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

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Abstract

Using two data sets derived from German administrative data, including a linked employer-employee data set, 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 small firms hire mainly unemployed workers, and that they do so 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. 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.

JEL codes: *J63, J64, J21, E24*
Keywords: *worker flows, accessions, separations, business cycle, job-to-job, employer-to-employer, linked employer-employee.*

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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] Interest in this issue has been further increased by the debate about the relative importance of the ins and outs of unemployment in this context (cf. Darby, Haltiwanger, and Plant, 1986, and Shimer, 2007). While a consensus seems to emerge that both inflows into and outflows from unemployment have some role to play (cf. Elsby, Michaels, and Solon, 2009, and Fujita and Ramey, forthcoming), important questions remain unanswered. One crucial question, raised by Elsby, Michaels, and Solon (2009), is "why job-loss-induced inflows to unemployment increase at the beginning of a recession and why outflows do not increase enough to keep unemployment duration from rising."

An obvious suspect in this context is the interaction of heterogeneous agents on both sides of the labour market over the business cycle. However, as Moscarini and Postel-Vinay (2008) point out, this process is up to now little understood. 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.

Our analysis aims at testing whether this story holds when using both a very rich, linked employer-employee data set, and a data set spanning three decades of workers' employment history. Both data sets are based on administrative micro data sets providing information on dependent-status, social security employment for West Ger-

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

many. The former data set additionally contains information from a large firm survey. 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. We are thus able to provide a complete set of stylized facts on this topic, and to conduct a rigorous econometric analysis, controlling for both observed and unobserved heterogeneities on both sides of the labour market.

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.

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, as summarized by Yashiv (2008). 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

[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).

experience of different demographic groups, especially with respect to their sensitivity to cyclical factors. Fitzenberger and Garloff (2007) 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 accounting 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

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

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 procylical, 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 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

The following analysis uses two complementary data sets provided by the Institute for Employment Research (IAB), the IAB Employment Sample (IABS) and the LIAB, a linked employer-employee data set. The basis of both data sets is the *Employment*

Statistics Register, an administrative panel data set of the employment history of all individuals in Germany who worked in an employment covered by social security between 1975 and 2006.[4] 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. At the beginning and at the end of any employment spell, employers have to notify the social security agencies. This information is exact to the day. For spells spanning more than one calendar year, an annual report for each employee registered within the social insurance system is compulsory, and provides an update on, for example, the qualification and the current occupation of the employee. Further worker characteristics included are the year of birth, sex, marital status, and nationality.[5]

The first data set we use, the IAB Employment Sample (IABS) is a 2% representative sample of the Employment Statistics Register for the time period 1975-2004, supplemented with information on all unemployment spells of the workers covered. Given this relatively long time span, we are able to observe two full business cycles. From this sample, we exclude observations in East Germany, apprentices, trainees, homeworkers, part-time workers, and individuals older than 65. This results in a sample with 1.05 million individual workers.

The second data set used in our analysis, the linked employer-employee data set of the IAB (LIAB), combines the information on workers' employment and unemployment history described above with plant-level information from the *IAB Establishment Panel*, an annual representative survey of German establishments that employ at least one worker who pays social security contributions. Starting in 1993, this survey is drawn

[4]This data base has been used, among others, by Bender and von Wachter (2006) and Dustmann and Meghir (2005).

[5]A detailed description of the Employment Statistics Register and the notification procedure is given by Bender, Haas, and Klose (2000). Note that civil servants and self-employed workers are not included in the data.

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, the composition of the workforce, sales and investments.[7] Using the unique plant identification number, one can match the information on workers with the establishment panel, and obtain a linked employer-employee data set providing detailed information on individual and establishment characteristics.[8] 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 between 1997 and 2003. As a consequence, meaningful establishment-based turnover and flow rates can only be computed for these seven years. The resulting sample contains 1.9 million individuals and 4,856 establishments.

Both the IABS and the LIAB 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).[9] 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

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

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

[8]Information on the LIAB data set is given by Alda, Bender, and Gartner (2005). As short employment spells play an important role in our analysis, we use the longitudinal version of the LIAB.

[9]In the IABS data, the record on unemployment benefit recipients are unreliably measured before 1980. As we can therefore not use the worker flows to and from unemployment for the time period 1975-1979, we start our analysis in 1980.

sets, which implies that it is not possible to 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. The descriptive statistics of the data set as used in the econometric analysis are in Table A.1.

