The Importance of Two-Sided Heterogeneity for the Cyclicality of Labour Market Dynamics

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PRELIMINARY

Abstract

Using a linked employer-employee data set derived from German administrative data, we investigate the cyclicality of worker and job flows. The analysis stresses the importance of two-sided labour market heterogeneity in this context, taking into account both observed and unobserved characteristics. We find that firms that are characterized by high turnover, and small size, hire mainly at the beginning of an economic expansion. Later on in the expansion hirings more frequently result from direct job-to-job transitions, with employed workers moving to larger firms with lower worker turnover. Contrary to our expectations, workers moving to larger firms do not experience significantly larger wage gains than workers moving to smaller establishments. Furthermore, our econometric analysis shows that the interaction of unobserved heterogeneities on the two sides of the labour market plays a more important role for employed job seekers than for the unemployed.

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1 Introduction

The analysis of the cyclicality of labour market dynamics has been a very active field of research for the last two decades.[1] Nevertheless, important questions remain unanswered. In particular, this concerns the role of heterogeneity on both sides of the labour market. As Moscarini and Postel-Vinay (2007) point out, the interaction between heterogeneous workers and heterogeneous firms over the business cycle is a crucial and up to now little understood process. They argue that, on the US labour market, specific phases of the business cycle see different types of firms hiring different types of workers, which leads to specific labour market transitions and wage dynamics. In particular, in the early phase of an economic expansion, small firms hire mainly from the ranks of the unemployed, a process which results in relatively low wages. In later phases of an economic expansion, hirings from larger firms predominate. With the pool of unemployed workers having shrunk considerably, this entails more direct job-to-job transitions from small to large firms, and higher wages. The interaction of heterogeneous firms and workers thus has important implications for both labour market transitions and the evolution of the wage structure.

We perform a similar type of analysis using two administrative micro data sets on dependent-status, social security employment for West Germany. On the one hand, we use a linked employer-employee data set provided by the Institute for Employment Research (IAB), the LIAB. The latter contains detailed information on both workers and firms on the German labour market for the time period 1993-2006. On the other hand, we use a micro data set on German workers' employment and unemployment histories for the time period 1975-2004, also provided by the IAB, the IAB Employment Sample (IABS). This data set offers less information on the firm side than the LIAB, but follows workers over a much longer time period. Together, these two data sets make it possible to analyze the role of heterogeneity on both sides of the West German labour market over the business cycle.

The plan of the paper is as follows. The next section contains an overview of the literature on the cyclicality of labour market dynamics. The third section describes the data sets used in our analysis. The fourth section summarizes the stylized facts of West German labour market dynamics, paying particular attention to the heterogeneities involved. Section 5 offers an econometric analysis of the cyclicality of these dynamics. The last section summarizes our main findings and concludes the discussion.

[1] The next section provides an overview of the literature.

2 Labour Market Dynamics and Heterogeneity in the Literature

Previous research on the dynamics of the labour market has shown that the reallocation of jobs and workers is a pervasive phenomenon, which is also strongly influenced by the business cycle. The empirical analysis of worker turnover and job turnover has a long tradition, with the U.S. labour market having received particular attention.[2] Recently, the relative importance of hirings and separations for the cyclicality of labour market dynamics has taken centre stage. Summarizing the literature on this debate, Yashiv (2008) shows that there are facts that all studies agree upon, but that there is also much disagreement. Facts that are not contested mainly concern the flows between employment and unemployment. The most important differences between studies appear for the flows between employment and non-employment.

Empirical evidence for Germany remains relatively scarce. Schmidt (2000) uses a representative German household survey, the German Socio-economic Panel (SOEP), in order to analyse the dynamics of German labour market flows. His analysis stresses the heterogeneous experience of different demographic groups, especially with respect to their sensitivity to cyclical factors. Fitzenberger and Garloff (2005) use the IAB employment subsample (IABS) for the time period 1975 to 2001, and calculate labour market transitions. However, they only consider year-on-year changes, which means that a lot of the actual dynamics are not recorded in their study. Employing the same data set, Bachmann (2005) shows that hirings play an important role for labour market dynamics.

One important weakness of the aforementioned studies is that they only control for worker heterogeneity. This implies that they completely neglect the heterogeneity on the firm side, as well as match-specific characteristics. As Hamermesh (2007) points out, this can lead to severe misspecification problems if worker and firm characteristics interact in a systematic way. Those problems can be avoided by the usage of linked employer-employee data sets. Anderson and Meyer (1994) were among the first to use this kind of data. In a comprehensive analysis for the U.S., they analyze the determinants of worker flows by ac-

[2] Blanchard and Diamond (1989, 1990) were among the first to provide direct evidence on gross worker flows in the U.S.. For analyses of worker flows and job flows in European countries see Burda and Wyplosz (1994), and Contini and Rivelli (1997).

counting for various individual and firm characteristics, and quantify the relation between job and worker reallocation. Their findings suggest that worker flows are distinct from job flows and that individual as well as firm effects are important factors for the determination of labour market dynamics. Other studies that use linked employer-employee data to examine worker and job turnover are Albæk and Sørensen (1998) for Denmark, Abowd, Corbel, and Kramarz (1999) for France, Burgess, Lane, and Stevens (2000, 2001) for the U.S., and Alda, Allaart, and Bellmann (2005) for Germany and the Netherlands.[3] One common finding of these studies is that almost all firms are simultaneously hiring and experiencing separations: expanding firms continue to lose workers, while contracting firms continue to hire workers, meaning that churning is an omnipresent feature of the labour market. Much of this work points out that the amount of labour market dynamics varies substantially between different workers and employers. Lane, Stevens, and Burgess (1996) for example find that worker reallocation as well as job reallocation show a strong sectoral variation and tend to decrease with the age and the size of a firm. Another well documented empirical pattern is that worker flows are more pervasive among young and low skilled employees, meaning that they are strongly affected by individual characteristics. Studies that do not only take into account observed heterogeneity but do also control for unobserved heterogeneity, which might affect transition probabilities, remain relatively scarce. Bjelland, Fallick, Haltiwanger, and McEntarfer (2008) present descriptive evidence on the importance of worker and firm characteristics for direct job-to-job transitions using linked employer-employee data for the United States. They find that the pace of these transitions is highly procycylical, and varies systematically across worker, job and employer characteristics. Frederiksen and Westergaard-Nielsen (2007) analyse the effects of individual and workplace characteristics, as well as of the business cycle, on individual job separations and the associated destination states in the Danish private sector. They find that there is large heterogeneity both within and between destination states. In examining the relationship between job flows and worker flows, Burgess, Lane, and Stevens (2001), allow for firm fixed effects in order to control for the unobserved heterogeneity that exists on the employer side.

When analyzing the evolution of hirings over the business cycle, it is important to note that firms generally seem to have a preference for hiring workers who are currently employed, rather than hiring out of unemployment. For example, Eriksson and Lagerström (2006) show

[3]See Abowd and Kramarz (1999) for a comprehensive review.

that, on the Swedish labour market, unemployed job applicants face a lower probability to get contacted by a firm than otherwise identical employed applicants. They argue that this is due to the fact that firms view employment status as an important signal for productivity. Nagypál (2006) provides another theoretical argument for why firms might prefer hiring employed, rather than unemployed, workers. Workers arriving from unemployment are less likely to end up in a job they are happy with than employed job searchers. Therefore, the former workers are more likely to engage in job-shopping and to leave an employment relationship for a more appealing job. Given that hiring workers involves fixed costs, firms can economize on these costs by hiring employed workers. It therefore seems important to analyze hirings from employment and hirings from unemployment separately.

There is thus a number of studies analysing labour market dynamics and the role played by individual heterogeneity. However, to the best of our knowledge, there is no literature on the determination of labour market mobility which takes into account the observed as well as the unobserved heterogeneity that is present on both sides of the labour market. In contrast to this, the research on wage determination is further developed as it includes individual as well as firm fixed effects in the estimation equations. In one of the first studies of earnings based upon linked employer-employee data, Abowd, Kramarz, and Margolis (1999) analyze the annual compensation for French workers by holding the unobserved time-invariant characteristics of workers and firms constant. Abowd, Kramarz, and Roux (2006) continue this line of research analzying both worker and wage mobility. They take into account heterogeneity on both sides of the labour market. However, they do not take into account workers' transitions from unemployment to employment. In this paper, we adopt one of the fixed effects approaches proposed by Abowd, Kramarz, and Margolis (1999) for wage regressions, to the analysis of labour market transitions. In particular, we estimate a non-linear model with establishment and individual fixed effects using German linked employer-employee data. Therefore, we contribute to the existing literature by controlling for the observed as well as unobserved heterogeneity on both sides of the labour market, when examining labor mobility out of employment and unemployment.

3 Data and Concepts

3.1 The data set

The following analysis of the importance of two-sided heterogeneity on labour market dynamics requires individual as well as firm information. For that reason, we use the German LIAB, a linked employer-employee panel data set provided by the Institute for Employment Research (IAB), which currently comprises the years 1993-2006.[4] This data set is a combination of process-induced person-specific data from the *Employment Statistics Register* and plant-level data from the *IAB Establishment Panel*.

