations regarding (re)training provisions. Galunic and Anderson (2000) consider different impacts of the accumulation of specific or general human capital on the employer-employee commitment on the firm.

In contrast to Hübler (1989), who analyzed the optimal number of job changes, the setting derived above is to illustrate a wage-maximizing optimal employer-to-employer mobility strategy. The author introduced the term *suboptimal* which is defined in a similar way herebecause the isolated decision between two jobs according to a wage maximization problem is under investigation. In this paper, the number of mobility events is restricted to one. In particular, suboptimal employer-to-employer mobility is defined as hopping from one wage trajectory to another one. In the following section, it is illustrated that this type of mobility may be accompanied by wage losses and is therefore actually suboptimal.

2.2 Illustration of the model

This section presents some figures to visualize the scope of the model. One mobility event is considered in this analysis. Moreover, different scenarios regarding the different strategies for employer-to-employer transitions are described.
Figure 2 displays five different wage-experience contracts of firms to which the worker applied. Firm 5 offered a wage contract of 0. This can be interpreted to mean that a rejection letter was sent to the applicant. Therefore, firm 5 is to be examined as a representative firm where individual i's skills do not match up the requirements of the job for which he/ she applied. All the remaining wage trajectories are describing wage contracts that are increasing in experience. The wage offers of firm 1 and firm 3 are below the combination of the offers of firm 2 and firm 4 at any point of individual i's working career. Hence, a wage maximizing employee prefers working at firms 2 and 4 during his/ her working career.

Insert Figure 2 about here

Moreover, the wage-experience trajectory of firm 2 intersects the one of firm 4 from below when the labor market experience of individual i increases[8]. Therefore, before the intersection point, it is more valuable to work at employer 4, while, with increasing experience, individual i benefits by moving to employer 2.

Figure 2 shows that the analysis is reduced to a closer inspection of the top wage trajectories over the working career. Moreover, the entire wage career is restricted to a maximum of one mobility event.[9] Therefore, the present analysis is restricted to two acceptable wage trajectories for individual i.

Insert Figure 3 about here

Figure 3 presents both wage trajectories of interest. At the intersection point of the curves, the individual should change the employer to avoid a discontinuous wage profile and to maximize the wage path across the working career. This intersection point determines the optimal period for being mobile (OPM). Hence, if optimal mobility occurs, then the wage trajectory offered by firm 1 is not to be observed after the intersection point, while that of firm 2 is counterfactual before the intersection point. This is the main problem of this analysis, and the following sections show how this analysis deals with that issue. As described above, no wage above those presented can be achieved by a worker.

The maximization problem of individual i, working in firm f at period t, is described by the choice of the utility-maximizing firm over the career horizon (t=1,..., T):

$$\max_{f} V_{i,f,t} = \int_{t=1}^{T} F_f(exp_{i,t}); f \in (1,2) \tag{8}$$

The complete wage path of individual i over his/ her working career is here described by the following cases.

[8] In comparison to firm 2, firm 4 can be considered as a dead-end job for worker i because the wage growth is larger in firm 2.

[9] This restriction is used for identification issues in the empirical work and is consistent with recent literature conducted in Germany. Orlowski and Riphahn (2007) suggest that number of employer-to-employer changes of individuals is rather low.

The individual is working in firm 1 if:

$$V_{i,f,t} = \int_{t}^{OPM} [F_1(exp_{i,t}) - F_2(exp_{i,t})] > 0 \text{ (if t} \rightarrow \text{OPM)} \tag{9}$$

In the optimal period for mobility (OPM), the area under both wage trajectories is 0:

$$V_{i,f,t} = \int_{OPM} [F_1(exp_{i,t}) - F_2(exp_{i,t})] = 0 \text{ (if t = OPM)} \tag{10}$$

$$\int_{OPM} F_1(exp_{i,t}) = \int_{OPM} F_2(exp_{i,t}) \tag{11}$$

Working in firm 2 is more valuable if:

$$V_{i,f,t} = \int_{OPM}^{T} [F_2(exp_{i,t}) - F_1(exp_{i,t})] > 0 \text{ (if OPM} \rightarrow \text{T)} \tag{12}$$

Because of the mobility and search costs in real life, suboptimal mobility is to be expected. Two settings for suboptimal mobility behavior are depicted in figures 4 and 5.