3.2 The concepts of worker flows and job flows

Since both data sets used contain daily information on the employment and unemployment history of every individual in the sample, it is possible to calculate worker flows taking into account every change of labour market state that occurs within a given time period. We are thus able to compute the flows between employment, unemployment and nonparticipation, as well as direct job-to-job transitions (EE flows) using the establishment identification number. In addition to EE flows, our analysis focuses on the flows from employment to unemployment and to nonparticipation (EU and EN, respectively), and from unemployment and from nonparticipation to employment (UE and NE, respectively). We define as separation flows all flows emanating from employment, $S_t = EE_t + EU_t + EN_t$, and as accession flows all flows going to employment, $A_t = EE_t + UE_t + NE_t$. It should be noted here that our definition of a job is establishment-based. Therefore a transition from one establishment to another one within the same firm will also be identified as a job-to-job transition. 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.

Since the LIAB data provide information on all workers employed in the establishments covered by the data set for the time period 1997-2003, we are able to exploit the individual information to calculate annual worker and job flows at the establishment level. 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. The worker turnover rate or the worker flow rate is measured as the sum of accession and separation rates

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

Note that by definition 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 churning flow rate, or excess worker flow rate, i.e. the part of the worker flows which does not contribute to a change of the workforce at the establishment level.

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 82/IV, 93/IV and 2002/IV.[10] 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 during recessions. 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, we split up the accession flows into EE flows, UE flows and NE flows. The time series patterns of the three transitions for the time period 1980-2003 are presented in Figure B.2. Regarding the cyclical behaviour,

[10] A recession is defined as a decline in GDP for two or more successive quarters of a year.

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, 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.

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, calculated from the LIAB. 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.[11] Furthermore, we find evidence for a strongly procyclical behaviour of worker and churning flows.[12] 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

[11]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.

[12]The same finding has been made by Burgess, Lane, and Stevens (2000) and Albæk and Sørensen (1998) for Maryland (U.S.) and Denmark, respectively.

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 needs and worker abilities. Thus, the heterogeneity on both sides of the labour market seems to play an important role for labour market dynamics. To this issue we now turn.

4.2 Two-sided heterogeneity and labour market dynamics

4.2.1 Cross-sectional features

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 worker flows for different establishment categories in Table A.4 and for different worker categories in Table A.5. Several features are worth noting. 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 production sector, while they are 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-rates 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, 40.8% of the new hired men come from employment, 29.4% come from unemployment, and 29.8% from nonparticipation (cf. Table A.6). For female workers we can observe that a smaller proportion is hired out of employment (33.9%) and unemployment (19.6%), but a much higher proportion stems from nonparticipation (46.5%). The hiring source, however, depends strongly on the size of the establishment. Small establishments hire about an equal proportion of their new male workers from employment and from unemployment (34.4% and 34.8%, respectively). With growing establishment size, however, the proportion of hires from employment increases at the expense of hirings from unemployment. Very large establishments hire 51.2% of their new workers from employment, but only 15.1% from unemployment. Likewise, for women a similar pattern can be observed, although not as strongly as for men. 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 for male workers, 33.3% of the separations lead to a new employment relationship, 24.7% are followed by unemployment, and 42.0% by 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 (30.5%) and to unemployment (31.4%). In contrast to this, separations from very large establishments are followed by employment in 32.3% of cases, and only 14.4% are followed by an unemployment spell. For women we see that, taking into account the smallest establishments in the sample, 28.2% of the separations lead to a new employment, 22.2% to unemployment and with 49.6% the largest proportion end in nonparticipation. The share of separations to employment and to unemployment are both decreasing with establishment size. But since the latter one falls at a higher rate, we again can observe that the separations from large establishments are more often followed by employment (24.7%) than by unemployment (14.8%).

4.2.2 Cyclical properties

As we are mainly interested in the cyclical features of labour market dynamics, we now analyse the evolution of the different flows over time in more detail. Figure B.3 shows the hiring flows EE, UE, and NE, computed as the share of hirings, for 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.

In order to emphasize the differences in the behaviour of the different labour market flows between 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 calculate the above share for hirings and for separations, and use a Hodrick-Prescott (HP) filter to isolate the cyclical from the structural component.[13] The times series for the HP-filtered deviations from the 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.

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

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 variation 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 establishments 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.

Finally, we investigate whether the evolution of the churning rate differs over time between establishments of different size. Figure B.7 shows that this is clearly the case. In particular, the peak of the churning rate occurs earlier the smaller the establishment. Given that the peak of the business cycle occurred in 2001/IV, establishments belonging to the smallest size class had their highest churning rate three years before. Contrary to that, the peak of the churning rate of large establishments can be observed in 2001, i.e. towards the end of the boom. This is consistent with the fact that larger establishments hire more workers during economic upswings, and that these hirings come from existing employment relationships, resulting in direct job-to-job transitions. Whether this fact is related to the evolution of wages, is discussed in the next section.