The *Employment Statistics Register* is an administrative panel data set of all individuals in Germany who worked in an employment covered by social security between 1975 and 2006. This means that for example civil servants, self-employed and workers in marginal employment are not included. For 1995, this data source contains the employee history of nearly 79,4% of all employed persons in Western Germany, and 86,2% of all employed persons in Eastern Germany. The basis of the employee history is the integrated notification procedure for health insurance, the statutory pension scheme and unemployment insurance, which was introduced in 1973. Since then, employers have been obliged to make notifications to the social security agencies at the beginning and at the end of any employment spell. Furthermore, an annual report for each employee registered within the social insurance system is compulsory at the end of the year. The reports provide information on a daily basis on, for example, the year of birth, sex, marital status, nationality, qualification and the current occupation of the employee.[5]

The second data source, the *IAB Establishment Panel*, is an annual representative survey of German establishments that employ at least one employee who pays social security contributions. Starting in 1993, this survey is drawn from a stratified sample of the establishments included in the Employment Statistics Register, where the stratification is done according to 10 establishment size classes and 16 industries.[6] The establishments covered by the survey were questioned each year about various issues, such as the number of employees,

[4] Information on the LIAB data set is given by Alda, Bender, and Gartner (2005).

[5] A detailed description of the Employment Statistics Register and the notification procedure is given by Bender, Haas, and Klose (2000).

[6] From 2000 onwards the stratification cells are defined over 20 industries.

the decomposition of the workforce, sales and investments.[7]

Using the unique plant identification number, it is possible to match the two data sets to a linked employer employee data set providing detailed information on individual and establishment characteristics. In a first step of this matching process, establishments who participated in the IAB Establishment Panel between 2000 and 2002 are selected. In a second step, the Employment Statistics Register is used to link the sample of establishments with the employee history information for all individuals who worked at least one day in one of the selected establishments during 1997 to 2003. From this sample, we exclude observations in East Germany, apprentices, trainees, homeworkers, part-time workers, individuals older than 65 and establishments with missing values for the variables of interest. Selecting only individuals without parallel employment spells the resulting sample contains 1.9 million individuals, 4856 establishments and a total of about 12.1 million observations. From the establishment level data we retrieve information on some establishment characteristics, which may be expected to affect labour market dynamics. These include industry, establishment size, as well as establishment age. The individual information is exploited to calculate a number of establishment-specific means, such as the share of apprentices, females, part-time workers, as well as the shares of different skill groups. A description of these establishment characteristics is provided by Table A.1 in the appendix.

Since the linked employer employee data set is solely available from 1993 until 2006, the time period under consideration is relatively short for an analysis of business cycle properties. We therefore also use the IAB employment sample (IABS). This data source is a subsample of the Employment Statistics Register and covers 2% of all persons in Germany who were employed at least for one day between 1975 and 2004. Given this longer time span, we are able to observe two full swings of the business cycle. With respect to the individual workers, we use the same restrictions as in the LIAB, which results in a sample with 1.05 million individuals and a total of about 15 million observations.

The LIAB as well as the IABS are representative regarding employment covered by the social security system but not regarding unemployment. Only those unemployed who are entitled to transfer payments are covered. In both data sets, we can derive three labour market states at each moment in time: employment (E) covered by social security, unemployment (U), if the worker is receiving transfer payments, and non-participation (N).[8]

[7] A detailed description of the IAB Establishment Panel is given by Kölling (2000).

[8] In the IABS data, the record on unemployment benefit recipients are unreliably measured before 1980,

Since the latter state cannot be directly observed, we define non-participants as individuals out of sample. These individuals are not recorded in the data sets, meaning that we cannot differentiate them from civil servants, self-employed, retired and marginally employed workers. Regarding these labour market states, there might exist measurement errors. Because of the way the data are collected, both firms reports of a new employee and individuals notifications of moving into or out of unemployment are not exactly consistent with the actual change of labour market state. The latter potential measurement error can be corrected in the following way: If the time lag between two employment or unemployment notifications does not exceed 30 days, it is defined as a direct transition between the two states recorded. We count it as an intervening spell of non-participation if the time interval between the two records is larger than 30 days.

3.2 The concepts of worker flows and job flows

The IABS data set contains daily information on the employment and unemployment history of every individual in the sample. Therefore, it is possible to calculate worker flows taking into account every change of the labour market state that occurs within a given time period. Using the three mentioned states E, U and N, as well as the establishment identification number provided in the data set, we are able to identify seven possible worker flows. On the one hand, there are the flows from employment to another job (EE flows), to unemployment (EU flows), and to non-participation (EN flows). Adding up these three flows yields the separations for the aggregate economy, $S_t = EE_t + EU_t + EN_t$. On the other hand, there are the flows to employment from another job (EE flows), from unemployment (UE flows) and from non-participation (NE flows). The accessions for the aggregate economy are calculated by summing up these three flows, $A_t = EE_t + UE_t + NE_t$. It should be noted here that our definition of a job is based on the establishment level and not on the firm level. Therefore a transition from one establishment to another one within the same firm will also be identified as an employer-to-employer flow. Following Davis and Haltiwanger (1999), we calculate the corresponding rates of each flow by using the average of current and past employment $(E_{t-1} - E_t)/2$ as the denominator. On the basis of the LIAB data set, we construct the

such that we cannot use the worker flows to and from unemployment for the time period 1975-1979. Therefore we start our analysis in 1980

worker flows for the aggregate economy in the same way as described above.[9]

But since the LIAB data allow us to identify establishments, we are able to exploit the individual information to calculate annual worker and job flows on the establishment level. By doing so, we define the stock of employment in establishment e at time t, E_{et}, as the number of employment spells including the reference date June 30th in year t. Following the standard terminology (Davis and Haltiwanger, 1999), in which job flows are defined as the net change in employment at an establishment e, the year-to-year job flow rate is given by

$$JFR_{et} = \frac{E_{et} - E_{et-1}}{(E_{et} + E_{et-1})/2} = \frac{\Delta E_{et}}{(E_{et} + E_{et-1})/2}, \tag{1}$$

where E_{et} and E_{et-1} reflect the level of employment in year t and year $t-1$, respectively. The job reallocation rate for any given establishment is the absolute value of JFR_{et}:

$$JRR_{et} = |\frac{E_{et} - E_{et-1}}{(E_{et} + E_{et-1})/2}| \tag{2}$$

A positive year-to-year job flow rate is called job creation rate, $JCR_{et} = JRR_{et}$ if $JFR_{et} \geq 0$, while a negative job flow rate is referred to as job destruction rate, $JDR_{et} = JRR_{et}$ if $JFR_{et} < 0$. Following Burgess, Lane, and Stevens (2000) we define accession and separation rates at the establishment level as follows:

$$AR_{et} = \frac{A_{et}}{(E_{et} + E_{et-1})/2} \tag{3}$$

and

$$SR_{et} = \frac{S_{et}}{(E_{et} + E_{et-1})/2}, \tag{4}$$

where worker accessions A_{et} include any employment relationship which is observed on June 30th in year t but not on June 30th in year $t-1$. Correspondingly, worker separations S_{et} comprise any employment relationship which is observed in year $t-1$ but not in year t.[10] The worker turnover rate or the worker flow rate is measured as the sum of accession and separation rate

$$WFR_{et} = \frac{A_{et} + S_{et}}{(E_{et} + E_{et-1})/2}. \tag{5}$$

[9] Because of the way the LIAB data are constructed, it is only possible to calculate reliable worker flows between the three labour market states for the time period 1997-2003.

[10] Because of the way we define accessions, separations and job flows, we are not able to calculate the labour market dynamics for the first time-series observation of an establishment in the panel. Therefore, we cannot start our analysis with 1993.

Note that by definition it holds that the change in employment must be equal to the difference between accessions and separations, i.e. $JRR_{et} = |AR_{et} - SR_{et}|$. Therefore, the worker flow rate can also be expressed as

$$WFR_{et} = JRR_{et} + CFR_{et}, \tag{6}$$

where CFR_{et} is the level of the so called churning flow rate. It is also referred to as the excess worker flow rate, meaning that this part of the worker flow is actually not needed for adjusting the workforce in an establishment to its desired level.[11]

4 Stylized Facts

4.1 Job, worker and churning flows: aggregate evidence

In this section, we derive some stylized facts concerning the cyclical features of worker flows and job flows in the West German labour market. We start by analyzing the evolution of worker flows over the cycle using the IABS data. Figure B.1 shows the accession and separation rates for the time period 1980-2003. The shaded areas in this figure indicate the times from the beginning of a recession (business cycle peak) until the end of a recession (business cycle trough). The peaks of the German business cycle are in 1980/I, 1992/I and 2001/I, while the troughs are in 81/IV, 92/IV and 2001/IV. Here one can see, as expected, that the accession rate is clearly procyclical. The separation rate is procyclical as well, but less so than the accession rate, which implies a reduction of the aggregate employment level at times of recession. These findings are in line with Bachmann (2005), who points out that during recessions a decline in the hiring activity can be observed, together with a rise in separations.