Insert Figure 4 about here

Suboptimal mobility (early) is shown in Figure 4. Here, the wage path of the individual i is discontinuous by mobility and, therefore, assumed to be suboptimal because the mobility event does not take place at the intersection point. A wage loss becomes evident by closer inspection of figure 4: In the scope of the model derived above, the area under both curves until the intersection point is to be interpreted as a wage loss during the working career. Moreover, downward mobility as mentioned by Smith (1994) becomes evident. Hence, the question asked by Connolly and Gottschalk (2008), whether wage cuts can be interpreted as investments in future wage growth becomes actual. From this model, one can see that wage reductions are never due to investment in future wage growth, but they are due to suboptimal behavior of individuals.

As shown in figure 4, the individual hops from one wage trajectory to another one in the period of mobility. This is exactly what is described as 'discontinuous' in this paper. In this case, it is not possible that the difference of the areas between both trajectories is zero. Hence, the individual changes employers suboptimally and is generating a loss of wages over his/ her working career.

$$V_{i,f,t} = \int_{t=1}^{OPM} F_1(exp_{i,t}) + \int_{OPM}^{T} F_2(exp_{i,t}) + \underbrace{\int_{m}^{OPM} [F_2(exp_{i,t}) - F_1(exp_{i,t})]}_{< 0;\ \text{wage loss}} \tag{13}$$

where m describes the period of mobility realized by individual i,

T is the end of individual i's working career,

and OPM describes the optimal period of mobility.

Suboptimal employer-to-employer transitions can also be executed after the optimal mobility period. Job satisfaction can possibly cause this type of suboptimal mobility. Here, in this case, the suboptimal mobility problem is more differentiated than in the 'early' case.

Insert Figure 5 about here

In this case, again, the individual hops from one wage trajectory to another. Again, the individual changes employers suboptimally in the context of this model.

$$V_{i,f,t} = \int_{t=1}^{OPM} F_1(exp_{i,t}) + \int_{OPM}^{T} F_2(exp_{i,t}) + \underbrace{\int_{OPM}^{m} [F_1(exp_{i,t}) - F_2(exp_{i,t})]}_{< 0;\ \text{wage loss}} \tag{14}$$

A wage loss, defined as the area from the intersection point of the curves to the mobility event is also evident. Furthermore, upward mobility as mentioned by Borjas (1981), Topel and Ward (1992), and Smith and Vavrichek (1992) becomes evident. None of the above authors consider the question of wage

losses explicitly.

As shown above, in this model, wage reductions and wage markups result simply from a suboptimal mobility choice of individual i. Therefore, wage markups are possibly not compensating for the wage loss attained by the suboptimal mobility period but are, rather, describing a waste of wage potentials of individuals. Hence, if the underlying model is reflecting real between-firm mobility to the largest extent, all discontinuous wage profiles are accompanied by wage losses and result from suboptimal mobility.

It is necessary to mention that downward and upward mobility in the sense of Smith (1994) or Borjas (1981) explicitly allow for hopping from one wage trajectory to another one. Therefore, the concepts of Borjas and Smith contradict the optimal employer-to-employer mobility pattern derived in this model.

- Downward mobility (Smith, 1994):

$$V_{i,f,t} = \int_{t=1}^{m} F_1(exp_{i,t}) + \int_{t=m}^{T} F_2(exp_{i,t}) + \underbrace{\int_{m}^{T} [F_2(exp_{i,t}) - F_1(exp_{i,t})]}_{< 0} \tag{15}$$

  A loss of utility is realized from the mobility period to the end of the working career because working in firm 1 all the time is of higher value at all points of individual i's working career.

- Upward mobility (Borjas, 1981):

$$V_{i,f,t} = \int_{t=1}^{m} F_1(exp_{i,t}) + \int_{t=m}^{T} F_2(exp_{i,t}) + \underbrace{\int_{t=1}^{m} [F_1(exp_{i,t}) - F_2(exp_{i,t})]}_{< 0} \tag{16}$$

  A loss of utility is realized from the beginning of the working career until the period of mobility because working in firm 2 all the time is of higher value at all points of employee i's working career.

In this paper, with regard to discontinuous wage profiles, these two special cases of mobility are recognized. Both are excluded by the model derived above because of the assumption of a perfect search (infinite applications) in each period. Moreover, an optimal mobility period for individual i is not existent because the wage trajectories do not intersect at any point of a worker's career.

Hence, the maximization problem, as referred to in this setting, is not explicitly accounted for in the current literature. The maximization problem of individuals moving from one employer to another employer is to minimize the loss introduced by suboptimal mobility.