4.3 Job-to-job transitions and wages

In order to analyse whether large firms compete for employed workers by offering them higher wages, we first calculate 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, for each year in the time period 1975-2004.[14] 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.8. 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.9 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, making 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.

[14] 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.

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 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).[15] The vector gdp_t, our measure of the

[15]Large establishments are defined as those employing more than 100 workers. Trying alternative

business cycle, contains lagged GDP growth (lags 1 to 4) and captures the dynamic structure of the labour market process under investigation.[16] 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.[17]

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 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

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

definitions, we find very similar estimation results.

[16] 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.

[17] As Ai and Norton (2003) point out, special care has to be taken when interpreting the coefficients of interaction terms in nonlinear models. We use their method of calculating the marginal effect of the interaction term as the cross derivative of the expected value of the dependent variable.

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

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

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.[18] 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.10 shows the marginal effects and robust standard errors for separation flows, while Tables A.8 and A.9 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 and the spell fixed effects estimation - the tables additionally provide the results of a restricted individual fixed effects estimation. This estimation is based on the same sample that was used for the spell fixed effects estimation.

5.2.1 Hirings

In our analysis of hirings, we concentrate on direct job-to-job transitions and transitions from unemployment to employment. An econometric analysis of the flow from nonpar-

[18] 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.

ticipation to employment does not seem useful, because controlling for the duration spent in nonparticipation is impossible (the workers residing in nonparticipation are not observed in our data sets), and because nonparticipation is a very heterogeneous labour market state in our data set. We thus analyse the two hiring flows, EE and UE, separately. In particular, our regressions examine the probability that a worker employed at a particular firm was hired (from another employment, or from unemployment) during the current quarter. The results are displayed in Tables A.8 and A.9, respectively.

For both, the probability of a hire from employment, and from unemployment, the establishment size exerts a negative effect. Furthermore, the age of an employee reduces the two probabilities as well, as do medium skills, and high skills for hirings from unemployment. The estimated coefficients of the GDP variables in Table A.8 indicate that a one standard deviation increase of GDP leads to a 1.7 percentage point increase in the probability of EE flows.[19] This implies that the probability of small firms hiring workers out of another employment relationship is higher during a cyclical upswing, which reflects the procyclicality of job-to-job transitions at the aggregate level. This effect is long-lasting, and increasing up to lag 3. Looking at the coefficients of the interaction term of (lagged) GDP with firm size, one can see that for large establishments this effect is initially slightly lower. A one standard deviation increase of GDP raises the likelihood of an EE hire by about 1.5 percentage points. But for lags 2 and 3 the cyclical effect is higher than for small establishments. This implies that higher GPD growth increases the propensity to hire workers out of another employment more strongly for large firms than it does for small firms, although with a certain lag.

The propensity to hire unemployed workers displays the opposite cyclical features (cf. Table A.9): The coefficients of the GDP variables indicate that in small establishments the probability of UE hires decreases by 0.28 percentage points if GDP rises by

[19]The standard deviation for EE flows divided by the standard deviation for GDP is 5.89. Multiplying the GDP coefficient (0.0028) gives the effect of a one standard deviation change in GDP on the probability of transiting from one job to another one.

one standard deviation. That is, the overall probability that an employed worker has been hired from unemployment is higher in a recession, which reflects the countercyclical nature of the transitions from unemployment to employment. Furthermore, the effect is relatively long-lasting. This pattern, however, does not hold for large establishments, as shown by the coefficients on (lagged) GDP interacted with establishment size. Here a one standard deviation increase of GDP leads to an increase of the probability of hiring from unemployment of 3.6 percentage points. This means that, for large establishments, the overall propensity to hire out of unemployment is procyclical in the short run (contemporaneous GDP and GDP lagged by one quarter). For GDP lags 2 and 3, this propensity becomes countercyclical. These results are in line with our observations in the descriptive analysis: at the beginning of a boom, hirings from unemployment by large firms are initially unaffected, but rise later.

Another feature emerging from the regression results is that the differences between the results obtained from worker fixed effects and spell fixed effects are much larger for direct job-to-job transitions than for transitions from unemployment to employment. In particular, 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

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

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.

5.2.2 Match separations

The estimated marginal effects of job separation, displayed in Table A.10, largely confirm the results from the descriptive analysis of the last section. In particular, the coefficients obtained from the individual fixed effects estimation 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, i.e. the impact of GDP on the probability of separation, the estimation results indicate that separations are procyclical. This effect is significant for lags up to $t-2$.[21] As the coefficients on the interaction variables of (lagged) GDP with the firm size dummy variable make clear, the impact of GDP, both contemporaneously and lagged by one quarter, is smaller for large firms. This implies that employees in large firms are affected more slowly by changes in GDP than employees in small firms. However, the interaction with GDP lags 2 to 4 indicates that eventually, employees at large firms are strongly affected by GDP growth as well.