In order to further investigate this matter further, we split up the accession flows into EE flows, UE flows and NE flows. The time series pattern of the three transitions for the time period 1980-2003 are presented in Figure B.2. Regarding the cyclical behaviour, one can see that job-to-job transitions show a clearly procyclical pattern, as do transitions from non-participation to employment. However, the flow from unemployment to employment,

[11] As with the individual worker flows, we are not able to calculate the aggregated worker- and job flows on the establishment level for the entire time period. Due to the construction of the data, we have to restrict our analysis to the time span 1997-2003.

being not as volatile as the other two worker flows, rises much earlier and drops during periods of economic recovery. These observations indicate that the outflow from unemployment dominates during recessions and during the beginning of expansions, while job-to-job transitions are the most important source of accessions in the mature phase of expansions. The three worker flows making up separations, namely the EE flows, EU flows and EN flows, are displayed in Figure B.2. As one can see, the job-to-job flows and the flows from employment to non-participation are procyclical, while the flow from employment to unemployment starts to increase during recessions and declines in periods of economic recovery. This means that we can observe a shift from employment-to-unemployment transitions to job-to-job transitions in the mature phase of the economic expansion.

Based on the LIAB data, we also calculated the hiring and separation flows for the aggregate economy. The resulting time series for the time period 1997-2003 show the same pattern as those obtained from the IABS data.[12] Table A.2 displays the annual rates of job flows, worker flows and churning flows at the establishment level over the time period 1997 to 2003. Regarding the time series properties, one noteworthy fact is that the job creation rate seems to be procyclical since it increases during the upturn period 1998-1999 and starts to decrease at the beginning of the recession in 2000. In contrast to this, job destruction is countercyclical, because it exhibits the opposite behaviour over the time period under consideration. As job destruction does not vary to a significantly greater degree than job creation, the job reallocation rate shows an acyclical behaviour.[13] Furthermore, we find evidence for a strongly procyclical behaviour of worker and churning flows.[14] Looking at job creation and job destruction, the table shows that both take place simultaneously in all observed years. We find job destruction rates ranging from 4.1% to 10.6%, while employment expanded over the sample period. Finally, we see the mean job reallocation rate at a value of 17.2%, and the worker reallocation rate at a level almost three times higher. Hence, churning flows make up at least two thirds of total worker flows and therefore are a pervasive phenomenon of the German labour market. This implies that firms hire and fire workers, and that workers leave and enter jobs, mostly for reasons related to specific firm

[12] The accession and separation rates based on the LIAB data set are available from the authors upon request.

[13] This result is in line with what has been found for OECD countries (OECD, 1996). However, Davis and Haltiwanger (1999) report job reallocation to be countercyclical in the U.S.

[14] The same finding has been made by Burgess, Lane, and Stevens (2000) and Albæk and Sørensen (1998).

needs and worker abilities. This concerns both observable and unobservable worker and firm/job characteristics. To this issue we now turn.

4.2 Two-sided heterogeneity and labour market dynamics

In order to analyse the interaction between worker and firm heterogeneities on both sides of the labour market in more detail, we first present stylized facts about job and worker flows at the establishment level (cf. Table A.3). It becomes apparent that the job reallocation rate declines with the establishment size, ranging from 19.8% in small establishments to 6.6% in very large establishments. Moreover, job reallocation tends to be larger in younger establishments, which seems to be mostly caused by higher job creation rates, since job destruction rates show only slight variations. The same observations can be made for worker and churning flows, which are also higher in smaller and younger establishments throughout all categories. This is also true for the accession (or hiring) rate, which plays an important role in our analysis. It falls monotonically from 29.4% per year for small establishments to 11.5% for large establishments.

Worker flows also vary strongly across different worker and establishment categories. Tables A.4 and A.5 report the yearly averages of the worker flow rates for the time period 1997-2003 for establishment and worker categories, respectively. The establishment categories considered are the industry, the size, and the age of the establishment. The worker categories we consider are age, gender and skill group. Several features are worth noting, shedding some light on the impact of heterogeneities on labour market dynamics. Regarding the establishment categories, it becomes apparent that the size, the age and the industry of establishments have a strong impact on worker flows. There is a general tendency of hiring flows and separation flows to decline with the establishment size as well as the establishment age, implying that in smaller and younger establishments more fluctuations exist. This finding is consistent with other research (Davis and Haltiwanger, 1999, and Lane, Stevens, and Burgess, 1996). With respect to the industry, one can see from the tables that worker flows are relatively low in the government sector, while are they very high in the construction sector. In this respect, the transitions between unemployment and employment display the strongest difference. While in the government sector, the EU- and UE-rate are close to 5%, they reach more than 20% in the construction sector, which can mainly be attributed to seasonal variations. Looking at worker categories, one can see that there are substantial

age-specific differences in worker flows. The flows decrease with the age of employees, which can be explained by the fact that older workers tend to have accumulated more job-specific human capital, and that they are more likely than younger workers to have ended up in a job which suits their skills. Finally, workers characterized by a lower skill level particularly transit between employment and unemployment as well as employment and non-participation. More highly skilled employees, however, are more likely to experience job-to-job transitions. To sum up, we can see that labour market dynamics vary with worker as well as establishment categories, with the size of an establishment having a particularly strong impact. For that reason, we now examine the behaviour of labour market dynamics across various establishment size categories in more detail.

As pointed out in the introduction, firms are likely to have preferences over the previous labour market state of their new hires. Firms are likely to prefer hiring employed workers because unemployment may be perceived as a negative signal. Furthermore, the expected duration of a new job is higher for previously employed job seekers because the match is likely to be a better fit than if the worker had been previously unemployed. In order to investigate the consequences of these mechanisms, we analyse the origin of new hires for different establishment size classes. Looking at all the establishments considered, 34.9% of new hires come from employment, 25.6% come from unemployment, and 39.5% from nonparticipation (cf. Table A.6). The hiring source, however, depends strongly on the size of the establishment. Small establishments hire about an equal proportion of their new workers from employment and from unemployment (29.3% and 30.5%, respectively). With growing establishment size, however, the proportion of hires from employment increases at the expense of hirings from unemployment. Very large establishments hire 42% of their new workers from employment, but only 12.4% from unemployment. Thus, to the extent that firms prefer hiring employed workers, large firms are able to compete more successfully for employed job seekers in the labour market.

An examination of the distribution of destination states that follow a job separation leads to very similar results (cf. Table A.7). Considering all observations, 36.7% of the separations end in employment, 25.1% in unemployment, and 38.2% end in nonparticipation. When we split up the establishments into different size classes, we can observe strong size-specific variations in the distribution of separation destinations. In particular, for small establishments we find a roughly equal proportion of the separations to lead to a new

employment (32.2%) and to unemployment (30.08%). In contrast to this, separations from very large establishments are followed by employment in 39.1% of cases, and only 15.9% are followed by an unemployment spell.

As we are mainly interested in the cyclical features of labour market dynamics, we now look at the time series of these distributions. Figure B.3 shows the hiring flows EE, UE, and NE, computed as the share of hirings, across different establishment size classes. As in Table A.6, it again becomes obvious that for larger establishments, job-to-job transitions play the biggest role, whereas the outflow from unemployment makes up only a small part of hirings. For large establishments, this stylised fact does not change over the business cycle. For smaller establishments the picture is more diverse as the importance of the different hiring sources changes over the business cycle. While during recessions and the beginning of expansions, a larger part of the newly hired employees comes from unemployment than from employment, the opposite is the case during the mature phase of economic expansions. One can see very similar patterns in Figure B.4, which presents for different establishment size classes the three separation flows as a share of total separations. Here the employer-to-employer flows also seem to gain importance with increasing establishment size, while the flows from employment to unemployment become less important the larger the establishments get. Looking at smaller establishments, however, we observe strong cyclical fluctuations in the importance of the destination states. During recessions, the flow to unemployment becomes more important and is the most relevant separation flow in the early phase of an economic upturn, whereas the importance of job-to-job transitions is largest during later expansion phases and decreases afterwards. Doing the same calculations with the LIAB data, we obtain very similar results. In order to emphasize the differential behaviour of the different labour market flows across establishment size classes, we calculate the size-specific worker flows as a share of total worker flows. That is, we calculate the following fraction:

$$SF_{gt} = \frac{F_{gt}}{F_t}, \tag{7}$$

where F_{gt} refers to a particular flow occurring in establishment size class g in year t, and F_t denotes the same, but economy-wide, flow in year t. We calculated the above share for hirings and for separations, and used a Hodrick-Prescott (HP) filter to isolate the cyclical from the structural component.[15] The times series for the HP-filtered deviations from the

[15] Following Ravn and Uhlig (2002) we use a HP smoothing parameter value of 6.25 for our yearly data.

trend are displayed in Figure B.5. As one can see, there exist important establishment-size specific differences in the cyclical timing of hirings. In particular, smaller establishments already increase their share in hirings during periods of recessions. In contrast to this, the hiring activity of large firms, relative to smaller firms, decreases during recessions and mainly takes place in the mature phase of economic expansions. These observations indicate that the smaller the establishments are, the earlier the hirings occur. It might be the case that larger establishments start hiring at a later date because they lay off fewer people during recessions, which implies that their capacity utilization fluctuates to a greater extent than that of smaller establishments. Regarding the timing of separations,we can observe that for smaller establishments, the share in match separations rises during periods of recessions, while it decreases in larger establishments.