In the sense of the model derived above, the maximization problem in the case of suboptimally early mobility is:

$$\max_t V_{i,f,t} = \min_t \int_m^{OPM} [F_2(exp_{i,t}) - F_1(exp_{i,t})] \tag{17}$$

The corresponding maximization problem in the case of suboptimally late mobility is as follows:

$$\max_t V_{i,f,t} = \min_t \int_{OPM}^{m} [F_1(exp_{i,t}) - F_2(exp_{i,t})] \tag{18}$$

Therefore, the present analysis focuses on the discontinuity of wage trajectories and spotlights the question of optimal mobility as defined above is evident. Under the assumption that workers are averse to suffering wage losses, the wage loss, as defined as the area enclosed by two wage trajectories from the mobility period to the OPM, is 0. Hence, if individuals are able to calculate the wage trajectories given their experience, suboptimal mobility should not occur, but suboptimal or discontinuous between-firm mobility is emphasized by several authors (e.g., Borjas, 1981, Smith, 1994, Nosal and Rupert, 2002).

3 Data and Methodology

3.1 Data

To investigate the explanatory power of the model empirically, the 'linked employer-employee data set of the Institut für Arbeitsmarktforschung' (LIAB) is used. The data consist of observations of all workers from a representative sample of firms in Germany. The data set is set up as a panel of cross-sections from 1993 to 2006 at the corresponding record date of June 30th. Hence, 14 periods are available for inspecting working careers. Although a larger time horizon would be of advance, 14 years of data are adequate to analyze working histories of individuals. A further benefit of this dataset is that the construction of wage trajectories is made as precise as possible by controlling for a variety of firm characteristics and observing comparable workers of the same firm. Therefore, the main interest is in the individual wages achieved by workers in the primary occupation at firm f. The data are set up such that individual daily wages are surveyed.

This analysis focuses on mobile full-time working employees changing from one LIAB-firm to another LIAB-firm in two consecutive periods. Moreover, vocational trainees are included in the analysis because they compose the most flexible group of workers. By looking only at full-time employed workers and vocational training participants, one can assume that any bias caused by the non-consideration of working hours will be diminished. Moreover, individuals changing employer more often than once are excluded from the analysis. By referring to schooling, it is accounted for the school leaving degree surveyed by each individual. This assures that the reward of schooling remains constant during the whole working career among the different employers, as postulated by the model. Different rewards to schooling is accounted for by performing estimates for each firm. Hence, the procedure described in the following section will absorb the bias introduced by different rewards for education in different firms. Potential experience is calculated with respect to the individuals' stated

labor market entry. Hence, no approximation of the potential experience is a necessary.

3.2 Methodology

The empirical analysis is to estimate the wage trajectories of the individuals changing from a LIAB-firm to another LIAB-firm. This methodology becomes necessary as the wages of individual i can not be observed in two firms simultaneously. Individuals are only included in the analysis if they are observed in two consecutive periods. The wage trajectories are estimated for each LIAB-firm f $\in (1, 2)$ by OLS. The inclusion of the squared experience is to impose decreasing returns to experience over time.

The specification for describing the individual i's log wage in period t at employer f contains both individual as well as firm characteristics. Separated estimations are conducted to for each firm. Hence, this exploits the advantages of linked employer-employee data.

$$log(w)_{i,1,t} = \beta_{0,1} + \beta_{1,1} \left(experience\right)_{i,t} + \beta_{2,1} \left(experience\right)^2_{i,t} + \delta' Z_{1,t} + \gamma' X_{i,t} + \epsilon_{i,1,t} \tag{19}$$

$$log(w)_{i,2,t} = \beta_{0,2} + \beta_{1,2} \left(experience\right)_{i,t} + \beta_{2,2} \left(experience\right)^2_{i,t} + \delta' Z_{2,t} + \gamma' X_{i,t} + \epsilon_{i,2,t} \tag{20}$$

where the indices 1 and 2 identify the first and second LIAB-firm at which individual i is employed at period t, $Z_{f,t}$ is a matrix containing firm characteristics, $X_{i,t}$ is a matrix containing information about the individual i, $w_{i,f,t}$ is the daily wage of individual i at employer f in period t, and $\epsilon_{i,f,t}$ is to be composed of individual, firm, and time effects.

3.3 Procedure

The main goal of this procedure is to extract information about whether the between-firm mobility wage trajectory exceeds the within-firm wage path. It is possible to construct the information on whether an individual changed employer by moving from one LIAB-firm to another LIAB-firm. Based on this information, the wage trajectories of these individuals are estimated. Hence, for each mobile individual, wages are estimated in both firms at which the individual was employed at period t (f $\in (1, 2)$).[10] Separate estimates for each firm are necessary as it is assumed that different employers reward labor market experience in different ways and individual i's wages are not observable in two firms simultaneously. Hence, estimation of wage-experience contracts in the sense of the model above is expected to be most precise by this procedure. For reasons of efficiency in estimating the wages, the analysis only includes firms for which at least 100 observations are available[11].