The results from the spell fixed effects estimation are qualitatively similar. However,

[21] This is mainly due to the fact that separations also include direct job-to-job transitions, which are strongly procyclical. See Bachmann (2005) for an explicit analysis of the different separation flows.

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 inflated, and potentially biased, coefficients on the observable explanatory variables.

6 Conclusion

Using two data sets on individual workers' labour market histories derived from German administrative data which allow us to identify heterogeneities on both sides of the labour market, we investigate 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 this context. 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 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 are mainly interested in the impact of firm size on the probability of workers having been hired from unemployment or out of an existing employment, and on the probability of match separation. Our results are in line with the descriptive evidence. First, the probability of a worker being hired out of another job is procyclical, and it is more strongly affected by GDP growth for larger firms than for smaller firms. Second, for larger firms, this effect comes later on in the expansion. Third, hirings from unemployment are nearly acyclical for large firms, and countercyclical for small firms. This reflects the fact that small firms rely on unfavourable business cycle conditions to recruit unemployed workers that suit their needs; such workers are more numerous in the pool of the unemployed during recessions. Fourth, our use of spell fixed effects to take into account the unobserved heterogeneities on the two sides of the labour market significantly reduces the coefficients on the explanatory variables. This shows that unobserved characteristics play an important role for these transitions, and that regressions without two-sided fixed effects feature artificially inflated, and potentially biased, coefficients on the observable explanatory variables. Finally, our regression results show 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 employed workers by firms.

References

Abowd, J. M., P. Corbel, and F. Kramarz (1999): "The entry and exit of workers and the growth of employment: An analysis of French establishments," *The Review of Economics and Statistics*, 81(2), 170–187.

Abowd, J. M., and F. Kramarz (1999): "The Analysis of Labor Markets using Matched Employer-Employee Data," in *Handbook of Labor Economics, Volume 3B*, ed. by O. Ashenfelter, and D. Card, pp. 2629–2710. Elsevier Science, Amsterdam et al.

Abowd, J. M., F. Kramarz, and D. N. Margolis (1999): "High wage workers and high wage firms," *Econometrica*, 67(2), 251–333.

Abowd, J. M., F. Kramarz, and S. Roux (2006): "Wages, mobility and firm performance: Advantages and insights from using matched worker-firm data," *The Economic Journal*, 116, F245–F285.

Ai, C., and E. C. Norton (2003): "Interaction Terms in Logit and Probit Models," *Economics Letters*, 80(1), 123–129.

Albæk, K., and B. E. Sørensen (1998): "Worker flows and job flows in Danish manufacturing, 1980-91," *The Economic Journal*, 108, 1750–1771.

Alda, H., P. Allaart, and L. Bellmann (2005): "Churning and institutions: Dutch and German establishments compared with micro-level data," IAB Discussion Paper 12, Institute for Employment Research (IAB).

Alda, H., S. Bender, and H. Gartner (2005): "The linked employer-employee dataset of the IAB (LIAB)," IAB Discussion Paper 6, Institute for Employment Research (IAB).

Anderson, P. M., and B. D. Meyer (1994): "The extent and consequences of job turnover," *Brooking Papers on Economic Activity: Microeconomics*, 2, 495–594.

Andrews, M., T. Schank, and R. Upward (2004): "Practical estimation methods for linked employer-employee data," IAB Discussion Paper 3, Institute for Employment Research (IAB).

Bachmann, R. (2005): "Labour market dynamics in Germany: Hirings, separations, and job-to-job transitions over the business cycle," Discussion Paper 2005-045, SFB 649, Berlin.

Bender, S., A. Haas, and C. Klose (2000): "IAB employment subsample 1975-1995. Opportunities for analysis provided by the anonymised subsample," IZA Discussion Paper 117, Institute for the Study of Labor (IZA).

Bender, S., and T. von Wachter (2006): "In the right place at the wrong time - The role of firms and luck in young workers' careers," *American Economic Review*, 96(5), 1679–1705.

Bjelland, M., B. Fallick, J. Haltiwanger, and E. McEntarfer (2008): "Employer-to-employer flows in the United States: Estimates using linked employer-employee data," NBER Working Papers 13867, National Bureau of Economic Research.

Blanchard, O., and P. A. Diamond (1989): "The Beveridge Curve," *Brookings Papers on Economic Activity*, 1989(1), 1–76.

——— (1990): "The cyclical behaviour of gross flows of workers in the US," *Brookings Papers on Economic Activity*, 2, 85–11.