To assess the differences in the hiring and separation behaviour between establishments with different job turnover rates, we calculate the fraction in equation (7), where F_{gt} now refers to a particular flow occurring in the turnover size category g in year t. Figure B.6 displays the detrended time series. Although the time period under consideration is relatively short to investigate empirical regularities, it becomes apparent that establishments of different turnover categories also show varieties in the timing of hirings and separations. While establishments with a low job turnover reduce their hiring activity during the recession and raise it in mature phase of the expansion, establishments characterized by a high turnover hire most notably during the recession and the early phase of the expansion. This implies that establishment with a high turnover show the same cyclical timing as small establishments and supports the finding that small firms are characterized by a high turnover. The reverse holds for large establishments (cf. Table A.3). While we can observe similar patterns for the cyclical timing of separations, the latter time series is much more noisy, which makes it difficult to draw clear-cut conclusions in this case.

4.3 Job-to-job transitions and wages

We have seen that large firms primarily hire workers out of an existing employment relationship. One potential reason for this is that large firms compete more successfully for employed job seekers than small firms because they choose to offer higher wages. In order to investigate this fact, we analyze the wage effect of job-to-job transitions. For that purpose, we first calculate for each year in the time period 1975-2004 the "fraction of EE flows leading

to a higher wage", which is defined as EE flows leading to a higher wage divided by total EE flows.[16] Since this time series contains a strong trend, again a Hodrick-Prescott filter (HP filter) is used. The HP-filtered deviations from the trend are displayed in Figure B.7. As expected, the share of job-to-job transitions yielding a higher wage decreases during times of recession and rises until the mature phase of the economic expansion. This observed procyclical pattern can be put down to the fact that in periods of economic recovery employers want to attract employed job seekers, resulting in an increase in the availability of better paid jobs (see Pissarides, 1994). During economic downturns, however, better jobs and higher wages are hard to find. Figure B.8 illustrates that the magnitude and the cyclical behavior of this fraction is very similar for job-to-job transitions to larger establishments and job-to-job transitions to smaller establishments. Furthermore, the series are relatively noisy and seem to be partly driven by idiosyncratic factors unrelated to the business cycle. This could be due to the effects of the institutional settings of the German labour market institutions, such as trade unions, may make wages relatively unresponsive to economic conditions, which results in wages reacting only weakly to differences between firms (such as firm size) or to changes in aggregate economic factors, the business cycle. This, however, is a matter of further investigation.

5 Econometric Analysis

5.1 Econometric specification

The descriptive analysis indicated that two-sided heterogeneity plays an important role for the cyclicality of labour market dynamics. We now want to analyse this issue econometrically, taking into account observable individual characteristics, observable establishment characteristics, and unobserved heterogeneity on both sides of the labour market.

We start by investigating the determinants of worker flows. The aim is to find out how the heterogeneity on both sides of the labour market affects the probability of person i in establishment e of experiencing a certain transition at time t, y_{iet}. For that purpose, we use

[16] Due to the upper contribution limit to the social security system in Germany, the wages reported in the data set are top coded. In order to address this top-coding problem we leave unconsidered the wages close to the contribution ceiling.

two different versions of a fixed effects logit model:

$$P(y_{iet} = 1) = \frac{exp(x_{it}\alpha_1 + f_{et}\beta_1 + gdp_t\gamma_1 + \delta_i)}{1 + exp(x_{it}\alpha_1 + f_{et}\beta_1 + gdp_t\gamma_1 + \delta_i)} \tag{8}$$

$$P(y_{iet} = 1) = \frac{exp(x_{it}\alpha_2 + f_{et}\beta_2 + gdp_t\gamma_2 + \delta_i + \lambda_e)}{1 + exp(x_{it}\alpha_2 + f_{et}\beta_2 + gdp_t\gamma_2 + \delta_i + \lambda_e)}, \tag{9}$$

where $i = \{1, ..., N\}$ denotes the number of persons in the data set, $e = \{1, ..., E\}$ the number of establishments, and $t = \{1, ..., T\}$ the number of quarters. As dependent variables, we consider separations ($y_{iet} = s_{iet}$), accessions ($y_{iet} = a_{iet}$), transitions from unemployment to employment ($y_{iet} = ue_{iet}$), and direct job-to-job-transitions ($y_{iet} = ee_{iet}$). In particular, the logit model for separations specifies the probability whether or not an individual leaves the establishment between $t-1$ and t, while the logit models for the accession flows specify what happened to individuals between $t-1$ and t for all employees being employed at time t. These probabilities are explained by observable person characteristics x_{it} (age, skill level, duration of previous employment, duration of previous unemployment) as well as observable firm characteristics f_{et} (industry, dummy variable indicating large establishment size).[17] The vector gdp_t, our measure of the business cycle, contains lagged GDP growth (lags 1 to 4) and captures the dynamic structure of the labour market process under investigation.[18]

Since the descriptive analysis has shown that there exist relevant size-specific variations in the cyclical timing of hirings and separations, we interact gdp_t with a dummy variable indicating large establishments. In the first version of the fixed effects logit model (8), we also include a person fixed effect δ_i. This fixed effect can be removed by time-demeaning the data, which implies that we are able to control for the part of the individual unobserved heterogeneity which does not vary over time. But since this fixed effects-procedure eliminates all time-invariant effects, it is not possible to explicitly use time-invariant covariates as explanatory variables. Therefore, the fixed effect δ_i indicates the impact of both observable and unobservable time-invariant characteristics.

The second version (equation 9) extends the first one by additionally including an establishment fixed effect, allowing us to take into account unobserved heterogeneity both on

[17] Large establishments are defined as those employing more than 100 workers. Trying alternative definitions, we find very similar estimation results.

[18] We have also estimated the model using only one GDP growth lag as explanatory variable and the estimation results are robust to alternative model specifications.

the firm side and on the worker side of the labour market. Abowd, Kramarz, and Margolis (1999) introduce various estimation methods to deal with firm and worker fixed effects in linear models. Amongst these is a method, referred to as *spell fixed effects*-approach by Andrews, Schank, and Upward (2004), which gives the opportunity to sweep out all time-invariant unobservable effects by time-demeaning each unique worker-establishment combination (or each spell). We now adopt this estimation method for our non-linear logit model and define the spell-level heterogeneity or *spell fixed effect* as

$$\pi_s = \delta_i + \lambda_e, \tag{10}$$

such that the two fixed effects logit model (equation 9) is now given by

$$P(y_{iet} = 1) = \frac{exp(x_{it}\alpha_2 + f_{et}\beta_2 + gdp_t\gamma_2 + \pi_s)}{1 + exp(x_{it}\alpha_2 + f_{et}\beta_2 + gdp_t\gamma_2 + \pi_s)}. \tag{11}$$

Since neither δ_i nor λ_e vary for each spell of an employee within an establishment, the spell fixed effects can be eliminated by subtracting averages at the spell-level, which implies that we are able to control for all time-invariant unobserved heterogeneity.[19] As in the first version of the fixed effects logit model (equation (8)), the effect of time-invariant regressors is absorbed by the fixed effect. In both versions we correct the standard errors for clustering at the individual level and spell level, respectively.

5.2 Estimation results

We present the results from estimating the fixed effects logit model in the following way. Table A.8 shows the marginal effects and robust standard errors for separation flows, while Tables A.9 and A.10 display the estimation results when we split up accession flows into the UE and EE flow. These tables include only the main variables of interest. Note that in the *spell fixed effects* logit model only those worker-establishment combinations are considered that show a variation in the dependent variable. This leads to a loss in observations, which implies that the sample used by the spell fixed effects logit model is smaller than the sample used by the logit model with only individual fixed effects. To allow for a better comparison between the two estimation methods - the individual fixed effects estimation (Column A) and the spell fixed effects estimation (Column B) - the tables additionally provide the results

[19] Note that this type of heterogeneity is unobserved by the econometrician, but that it might well, and in fact is likely to, be observed by firms and workers.

of a restricted individual fixed effects estimation (Column C). This estimation is based on the same sample that was used for the spell fixed effects estimation.

The estimated marginal effects of job separation, displayed in Table A.8, largely confirm the results from the descriptive analysis of the last section. In particular, the coefficients obtained from the individual fixed effects estimation (Column A) indicate that the probability of separation significantly declines with the size of an establishment as well as with the employees' skill level. Furthermore, individuals experience fewer job separations with increasing age and increasing employment duration. For individuals aged 55-65, however, we observe a rise in the separation probability, which can mainly be explained by retirements. Regarding the cyclical behaviour, these estimation results indicate that initially separations are countercyclical, but from the second lag on show a procyclical pattern. Interestingly, the coefficients on the explanatory variables in the estimation with spell fixed effects are an order of magnitude smaller than in the estimation with worker fixed effects. This means that unobserved match characteristics play an important role for these transitions. If these unobserved characteristics are not explicitly taken into account, they are absorbed by observable worker and establishment characteristics. This is due to the fact that these observable characteristics are correlated with the unobserved characteristics. In other words, regressions without spell fixed effects feature biased and inflated coefficients on the observable explanatory variables.

For the two hiring flows, EE- and UE-flows, the coefficients of the individual fixed effects estimation (Column A, A.9 and A.10) show that very similar features emerge with respect to the establishment size, and the age of employees. Moreover, as already seen for separations, we observe that the probability of UE-transitions decreases with the skill level of an individual. In contrast to this, higher skilled individuals are more likely to experience job-to-job transitions. The estimated coefficients of the gdp variables indicate that job-to-job transitions are procyclical, with the positive impact increasing with the lag. Looking at the coefficients of the interaction term, we see that for large establishments this effect is initially slightly lower but from the first lag on higher than for small establishments. The coefficients of the gdp variables indicate that the transitions from unemployment to employment display a countercyclical pattern for smaller establishments, and a procyclical pattern for larger establishments. These results confirm our observations in the descriptive analysis: Larger establishments hire an increased number of employed job searchers during the later

phase of the expansion, while smaller establishments start to hire earlier mainly individuals out of unemployment.