Wage trajectories are estimated by OLS, distinguishing between the firms at which the employee was employed.

$$\widehat{log(w)}_{i,f,t} = \hat{\beta}_{0,f} + \hat{\beta}_{1,f}\,(experience)_{i,t} + \hat{\beta}_{2,f}\,(experience)^2_{i,t} + \hat{\gamma}' X_{i,t} \quad (21)$$

where the log wage of individual i at period t in firm f is to be estimated (f $\in (1, 2)$).

X contains information on the classifications of occupation, schooling (maximum degree achieved by individual i), gender, a dummy variable describing the first 100 days in a firm, and a dummy variable for Germans. All the information included in matrix X describes the main determinants of an individual's wage path. The dummy variable describing the first 100 days in a certain firm is

[10] Due to the large number of firms containing mobile employees, the results are not presented here. The output is accessible on request. The output contains 8736 estimates.

[11] This restriction does not explicitly exclude small firms because, on average, 7 workers have to be employed during the sample period horizon.

included in order to account for monitoring and seniority. During the monitoring period, the wages are lower than after the monitoring. This dummy is to account for this. If an individual is observed in another firm in the consecutive period, it is expected that the match was of worse quality and the match was broken up while a wage reduction due to the monitoring is accounted for. Schooling strongly configures one's individual working career in a strong matter as the school leaving certification provides access to certain jobs. The gender wage gap is controlled for by a dummy variable called 'male'. It is necessary to control for occupation because of its large influence on the wage determination.

Adjacent, the estimation results are used to determine optimal mobility. For each mobile individual changing from one LIAB-firm (firm 1) to another LIAB-firm (firm 2), the difference between the predicted wage trajectories is calculated.

$$\widehat{log(w)}_{i,1,t} - \widehat{log(w)}_{i,2,t} \tag{22}$$

where $\widehat{log(w)}_{i,f,t}$describes the linear prediction of the log wage of individual i, working in firm f at period t.

In order to detect discontinuous wage profiles and (sub)optimal mobility, the differences between the estimated wage trajectories are calculated. Here, 4 possible scenarios can be addressed by this procedure.

Insert Figure 6 about here

In table 1, scenarios 1 and 2 verify the hypothesis of discontinuous wage profiles of Borjas (1981). Hence, discontinuous mobility results in a wage gain as described in scenario 1. Evidence for this type of mobility is presented in Borjas (1981), Topel and Ward (1992), and Smith and Vavrichek (1992). Smith's (1994) 'growing problem' of wage cuts by mobility is evident when the predicted wage trajectories lead to scenario 2. Scenario 1 and 2 are discontinuous because changing employer implies hopping from one wage trajectory to the other one[12].

[12]Scenarios 1 and 2 have to be examined more differentiated according to a career horizon. If the wage trajectories do not run exactly parallel, they have to intersect at any point in time. Here, it is only necessary that the lines do not intersect during the observed working career horizon of individual i.

Insert Table 1 about here

Scenarios 3 and 4 describe continuous wage profiles. The wage profiles intersect each others as described in the model presented in section 3.

Scenario 3 describes individual mobility that is problematic for the model to deal with. While the individual is employed in firm 1, he/ she would be better off in firm 2, whereas, while he/ she is employed in firm 2, the estimated wage is larger in firm 1. This case is referred to as 'unanticipated mobility' because one can hypothesize that environmental pressure on the individual (e.g., bankruptcy of a firm, layoff, or the end of working contract) is responsible for the mobility decision. This is unanticipated because the model explicitly excludes this mobility pattern. Moreover, as Borjas and Rosen (1980) point out, the accuracy of discriminating between voluntary and involuntary mobility decisions is artificial and therefore, it is not open to special investigation in this analysis.

Scenario 4 describes wage trajectories for optimally mobile individuals, as described in figures 3, 4, and 5. Therefore, only individuals whose mobility described by this scenario are in line with the model described above.

4 Results

The empirical investigation of the model derived above shows that upward mobility is the most common among mobile workers. In the data set, 73854 workers change once from one LIAB-firm to another LIAB-firm. Almost half of the workers (46%) were found to realize a wage markup when changing employers, and are thus upwardly mobile.

Insert Table 2 about here

Downward mobility, in the sense of Smith (1994), is also very likely. About one third (37%) of the employees experience wage reductions as a result of mobility. Hence, the literature demonstrates large explanatory power in describing employer-to-employer mobility. The remaining 17% of the workers changing

employer once are featuring an intersection point of the wage trajectories along their career. Unanticipated mobility explains about 8% of the employer-to-employer mobile workers, while the model derived above describes about 9% of the mobility events. Therefore, the results show that the suboptimal mobility pattern is describing labor market mobility to a considerable degree.