Burda, M. C., and C. Wyplosz (1994): "Gross worker flows and job flows in Europe," *European Economic Review*, 38(6), 1287–1315.

Burgess, S., J. Lane, and D. Stevens (2000): "Job flows, worker flows and churning," *Journal of Labor Economics*, 18(3), 473–502.

——— (2001): "Churning dynamics: An analysis of hires and separations at the employer level," *Labour Economics*, 8(1), 1–14.

Contini, B., and R. Rivelli (1997): "Gross flows vs. net flows in the labor market: What is there to be learned?," *Labour Economics*, 4(3), 245–263.

Darby, M. R., J. C. Haltiwanger, and M. W. Plant (1986): "The Ins and Outs of Unemployment: The Ins Win," NBER Working Papers 1997, National Bureau of Economic Research, Inc.

Davis, S. J., and J. Haltiwanger (1999): "Gross Job Flows," in *Handbook of Labor Economics, Volume 3B*, ed. by O. Ashenfelter, and D. Card, pp. 2711–2805. Elsevier Science, Amsterdam et al.

Dustmann, C., and C. Meghir (2005): "Wages, experience and seniority," *Review of Economic Studies*, 72(1), 77–108.

Elsby, M. W., R. Michaels, and G. Solon (2009): "The Ins and Outs of Cyclical Unemployment," *American Economic Journal: Macroeconomics*, 1(1), 84–100.

Eriksson, S., and J. Lagerström (2006): "Competition between employed and unemployed job applicants: Swedish Evidence," *Scandinavian Journal of Economics*, 108(3), 373–396.

Fitzenberger, B., and A. Garloff (2007): "Labor market transitions and the wage structure in Germany," *Jahrbücher für Nationalökonomie und Statistik*, 227(2), 115–152.

Frederiksen, A., and N. Westergaard-Nielsen (2007): "Where did they go? Modelling transitions out of jobs," *Labour Economics*, 14(5), 811–828.

Fujita, S., and G. Ramey (forthcoming): "The cyclicality of separation and job finding rates," *International Economic Review*.

Hamermesh, D. S. (2007): "Fun with matched firm-employee data: Progress and road maps," *Labour Economics*, 15(4), 663–673.

Kölling, A. (2000): "The IAB-Establishment Panel," *Schmollers Jahrbuch / Journal of Applied Social Science Studies*, 120(2), 291–300.

Lane, J., D. Stevens, and S. Burgess (1996): "Worker and job flows," *Economics Letters*, 51, 109–113.

Moscarini, G., and F. Postel-Vinay (2008): "The Timing of Labor Market Expansions: New Facts and a New Hypothesis," in *NBER Macroeconomics Annual 2008*, ed. by D. Acemoglu, K. Rogoff, and M. Woodford, vol. 23.

Nagypál, E. (2006): "Amplification of productivity shocks: Why dont vacancies like to hire the unemployed?," in *Structural models of wage and employment dynamics, vol. 275 of "Contributions to Economic Analysis"*, ed. by H. Bunzel, B. J. Christensen, G. R. Neumann, and J.-M. Robin, pp. 481–506. Amsterdam: Elsevier.

OECD (1996): *Employment Outlook*. Paris.

Pissarides, C. A. (1994): "Search unemployment with on-the-job search," *Review of Economic Studies*, 61, 457–475.

Ravn, M. O., and H. Uhlig (2002): "On adjusting the Hodrick-Prescott filter for the frequency of observations," *The Review of Economics and Statistics, MIT Press*, 84(2), 371–375.

Schmidt, C. M. (2000): "Persistence and the German unemployment problem: Empirical evidences on German labor market flows," *Economie et Statistique*, 332-333(2000-2/3), 83–95.

Shimer, R. (2007): "Reassessing the Ins and Outs of Unemployment," NBER Working Papers 13421, National Bureau of Economic Research, Inc.

YASHIV, E. (2008): "U.S. labor market dynamics revisited," *Scandinavian Journal of Economics*, 109(4), 643–907.