Looking at the hiring hazards in more detail, one can see that in the case of the hazard of experiencing a direct employer-to-employer transition, taking into account spell fixed effects reduces the coefficients on the explanatory variables significantly. This is not the case for the hazard of transiting from unemployment to employment, where the coefficients of the spell fixed effects estimation are very similar to that of the worker fixed effects estimation.[20] This implies that unobserved characteristics play a much more important role for job-to-job transitions. There are several explanations for this. First, employed job searchers are better informed with respect to both their own abilities and potential jobs than their unemployed counterparts. Therefore, they are less dependent upon easily observable characteristics, and unobserved match and firm characteristics become more important. Second, employed job searchers, being employed and earning a wage, are likely to be more choosey with respect to future jobs than unemployed job searchers. Therefore, they will turn down job offers which are unlikely to lead to a good match, and where unobserved firm characteristics seem unfavourable. Unemployed job searchers, on the other hand, have a much lower reservation threshold. They will therefore accept jobs with unfavourable unobserved characteristics more often. Third, the labour market history of employed workers may provide more useful signals to firms than that of unemployed workers. Firms may therefore be able to find workers which suit their needs more easily among the employed than among the unemployed, i.e. sorting of workers by firms is more efficient in the case of employed workers.

6 Conclusion

Using a linked employer-employee data set and a data set on individual workers' employment histories derived from German administrative data, we have investigated the cyclicality of worker and job flows. Taking into account both observed and unobserved characteristics, our analysis stresses the importance of the interaction between heterogeneous workers and establishments in the labour market. We find that small establishments hire more workers from unemployment than their larger counterparts. Conversely, large establishments hire much more workers out of an existing employment relationship. We argue that this is in

[20] Note that for both transitions, the spell fixed effects are defined with respect to the destination state.

all likelihood due to the fact that large firms compete more successfully for employed job seekers than small firms.

As for the importance of heterogeneous firms and workers for the cyclicality of labour market dynamics, we find that small firms hire mainly at the beginning of an economic expansion. Later on in the expansion, hirings more frequently result from direct job-to-job transitions, with employed workers moving to larger firms. Contrary to our expectations, workers moving to larger firms do not experience significantly larger wage gains than workers moving to smaller establishments. This could be explained by the fact that institutions such as trade unions may make wages relatively unresponsive to economic conditions, which results in wages reacting only weakly to differences between firms.

In our econometric analysis we estimate transition probabilities, taking into account the unobserved heterogeneities on the two sides of the labour market by using a spell fixed effects approach. This significantly reduces the coefficients on the explanatory variables which shows that unobserved characteristics play an important role for these transitions. Furthermore, regressions without two-sided fixed effects feature artificially inflated coefficients on the observable explanatory variables. Finally, we showed that unobserved characteristics play a more important role for employed job seekers than for the unemployed. This is arguably a consequence of the informational advantage of employed workers relative to the unemployed, as well as of more efficient sorting of workers by firms.

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Appendix A Tables

Table A.1: Definition of variables

Variable	**Description**
Low-skilled workers	Individuals holding a lower secondary school diploma without a professional degree.
Medium-skilled workers	Individuals holding a lower secondary school diploma and professional degree; or individuals with a high school diploma and without a professional degree; or individuals holding a high school diploma as well as a professional degree.
High-skilled workers	Individuals holding a university degree or university of applied sciences degree.
duration (un)empl XY	Duration of previous (un)employment spell; ranging from X to Y quarters.

Table A.2: The dynamics of worker and job flows at the establishment level

	JCR	JDR	JRR	AR	SR	WFR	CFR
All observations	0.088	0.084	0.172	0.207	0.204	0.411	0.239
1997	0.103	0.106	0.209	0.201	0.204	0.404	0.195
1998	0.130	0.089	0.218	0.256	0.215	0.470	0.252
1999	0.158	0.049	0.207	0.275	0.166	0.441	0.234
2000	0.127	0.041	0.130	0.270	0.228	0.498	0.286
2001	0.088	0.091	0.180	0.218	0.221	0.439	0.259
2002	0.076	0.095	0.171	0.172	0.190	0.362	0.191
2003	0.079	0.104	0.183	0.135	0.160	0.295	0.112

Source: Authors' calculations, based on LIAB 1993-2006.

Note: JCR: Job creation rate; JDR: Job destruction rate; JRR: Job reallocation rate; AR: Accession rate; SR: Separation rate; WFR: Worker flow rate; CFR: Churning flow rate. The aggregate figures are calculated as described in Section 3.2, they are weighted using adjusted sample weights.

Table A.3: Worker and job flow rates at the establishment level across different establishment categories

	JCR	JDR	JRR	AR	SR	WFR	CFR
All observations	0.088	0.084	0.172	0.208	0.204	0.411	0.239
by establishment age							
Founded before 1990	0.085	0.079	0.164	0.201	0.195	0.396	0.232
Founded after 1990	0.091	0.087	0.178	0.211	0.207	0.418	0.240
by establishment size							
1-19 employees	0.101	0.097	0.198	0.294	0.290	0.584	0.386
20-99 employees	0.078	0.069	0.157	0.217	0.208	0.425	0.268
100-999 employees	0.044	0.042	0.086	0.170	0.168	0.338	0.252
1000 and more employees	0.035	0.031	0.066	0.115	0.111	0.226	0.160
by industry							
Agriculture, Energy, Mining	0.043	0.026	0.069	0.202	0.185	0.387	0.318
Production	0.033	0.041	0.074	0.123	0.131	0.254	0.180
Construction	0.095	0.035	0.130	0.291	0.231	0.522	0.392
Trade, Transport	0.067	0.068	0.135	0.253	0.254	0.507	0.372
Services	0.083	0.073	0.156	0.257	0.247	0.504	0.348
State	0.026	0.023	0.049	0.081	0.078	0.159	0.110

Source: Authors' calculations, based on LIAB 1993-2006.

Note: See notes to Table A.2. All figures are weighted averages of the seven annual values (1997-2003).

Table A.4: Worker flow rates across different establishment categories

	EE	NE	UE	EN	EU
All observations	0.075	0.138	0.070	0.142	0.069
by establishment age					
Founded before 1990	0.061	0.098	0.065	0.083	0.045
Founded after 1990	0.084	0.143	0.081	0.156	0.079
by establishment size					
1-19 employees	0.143	0.204	0.188	0.182	0.143
20-99 employees	0.098	0.132	0.087	0.140	0.073
100-999 employees	0.072	0.109	0.045	0.119	0.042
1000 and more employees	0.044	0.095	0.018	0.108	0.020
by industry					
Agriculture, Energy, Mining	0.058	0.122	0.106	0.138	0.094
Production	0.054	0.101	0.043	0.110	0.046
Construction	0.095	0.153	0.207	0.160	0.211
Trade, Transport	0.108	0.165	0.087	0.169	0.085
Services	0.091	0.186	0.078	0.174	0.071
State	0.048	0.105	0.053	0.134	0.051

Source: Authors' calculations, based on LIAB 1993-2006.

Note: EE: Employer-to-employer flows; NE: Nonparticipation-to-employment flows; UE: unemployment-to-employment flows; EN: Employment-to-nonparticipation flows; EU: Employment-to-unemployment flows. All figures are weighted averages of the seven annual values (1997-2003).

Table A.5: Worker flow rates across different worker categories

	EE	NE	UE	EN	EU
All observations	0.075	0.138	0.070	0.142	0.069
by individuals' age					
Age 15-24	0.172	0.334	0.200	0.383	0.165
Age 25-29	0.126	0.201	0.104	0.182	0.093
Age 30-34	0.102	0.138	0.071	0.141	0.067
Age 35-39	0.076	0.098	0.064	0.098	0.062
Age 40-44	0.060	0.080	0.060	0.079	0.059
Age 45-49	0.044	0.074	0.053	0.075	0.053
Age 50-54	0.036	0.070	0.045	0.088	0.047
Age 55-65	0.022	0.085	0.029	0.080	0.063
by individuals' sex					
Male	0.076	0.111	0.066	0.116	0.070
Female	0.075	0.201	0.072	0.202	0.069
by individuals' education					
Low-skilled	0.066	0.183	0.111	0.195	0.119
Medium-Skilled	0.071	0.120	0.058	0.129	0.056
High-Skilled	0.092	0.122	0.023	0.093	0.026

Source: Authors' calculations, based on LIAB 1993-2006.

Note: See notes to Table A.4.

Table A.6: Distribution of hiring sources by establishment size

	Hirings from		
Establishment size	Employment	Unemployment	Nonparticipation
All observations	0.349	0.258	0.393
1-19	0.293	0.305	0.402
20-99	0.354	0.289	0.357
100-999	0.412	0.195	0.393
1000 and more	0.420	0.124	0.456

Source: Authors' calculations, based on IABS 1975-2004.

Note: All figures are averages of the annual values (1980-2003).

Table A.7: Distribution of destination states after separation by establishment size

	Separations to		
Establishment size	Employment	Unemployment	Nonparticipation
All observations	0.367	0.251	0.382
1-19	0.322	0.308	0.370
20-99	0.388	0.254	0.358
100-999	0.408	0.194	0.398
1000 and more	0.391	0.159	0.450

Source: Authors' calculations, based on IABS 1975-2004.