In summary, the literature regarding employer-to-employer mobility is enhanced by introducing (sub)optimal mobility with respect to an isolated wage maximization problem. This (sub)optimal mobility is common in the case of changing the employer once during the career. Moreover, it is shown that 'unanticipated mobility' is also present. This provides some evidence in favor of discriminating between voluntary and involuntary mobility events.

To evaluate the existence of the optimal period of mobility (OPM), it is necessary to investigate the realized mobility period (m) as observed in the data. Note that, in the model, the OPM is characterized by the condition that there is no wage difference between firm 1 and firm 2. Table 3 presents descriptive statistics for the realized period of mobility of workers changing employer once according to the model derived above. On average, the wage markup involved is insignificant. This fits the scenario of optimal suboptimal mobility. On the one hand, the 25% quartile on suboptimally early mobility shows a wage reduction that does not exceed 0.01. On the other hand, the late suboptimal mobility shows that the wage markup is in absolute values less than 0.01 on the 90% quartile. This provides evidence in favor of overlapping OPM and m[13].

Insert Table 3 about here

Table 3 also displays statistics on the question of whether suboptimal mobility is present. Suboptimally early mobility is accompanied by downward mobility. One-third of the mobile workers executing employer-to-employer mobility as derived in the model are changing employers suboptimally (early). On average, they experience wage reductions of 0.066 log points. According to the model in combination with Connolly and Gottschalk (2008), this is to be interpreted

[13]The choice of the threshold 0.01 is small in itself, but choosen at haphazard.

as the average investment in future wage growth. Suboptimally late mobility is closely linked to wage markups. Two-thirds of the workers are changing employers after the OPM. The wage markup is, on average, 0.0735 log wage units.

The data show that employer-to-employer mobility, as defined by the model, is common. Therefore, further research is to be conducted about the characteristics of workers changing employer optimally, suboptimally, unanticipatedly, or as identified by discontinuity.

Insert Table 4 about here

Table 4 shows that, on average, young workers are mobile suboptimally early. This result points out that young workers are generating wage losses to a considerable degree. In contrary to the upward mobility emphasized by Topel and Ward (1992), this analysis shows that a plurality of young workers[14] are downward mobile. In combination with the findings of Connolly and Gottschalk (2008), this downward mobility is to be seen as an investment in future wage growth. Moreover, it is suggested that, on average, older employees execute discontinuous mobility. The upward mobility pattern is in line with the findings of Clark et al. (1996) who suggest that older workers assess their aspiration levels best. But this finding is under critical inspection by consideration of the theoretical background derived in this paper. The results obtained here support the perspective that young workers assess the optimal wage path best when accounting just for one mobility event. On average, (sub)optimal mobility is executed by younger employees.

Table 4 also suggests that, on average, a higher fraction of females is unanticipated mobile. Several studies emphasize a gender wage gap whereas this paper suggests further serious consequences for females changing employer. In order to explain labor market mobility with respect to gender, this result is to be inspected in future research. Possibly, this result is based on the mobility

[14]Reference to 'young workers' refers to workers with low potential labor market experience.

of the partner, the household's income, or mobility of females is affected by children.

5 Discussion

To conclude, this analysis advances the scope of literature regarding the employer-to-employer mobility. This paper contributes to the question whether the within-firm wage path exceeds the between-firm wage trajectory along the working career. A theoretical model is derived, showing that wage markups as well as wage reductions induced by between-firm mobility may be accompanied with wage losses. Therefore, this paper enhances the literature by introducing wage losses. The empirical analysis -based on German linked employer-employee data- shows that the model derived above is describing employer-to-employer transitions to a considerable degree.

Moreover, the results suggest extensive serious issues of interest. Especially gender related differences and the job shopping phenomenon (Topel and Ward, 1992) appear in a new light and have to be investigated in the future. Moreover, checks on the realized period of mobility and OPM have to be conducted. Choosing a threshold of $\left|\widehat{log(w)}_{i,1,t} - \widehat{log(w)}_{i,2,t}\right| \leq 0.01$ at haphazard delivers evidence that about 20% of the individuals changing the employer optimal. This suggests that further research about the optimal employer-to-employer mobility is to be conducted in order to define 'optimal mobility' based on empirical results, rather than a random choice.