Appendix A Tables

Table A.1: Summary statistics

Variable	Mean	Std. Dev.	Definition
EE	0.0228	0.1493	Direct job-to-job transition
EU	0.0172	0.1076	Transition from employment to unemployment
EN	0.0647	0.2461	Transition from employment to nonparticipation
NE	0.0626	0.2171	Transition from nonparticipation to employment
UE	0.0169	0.1291	Transition from unemployment to employment
Separation	0.0666	0.2493	EE + EU + EN
Hiring	0.0661	0.2484	EE + UE + NE
Age	38.5059	11.3684	Age of individual
Low-skilled	0.1938	0.3874	Individual holds a lower secondary school diploma but no professional degree
Medium-skilled	0.6959	0.4680	Individual holds a lower secondary school diploma and professional degree; or a high school diploma and but no professional degree; or a school diploma and a professional degree
High-skilled	0.1079	0.2516	Individual holds a degree from a university or a university of applied sciences
GDP	0.4811	0.8792	GDP growth rate (in %)
Large	0.4953	0.4999	Establishment with more than 100 employees
Employment duration	24.2992	23.0295	Duration of previous employment spell (in quarters)
Unemployment duration	3.1852	3.8576	Duration of previous unemployment spell (in quarters)
Agriculture, Mining, Energy	0.0391	0.1682	Dummy for employment in specific industry
Production	0.3671	0.4820	"
Construction	0.0778	0.2677	"
Trade, Transport	0.2120	0.4087	"
Services	0.2330	0.4162	"
State	0.0671	0.2322	"

Source: IABS; GDP are official figures from the German Statistical Office.

Notes: Statistics refer to the quarterly data set created by the authors and used in the econometric analysis. Flows normalized by labour force (E+U). Time period considered: 1980/I-2003/III.

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 calculated as described in Section 3.2, they 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					
	Employment		Unemployment		Nonparticipation	
Establishment size	Women	Men	Women	Men	Women	Men
All observations	0.339	0.408	0.196	0.294	0.465	0.298
1-19	0.337	0.344	0.205	0.348	0.458	0.308
20-99	0.334	0.404	0.210	0.316	0.456	0.280
100-999	0.343	0.483	0.178	0.227	0.479	0.290
1000 and more	0.356	0.512	0.145	0.151	0.499	0.337

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

Note: All figures are calculated as described in Section 3.2, they are weighted averages of the annual values (1980-2003).

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

	Separations to					
	Employment		Unemployment		Nonparticipation	
Establishment size	Women	Men	Women	Men	Women	Men
All observations	0.272	0.333	0.199	0.247	0.529	0.420
1-19	0.282	0.305	0.222	0.314	0.496	0.381
20-99	0.275	0.344	0.203	0.256	0.522	0.400
100-999	0.259	0.367	0.175	0.181	0.566	0.452
1000 and more	0.247	0.323	0.148	0.144	0.605	0.533

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

Note: See notes to Table A.6 .

Table A.8: Fixed effects estimation, employer-to-employer flows

	FE (individual)		**FE (spell)**		**FE$_{restr}$ (individual)**	
	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)
large	-.0760 ***	(.002)	-.0001 ***	(.000)	-.0154 ***	(.001)
Age 25-29	-.0446 ***	(.002)	-.0001 ***	(.000)	-.0270 ***	(.001)
Age 30-34	-.0832 ***	(.002)	-.0002 ***	(.000)	-.0402 ***	(.001)
Age 35-39	-.1058 ***	(.002)	-.0003 ***	(.000)	-.0473 ***	(.001)
Age 40-44	-.1173 ***	(.002)	-.0004 ***	(.000)	-.0494 ***	(.001)
Age 45-49	-.1244 ***	(.002)	-.0004 ***	(.000)	-.0497 ***	(.001)
Age 50-54	-.1342 ***	(.003)	-.0003 ***	(.000)	-.0493 ***	(.001)
Age 55-65	-.1537 ***	(.003)	-.0003 ***	(.000)	-.0508 ***	(.001)
Medium-skilled	-.0214 ***	(.002)	-.0001 *	(.000)	-.0052 ***	(.001)
High-skilled	.0048	(.005)	.0000	(.000)	-.0011	(.001)
duration empl 2-5	.0586 ***	(.002)	.0000 ***	(.000)	.0048 ***	(.000)
duration empl 6-10	.0283 ***	(.002)	.0001 ***	(.000)	.0079 ***	(.000)
duration empl 11-20	.0252 ***	(.002)	.0002 ***	(.000)	.0197 ***	(.001)
duration empl 21-30	.0302 ***	(.003)	.0007 ***	(.000)	.0507 ***	(.002)
duration 30 over	.1230 ***	(.003)	.0022 ***	(.000)	.1317 ***	(.003)
GDP(t)	.0028 ***	(.001)	.0000 ***	(.000)	.0004 ***	(.000)
GDP(t-1)	.0034 ***	(.001)	.0000 ***	(.000)	.0004 ***	(.000)
GDP(t-2)	.0096 ***	(.001)	.0001 ***	(.000)	.0011 ***	(.000)
GDP(t-3)	.0122 ***	(.001)	.0001 ***	(.000)	.0014 ***	(.000)
GDP(t-4)	.0094 ***	(.001)	.0000 ***	(.000)	.0009 ***	(.000)
GDP*large	-.0002 ***	(.000)	.0000	(.000)	-.0001 ***	(.000)
GDP(t-1)*large	.0039 ***	(.001)	.0000 ***	(.000)	.0009 ***	(.000)
GDP(t-2)*large	.0049 ***	(.001)	.0000 ***	(.000)	.0003 ***	(.000)
GDP(t-3)*large	-.0011	(.001)	.0000	(.000)	.0003	(.000)
GDP(t-4)*large	-.0010	(.001)	.0000	(.000)	.0001	(.000)
No. of obs.	4,360,644		2,526,554		2,526,554	