Note: All figures are averages of the annual values (1980-2003).

Table A.8: Fixed effects estimation, separations

	FE (individual)		**FE (spell)**		**FE$_{restr}$ (individual)**	
	Coeff.	(Robust S.E)	Coeff.	(Robust S.E)	Coeff.	(Robust S.E)
large	-0.1214***	(0.0021)	-0.0012***	(0.0001)	-0.0534***	(0.0017)
Age 25-29	-0.0563***	(0.0017)	0.0007***	(0.0000)	0.0057***	(0.0009)
Age 30-34	-0.0897***	(0.0019)	0.0012***	(0.0001)	0.0209***	(0.0011)
Age 35-39	-0.1168***	(0.0022)	0.0014***	(0.0001)	0.0395***	(0.0012)
Age 40-44	-0.1282***	(0.0025)	0.0016***	(0.0001)	0.0608***	(0.0013)
Age 45-49	-0.1110***	(0.0031)	0.0019***	(0.0001)	0.0850***	(0.0015)
Age 50-54	-0.0742***	(0.0038)	0.0021***	(0.0001)	0.1053***	(0.0018)
Age 55-65	0.1826***	(0.0046)	0.0030***	(0.0002)	0.1575***	(0.0027)
Medium-skilled	-0.0429***	(0.0021)	-0.0003***	(0.0001)	-0.0146***	(0.0013)
High-skilled	-0.1554***	(0.0043)	-0.0026***	(0.0005)	-0.0691***	(0.0042)
duration empl 2-5	0.0089***	(0.0015)	0.0014***	(0.0001)	0.1437***	(0.0025)
duration empl 6-10	-0.0376***	(0.0017)	0.0017***	(0.0001)	0.1334***	(0.0024)
duration empl 11-20	-0.0439***	(0.0018)	0.0023***	(0.0001)	0.1424***	(0.0025)
duration empl 21-30	-0.0564***	(0.0023)	0.0022***	(0.0001)	0.1364***	(0.0024)
duration empl 30over	0.0908***	(0.0026)	0.0083***	(0.0005)	0.2262***	(0.0036)
GDP(t)	0.0008	(0.0006)	-0.0001**	(0.0000)	-0.0016***	(0.0003)
GDP(t-1)	0.0071***	(0.0006)	0.0000***	(0.0000)	0.0004	(0.0003)
GDP(t-2)	0.0058***	(0.0006)	0.0000***	(0.0000)	-0.0009**	(0.0003)
GDP(t-3)	0.0002	(0.0006)	0.0000***	(0.0000)	-0.0028***	(0.0003)
GDP(t-4)	-0.0010*	(0.0006)	0.0000	(0.0000)	-0.0034***	(0.0003)
GDP(t)*large	-0.0046***	(0.0010)	0.0000***	(0.0000)	-0.0029***	(0.0005)
GDP(t-1)*large	-0.0024***	(0.0009)	0.0000**	(0.0000)	-0.0015**	(0.0005)
GDP(t-2)*large	0.0014	(0.0009)	-0.0001	(0.0000)	-0.0001	(0.0005)
GDP(t-3)*large	0.0077***	(0.0009)	0.0000***	(0.0000)	0.0032***	(0.0005)
GDP(t-4)*large	0.0055***	(0.0010)	0.0000***	(0.0000)	0.0024***	(0.0005)
Number of groups	381376		741069		37637	

Source: Authors' calculations, based on LIAB 1993-2006.

Note: Numbers shown are marginal effects; a ***/**/* indicates a 1%/5%/10% level of significance. Base category: individuals aged 15-24, low-skilled, with 1 quarter of previous (un)employment, working in establishments of the Agriculture, Energy, or Mining sector with 1-19 employees. Fixed effects regressions also include dummy variables for the quarter and for the industry of the establishments, but their estimated coefficients are not shown in this table.

Table A.9: Fixed effects estimation, Employer-to-employer flows

	FE (individual)		**FE (spell)**		**FE$_{restr}$ (individual)**	
	Coeff.	(Robust S.E)	Coeff.	(Robust S.E)	Coeff.	(Robust S.E)
large	-0.0766***	(0.0024)	-0.0009***	(0.0001)	-0.0302***	(0.0013)
Age 25-29	-0.0495***	(0.0018)	-0.0012***	(0.0001)	-0.0544***	(0.0016)
Age 30-34	-0.0925***	(0.0020)	-0.0024***	(0.0002)	-0.0807***	(0.0024)
Age 35-39	-0.1141***	(0.0022)	-0.0036***	(0.0003)	-0.0938***	(0.0028)
Age 40-44	-0.1290***	(0.0024)	-0.0041***	(0.0004)	-0.0983***	(0.0029)
Age 45-49	-0.1340***	(0.0027)	-0.0041***	(0.0004)	-0.0993***	(0.0030)
Age 50-54	-0.1450***	(0.0030)	-0.0038***	(0.0003)	-0.0984***	(0.0030)
Age 55-65	-0.1667***	(0.0034)	-0.0039***	(0.0003)	-0.1018***	(0.0031)
Medium-skilled	-0.0210***	(0.0025)	-0.0001***	(0.0001)	-0.0113***	(0.0012)
High-skilled	0.0128**	(0.0056)	0.0001	(0.0001)	-0.0020	(0.0025)
duration empl 2-5	0.0619***	(0.0020)	0.0004***	(0.0000)	0.0098***	(0.0007)
duration empl 6-10	0.0337***	(0.0022)	0.0010***	(0.0001)	0.0175***	(0.0010)
duration empl 11-20	0.0323***	(0.0024)	0.0023***	(0.0002)	0.0419***	(0.0017)
duration empl 21-30	0.0371***	(0.0031)	0.0088***	(0.0008)	0.0987***	(0.0034)
duration empl 30over	0.1368***	(0.0036)	0.0255***	(0.0022)	0.2388***	(0.0063)
GDP(t)	0.0026***	(0.0008)	0.0000***	(0.0000)	0.0014***	(0.0003)
GDP(t-1)	0.0035***	(0.0008)	0.0001***	(0.0000)	0.0011***	(0.0003)
GDP(t-2)	0.0097***	(0.0008)	0.0001***	(0.0000)	0.0024***	(0.0003)
GDP(t-3)	0.0131***	(0.0009)	0.0001***	(0.0000)	0.0028***	(0.0003)
GDP(t-4)	0.0100***	(0.0008)	0.0000***	(0.0000)	0.0019***	(0.0003)
GDP(t)*large	-0.0023*	(0.0013)	-0.0001	(0.0000)	-0.0006	(0.0004)
GDP(t-1)*large	0.0037**	(0.0013)	0.0000*	(0.0000)	0.0014*	(0.0004)
GDP(t-2)*large	-0.0027**	(0.0013)	0.0001	(0.0000)	-0.0002	(0.0004)
GDP(t-3)*large	-0.0027**	(0.0013)	0.0001	(0.0000)	-0.0002	(0.0004)
GDP(t-4)*large	-0.0003**	(0.0012)	0.0001	(0.0000)	0.0003	(0.0004)
Number of groups	88358		148833		83581	

Source: Authors' calculations, based on LIAB 1993-2006.

Note: See notes to Figure A.8.