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Figures and Tables

Figures

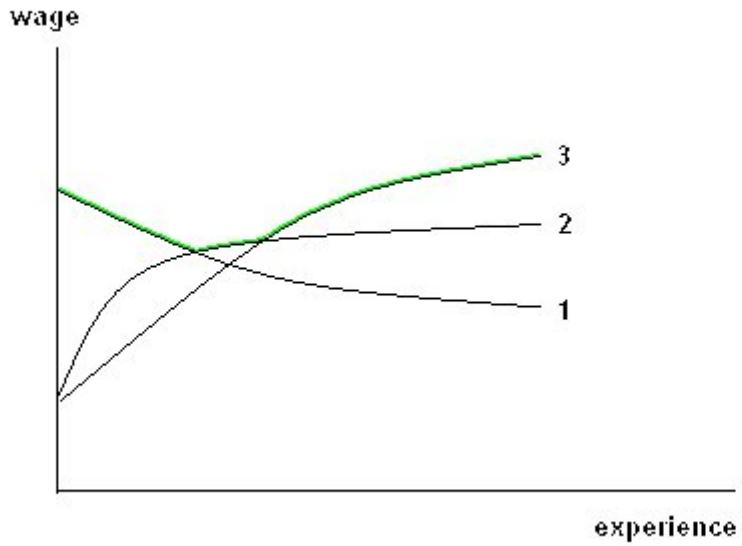

Figure 1: Optimal wage path

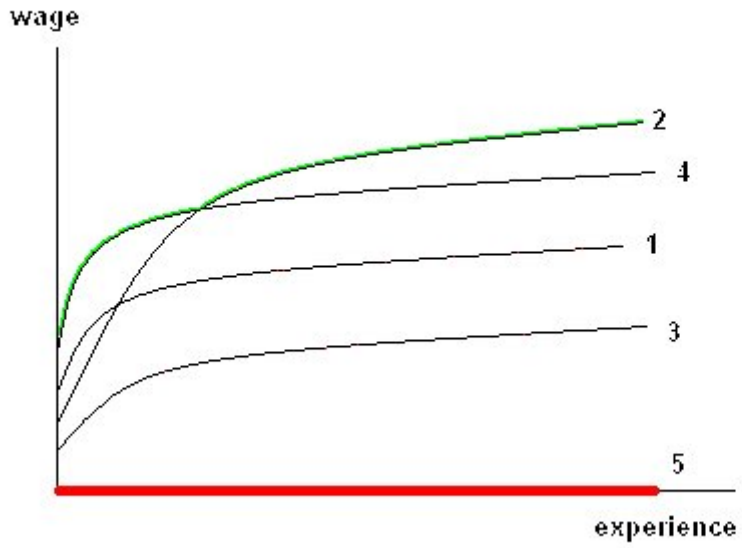

Figure 2: Different wage offers to a worker

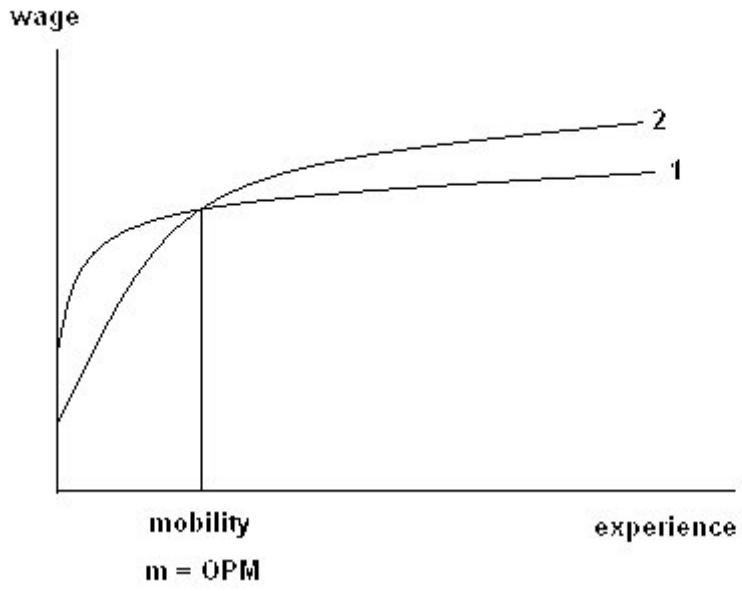

Figure 3: Wage trajectories of special interest (optimal mobility)