Source: IABS, transformed to a quarterly data set by the authors. Time period considered: 1980/I-2003/III.

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 with 1-19 employees. Fixed effects regressions also include quarterly dummies. Marginal effects of the interaction terms are estimated following Ai and Norton (2003).

Table A.9: Fixed effects estimation, unemployment-to-employment flows

	FE (individual)		**FE (spell)**		**FE$_{restr}$ (individual)**	
	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)
large	-.0839 ***	(.003)	-.0301 ***	(.003)	-.0462 ***	(.003)
Age 25-29	-.1134 ***	(.002)	-.0493 ***	(.003)	-.0928 ***	(.003)
Age 30-34	-.1534 ***	(.002)	-.0681 ***	(.004)	-.1226 ***	(.003)
Age 35-39	-.1784 ***	(.003)	-.0773 ***	(.005)	-.1400 ***	(.003)
Age 40-44	-.1908 ***	(.003)	-.0801 ***	(.005)	-.1518 ***	(.004)
Age 45-49	-.1938 ***	(.003)	-.0792 ***	(.005)	-.1559 ***	(.004)
Age 50-54	-.2003 ***	(.003)	-.0765 ***	(.005)	-.1585 ***	(.004)
Age 55-65	-.2077 ***	(.003)	-.0741 ***	(.005)	-.1597 ***	(.005)
Medium-skilled	-.0136 ***	(.003)	.0015	(.003)	-.0064 ***	(.003)
High-skilled	-.0205 **	(.010)	.0164	(.017)	-.0071 ***	(.001)
duration unempl 2-5	.7878 ***	(.004)	.9367 ***	(.002)	.8861 ***	(.003)
duration unempl 6-10	.7717 ***	(.004)	.9346 ***	(.003)	.8667 ***	(.004)
duration unempl 11-20	.7700 ***	(.004)	.9366 ***	(.004)	.8643 ***	(.004)
duration unempl 20 over	.7692 ***	(.004)	.9386 ***	(.005)	.8635 ***	(.004)
GDP(t)	-.0004 ***	(.000)	-.0005	(.000)	-.0020 ***	(.001)
GDP(t-1)	-.0127 ***	(.001)	-.0043 ***	(.000)	-.0106 ***	(.001)
GDP(t-2)	-.0026 ***	(.001)	-.0008 ***	(.000)	-.0038 ***	(.001)
GDP(t-3)	-.0042 ***	(.001)	-.0003 ***	(.000)	-.0026 ***	(.001)
GDP(t-4)	.0002	(.001)	.0012	(.004)	.0014	(.001)
GDP*large	.0074 ***	(.002)	.0028 ***	(.001)	.0514 ***	(.014)
GDP(t-1)*large	.0133 ***	(.002)	.0048 ***	(.001)	.0931 ***	(.013)
GDP(t-2)*large	-.0058 ***	(.002)	-.0042 ***	(.001)	-.0771 ***	(.015)
GDP(t-3)*large	-.0009	(.002)	-.0027 ***	(.001)	-.0480 ***	(.014)
GDP(t-4)*large	.0019	(.002)	-.0004	(.001)	-.0041	(.013)
No. of obs.	2,627,615		1,297,065		1,297,065	

Note: See notes to Table A.8.

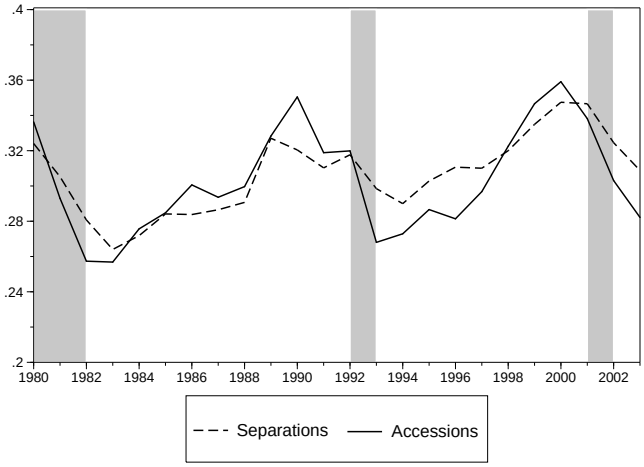
Table A.10: Fixed effects estimation, separations