Table A.10: Fixed effects estimation, Unemployment-to-employment flows

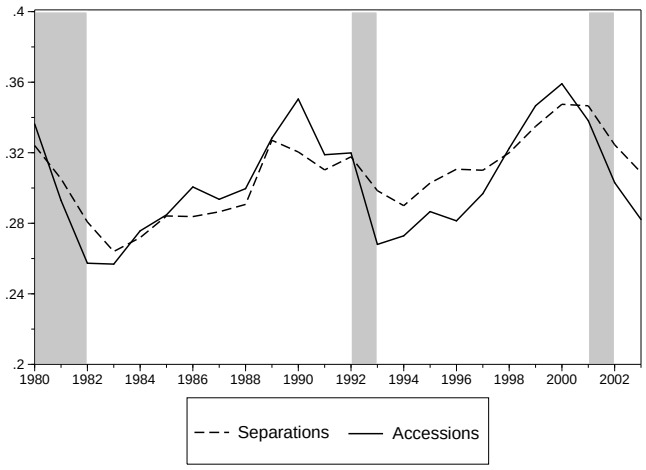
	FE (individual)		**FE (spell)**		**FE$_{restr}$ (individual)**	
	Coeff.	(Robust S.E)	Coeff.	(Robust S.E)	Coeff.	(Robust S.E)
large	-0.0770***	(0.0034)	-0.0738***	(0.0078)	-0.0642***	(0.0048)
Age 25-29	-0.1082***	(0.0026)	-0.1175***	(0.0077)	-0.1246***	(0.0041)
Age 30-34	-0.1475***	(0.0032)	-0.1622***	(0.0106)	-0.1651***	(0.0053)
Age 35-39	-0.1669***	(0.0035)	-0.1828***	(0.0119)	-0.1880***	(0.0060)
Age 40-44	-0.1769***	(0.0037)	-0.1889***	(0.0125)	-0.2017***	(0.0065)
Age 45-49	-0.1775***	(0.0038)	-0.1864***	(0.0126)	-0.2087***	(0.0069)
Age 50-54	-0.1834***	(0.0041)	-0.1820***	(0.0126)	-0.2138***	(0.0073)
Age 55-65	-0.1940***	(0.0045)	-0.1791***	(0.0126)	-0.2187***	(0.0077)
Medium-skilled	-0.0248***	(0.0030)	-0.0120	(0.0078)	-0.0128**	(0.0041)
High-skilled	-0.0386***	(0.0083)	-0.0224	(0.0282)	-0.0063	(0.0157)
duration empl 2-5	0.8002***	(0.0049)	0.8854***	(0.0078)	0.8433***	(0.0061)
duration empl 6-10	0.7852***	(0.0054)	0.8654***	(0.0095)	0.8149***	(0.0072)
duration empl 11-20	0.7834***	(0.0055)	0.8621***	(0.0099)	0.8104***	(0.0074)
duration empl 21-30	0.7831***	(0.0056)	0.8636***	(0.0104)	0.8092***	(0.0075)
GDP(t)	-0.0012	(0.0010)	-0.0012	(0.0009)	-0.0027**	(0.0011)
GDP(t-1)	-0.0134***	(0.0009)	-0.0108***	(0.0011)	-0.0156***	(0.0011)
GDP(t-2)	-0.0029**	(0.0010)	-0.0013	(0.0010)	-0.0053***	(0.0012)
GDP(t-3)	0.0005	(0.0010)	0.0022**	(0.0010)	-0.0001	(0.0011)
GDP(t-4)	0.0003	(0.0010)	0.0031***	(0.0009)	0.0014	(0.0010)
GDP(t)*large	0.0101***	(0.0020)	0.0090***	(0.0019)	0.0117**	(0.0022)
GDP(t-1)*large	0.0149***	(0.0017)	0.0113***	(0.0018)	0.0155***	(0.0020)
GDP(t-2)*large	-0.0077***	(0.0019)	-0.0127***	(0.0021)	-0.0148***	(0.0023)
GDP(t-3)*large	-0.0041***	(0.0018)	-0.0082***	(0.0020)	-0.0086***	(0.0023)
GDP(t-4)*large	-0.0019**	(0.0018)	-0.0048**	(0.0017)	-0.0045**	(0.0020)
Number of groups	63859		86912		58390	

Source: Authors' calculations, based on LIAB 1993-2006.

Note: See notes to Figure A.8.

Appendix B Figures

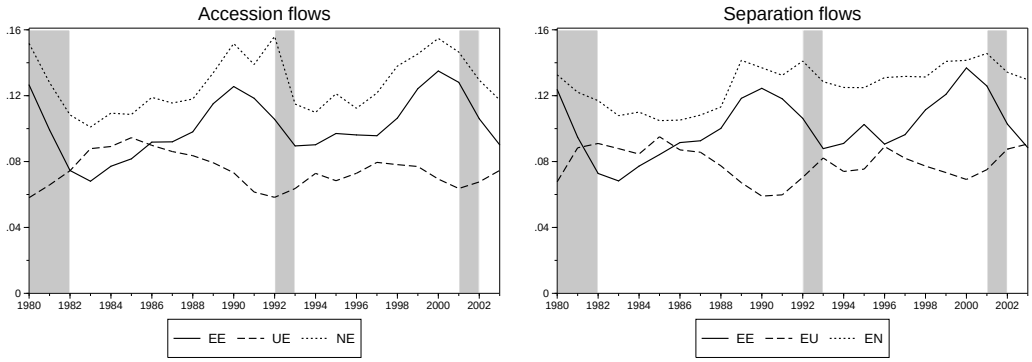
Figure B.1: Accessions and separations, 1980-2003, yearly rates



Source: Authors' calculations, based on IABS 1975-2004.

Note: The rates are calculated by using the average of current and past employment as the denominator. Shaded areas are times of recession.

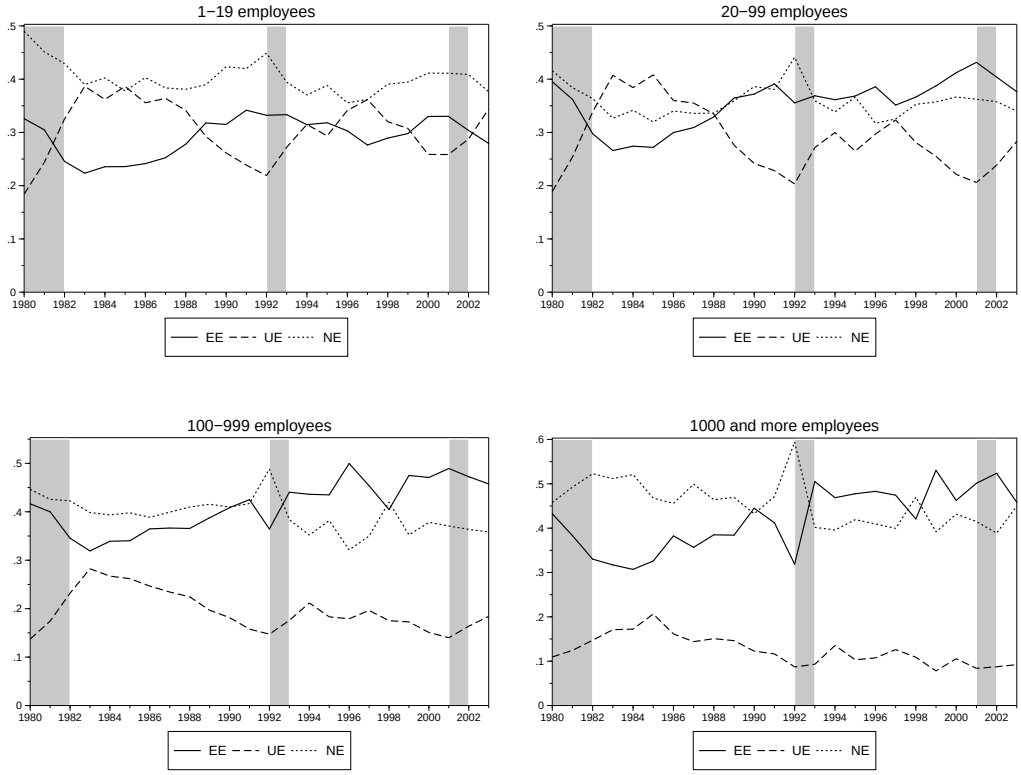
Figure B.2: The dynamics of worker flows, 1980-2003, yearly rates



Source: Authors' calculations, based on IABS 1975-2004.

Note: EE: Employer-to-employer flows; NE: Nonparticipation-to-employment flows; UE: unemployment-to-employment flows; EN: Employment-to-nonparticipation flows; EU: Employment-to-unemployment flows. The rates are calculated by using the average of current and past employment as the denominator. Shaded areas are times of recession.

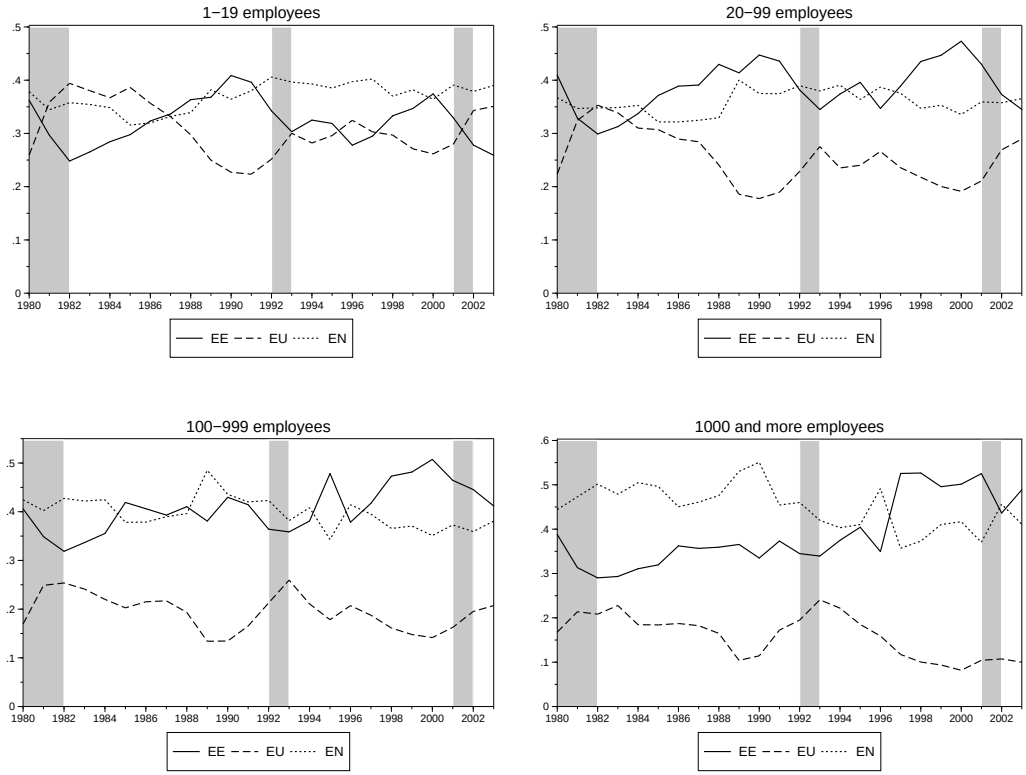
Figure B.3: The shares in hirings by establishment size, 1980-2003, yearly rates



Source: Authors' calculations, based on IABS 1975-2004.