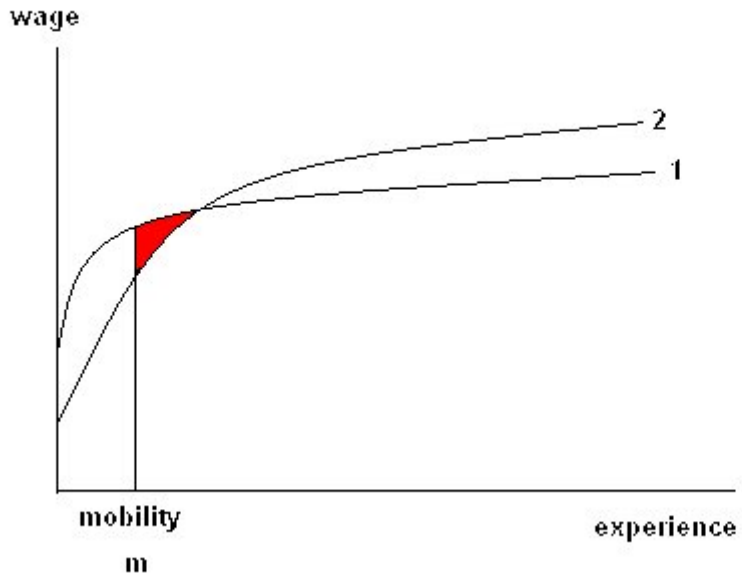

Figure 4: Wage trajectories of special interest (suboptimal mobility: early)

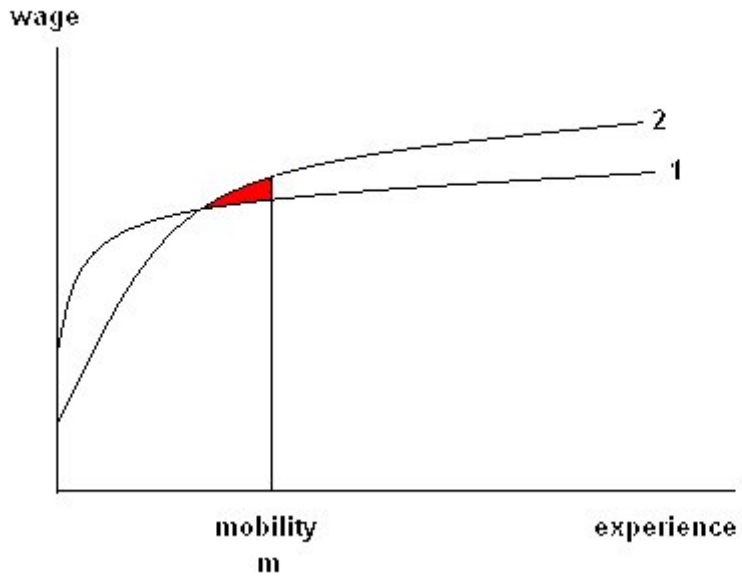

Figure 5: Wage trajectories of special interest (suboptimal mobility: late)