Note: For each establishment size class the flows are computed as share of hirings. EE: Employer-to-employer flows; NE: Nonparticipation-to-employment flows; UE: unemployment-to-employment flows; EN: Employment-to-nonparticipation flows; EU: Employment-to-unemployment flows.

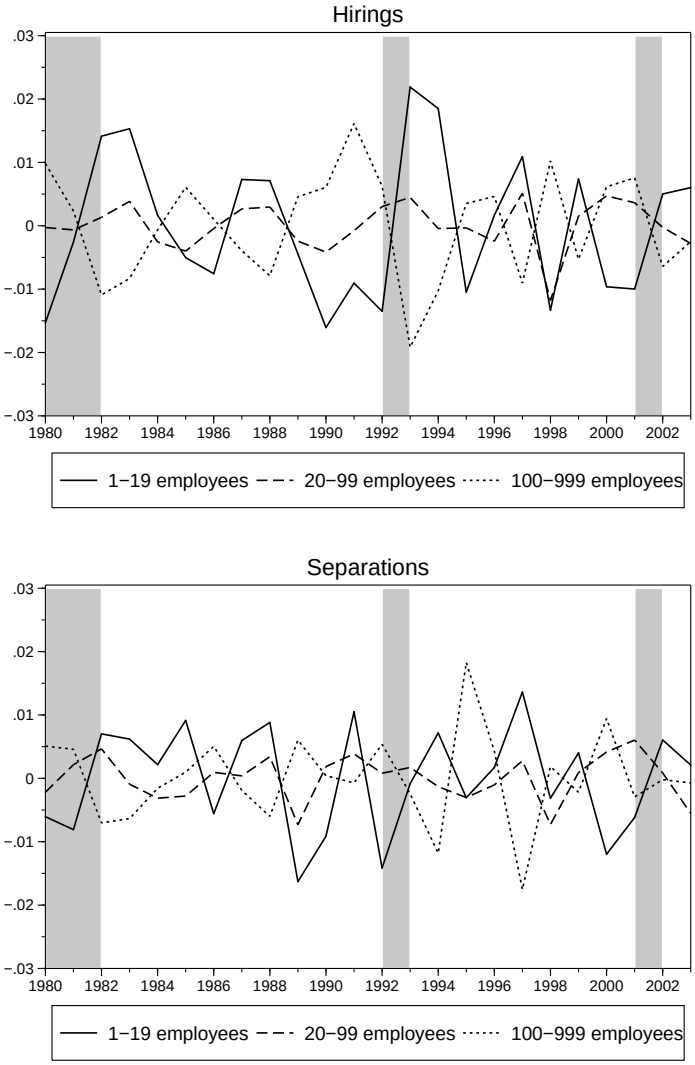
Figure B.4: The shares in separations by establishment size, 1980-2003, yearly rates



Source: Authors' calculations, based on IABS 1975-2004.

Note: For each establishment size class the flows are computed as share of separations. See notes to Table B.3.

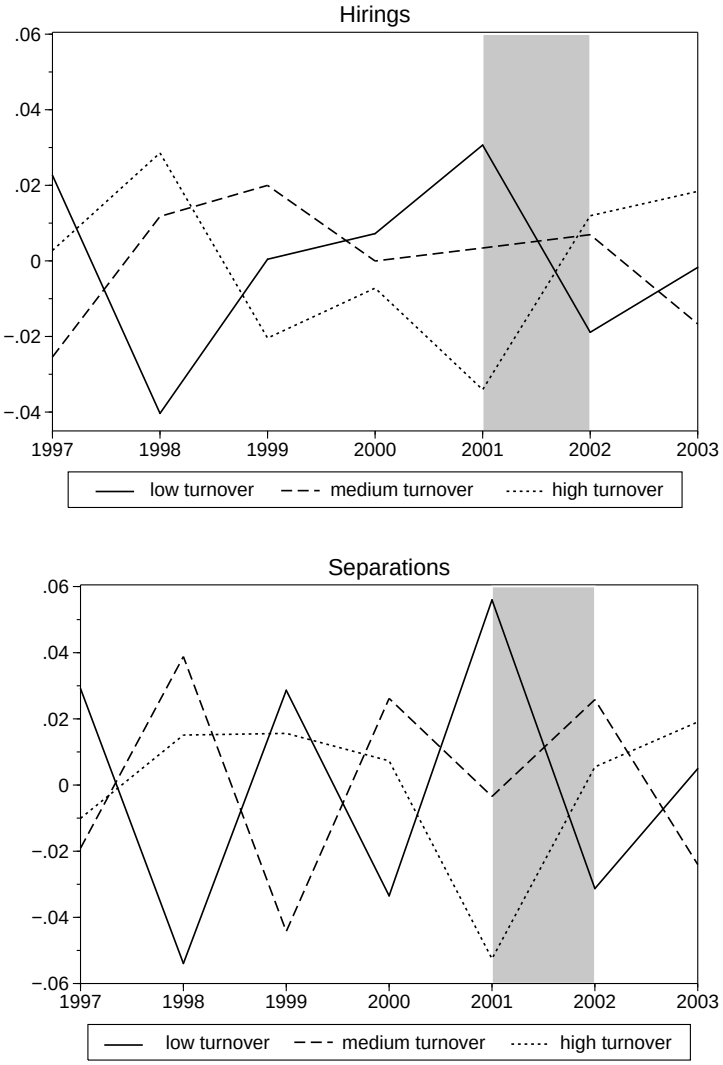
Figure B.5: Timing of hirings and separations by establishment size, 1980-2003



Source: Authors' calculations, based on IABS 1975-2004.

Note: This figure shows establishment size-specific worker flows as a share of total worker flows, detrended using a HP filter. The largest establishment size class (1000 employees and more) is not displayed here, since it shows a very similar pattern as the category 100-999 employees. Shaded areas are times of recession.

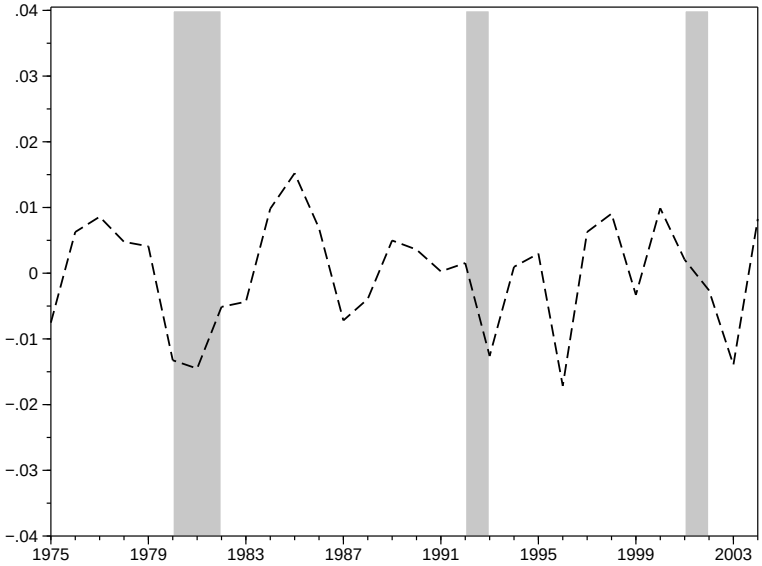
Figure B.6: Timing of hirings and separations by turnover size, 1997-2003



Source: Authors' calculations, based on LIAB 1993-2006.

Note: This figure shows turnover size-specific worker flows as a share of total worker flows, detrended using a HP filter. Shaded areas are times of recession.

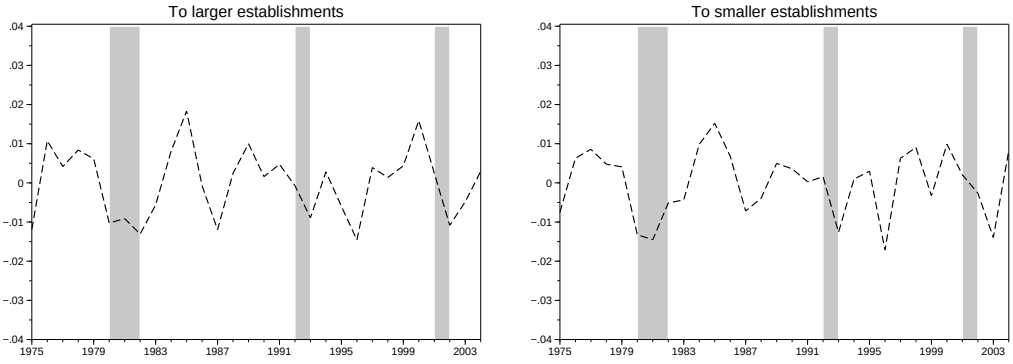
Figure B.7: The fraction of job-to-job transitions, which are leading to a higher wage



Source: Authors' calculations, based on IABS 1975-2004.

Note: This figure shows the share of EE flows leading to a higher wage, detrended using a HP filter. Shaded areas are times of recession.

Figure B.8: The fraction of job-to-job transitions to larger/ smaller establishments, which are leading to a higher wage



Source: Authors' calculations, based on IABS 1975-2004.

Note: See notes to Figure B.7.