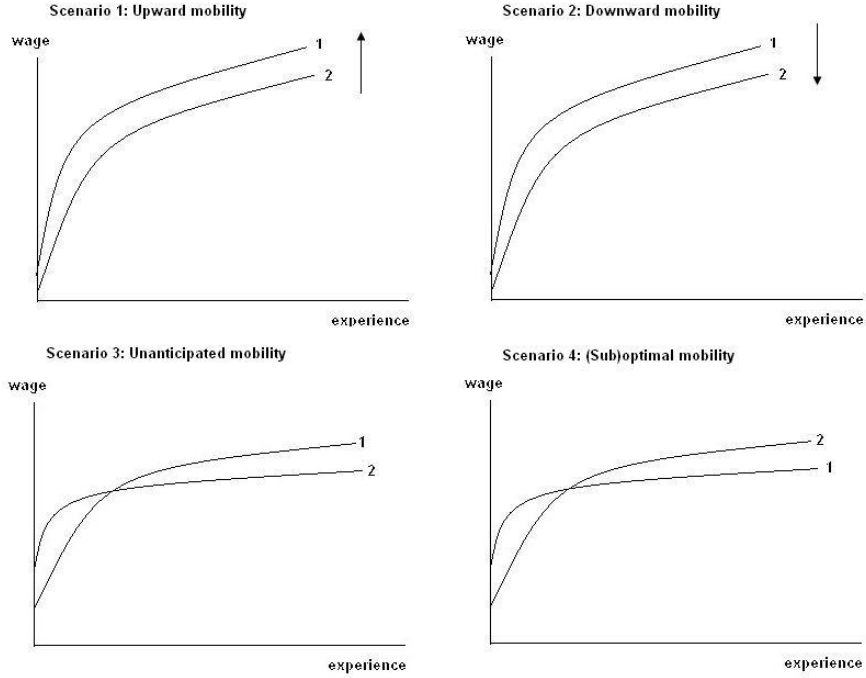

Figure 6: Scenarios

Tables

Predicted wage path differential in t, f∈(1,2)	Firm 1 $t_{1,i}, ..., t_{OPM,i}$	Firm 2 $t_{OPM+1,i}, ..., t_{T,i}$	Scenario (see Figure 6)
$\widehat{log(w)}_{i,1,t} - \widehat{log(w)}_{i,2,t}$	< 0	< 0	[1] 'upward mobility (Borjas)' *
$\widehat{log(w)}_{i,1,t} - \widehat{log(w)}_{i,2,t}$	> 0	> 0	[2] 'downward mobility (Smith)' *
$\widehat{log(w)}_{i,1,t} - \widehat{log(w)}_{i,2,t}$	< 0	> 0	[3] 'unanticipated mobility' **
$\widehat{log(w)}_{i,1,t} - \widehat{log(w)}_{i,2,t}$	> 0	< 0	[4] '(sub)optimal mobility' **

* discontinuous wage profile → no intersection point (OPM) existent

** changing signs imply an intersection point of the wage trajectories → intersection point (OPM) is existent

Table 1: Description of the different mobility scenarios

	Frequency	Percent	Cumulative
[1] upward mobility (Borjas)	34056	46.11	
[2] downward mobility (Smith)	27284	36.94	83.05
[3] unanticipated mobility	5861	7.94	90.99
[4] (sub)optimal mobility	6653	9.01	100
Total	73854	100	

Table 2: Scenarios of employer-to-employer changes; only individuals changing employer once is accounted for

Variable	Observations	Mean	Std.Dev	Quartiles				
				0.10	0.25	Median	0.75	0.90
$\widehat{log(w)}_{i,1,t} - \widehat{log(w)}_{i,2,t}$	6653	-0.0273	0.1366	-0.1375	-0.0588	-0.0130	0.0087	0.0588
$\widehat{log(w)}_{i,1,t} - \widehat{log(w)}_{i,2,t} > 0;$ suboptimal (early)	2203	0.0660	0.1244	0.0029	0.0088	0.0272	0.0731	0.1600
$\widehat{log(w)}_{i,1,t} - \widehat{log(w)}_{i,2,t} = 0;$ optimal	0	0	0	0	0	0	0	0
$\widehat{log(w)}_{i,1,t} - \widehat{log(w)}_{i,2,t} < 0;$ suboptimal (late)	4450	-0.0735	0.1175	-0.1760	-0.0902	-0.0353	-0.0128	-0.0042

Table 3: Descriptive statistics on the realized period of mobility; Scenario: (Sub)optimal mobility

Variable	Upward mobility	Downward mobility	Unanticipated mobility	Optimal mobility	Suboptimal mobility Early	Suboptimal mobility Late
Observations	34056	27284	5861	0	2203	4450
$\widehat{log(w)}_{i,1,t}$	4.4255	4.5145	4.3915	0	4.4644	4.3672
$\widehat{log(w)}_{i,2,t}$	4.5638	4.3793	4.3395	0	4.3984	4.4407
exp_{pot}	11.8410	11.0993	10.0476	0	9.9033	10.2818
exp^2_{pot}	195.5936	174.0912	162.9410	0	140.7204	157.9245
$\text{occup}_{vocational}$	0.0188	0.0254	0.0660	0	0.0436	0.0418
$\text{occup}_{unskilled}$	0.1677	0.1551	0.1353	0	0.1384	0.1402
$\text{occup}_{skilled}$	0.1926	0.2200	0.2075	0	0.2242	0.1838
$\text{occup}_{technician}$	0.0071	0.0083	0.0078	0	0.0073	0.0085
occup_{clerk}	0.6138	0.5912	0.5833	0	0.5865	0.6256
occup_{else}	reference category					
german	0.9234	0.9266	0.9481	0	0.9446	0.9389
monitoring*	0.1710	0.1840	0.3064	0	0.4544	0.2427
male	0.7208	0.6935	0.6410	0	0.7222	0.6526
west	0.8592	0.7425	0.7403	0	0.7463	0.7301
secondary school level I certificate	0.0842	0.0976	0.0570	0	0.0654	0.0580
secondary school level I certificate+apprenticeship	0.5357	0.5512	0.6176	0	0.5552	0.5962
advanced (technical) college entrance qualification	0.0165	0.0176	0.0357	0	0.0159	0.0308
advanced (technical) college entrance qual. + apprenticeship	0.0765	0.0709	0.0845	0	0.0790	0.0883
advanced technical college certificate	0.0849	0.0811	0.0679	0	0.0722	0.0787
other schooling	reference category					

* days in firm < 100

Table 4: Arithmetic means in the mobility period, displayed by the different scenarios