	FE (individual)		**FE (spell)**		**FE$_{restr}$ (individual)**	
	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)
large	-.1305***	(.002)	-.0007***	(.000)	-.0331***	(.001)
Age 25-29	-.0546***	(.002)	.0004***	(.000)	.0043***	(.001)
Age 30-34	-.0867***	(.002)	.0006***	(.000)	.0145***	(.001)
Age 35-39	-.1140***	(.002)	.0008***	(.000)	.0256***	(.001)
Age 40-44	-.1246***	(.002)	.0009***	(.000)	.0377***	(.001)
Age 45-49	-.1133***	(.003)	.0010***	(.000)	.0505***	(.001)
Age 50-54	-.0784***	(.004)	.0012***	(.000)	.0619***	(.001)
Age 55-65	.1799***	(.005)	.0016***	(.000)	.0901***	(.001)
Medium-skilled	-.0389***	(.002)	-.0001***	(.000)	-.0077***	(.001)
High-skilled	-.1400***	(.004)	-.0013***	(.000)	-.0361***	(.002)
duration empl 2-5	.0059***	(.001)	.0008***	(.000)	.0807***	(.001)
duration empl 6-10	-.0418***	(.002)	.0009***	(.000)	.0742***	(.001)
duration empl 11-20	-.0486***	(.002)	.0012***	(.000)	.0797***	(.001)
duration empl 21-30	-.0615***	(.002)	.0012***	(.000)	.0760***	(.001)
duration 30 over	.0811***	(.003)	.0045***	(.000)	.1309***	(.002)
GDP(t)	.0007***	(.000)	.00007 ***	(.000)	.0013***	(.000)
GDP(t-1)	.0064***	(.001)	.00002***	(.000)	.0015***	(.000)
GDP(t-2)	.0058***	(.001)	.00002***	(.000)	.0005***	(.000)
GDP(t-3)	-.0004	(.001)	.00007***	(.000)	-.0019***	(.000)
GDP(t-4)	-.0008	(.001)	-.00001	(.000)	-.0020	(.002)
GDP*large	-.0032***	(.001)	-.00006***	(.000)	-.0012***	(.000)
GDP(t-1)*large	-.0033***	(.001)	-.00006***	(.000)	-.0010***	(.000)
GDP(t-2)*large	.0025***	(.001)	.00000	(.000)	.0002	(.000)
GDP(t-3)*large	.0086***	(.001)	.00002***	(.000)	.0022***	(.000)
GDP(t-4)*large	.0055***	(.001)	.00001***	(.000)	.0014***	(.000)
No. of obs.	7,305,921		6,077,898		6,077,898	

Note: See notes to Table A.8.

Appendix B Figures

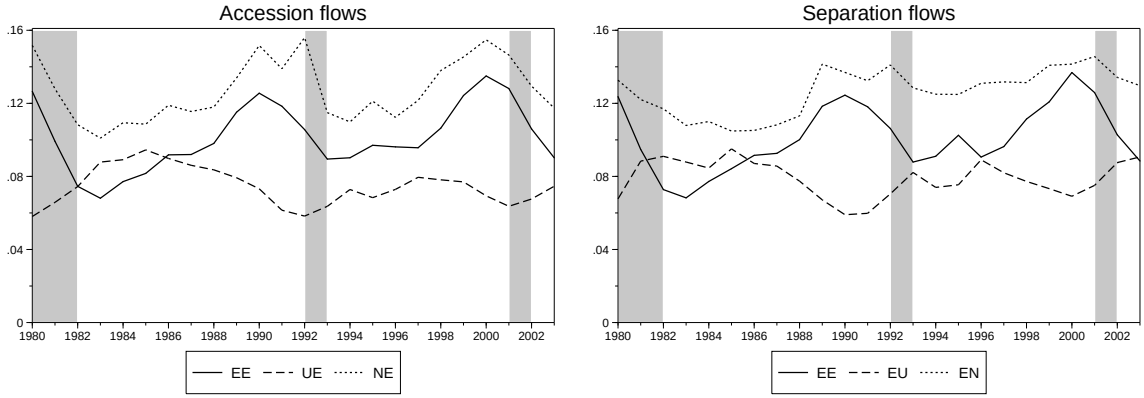
Figure B.1: Accessions and separations, 1980-2003, yearly rates



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

Note: The figures are calculated as described in Section 3.2.. Shaded areas are times of recession.

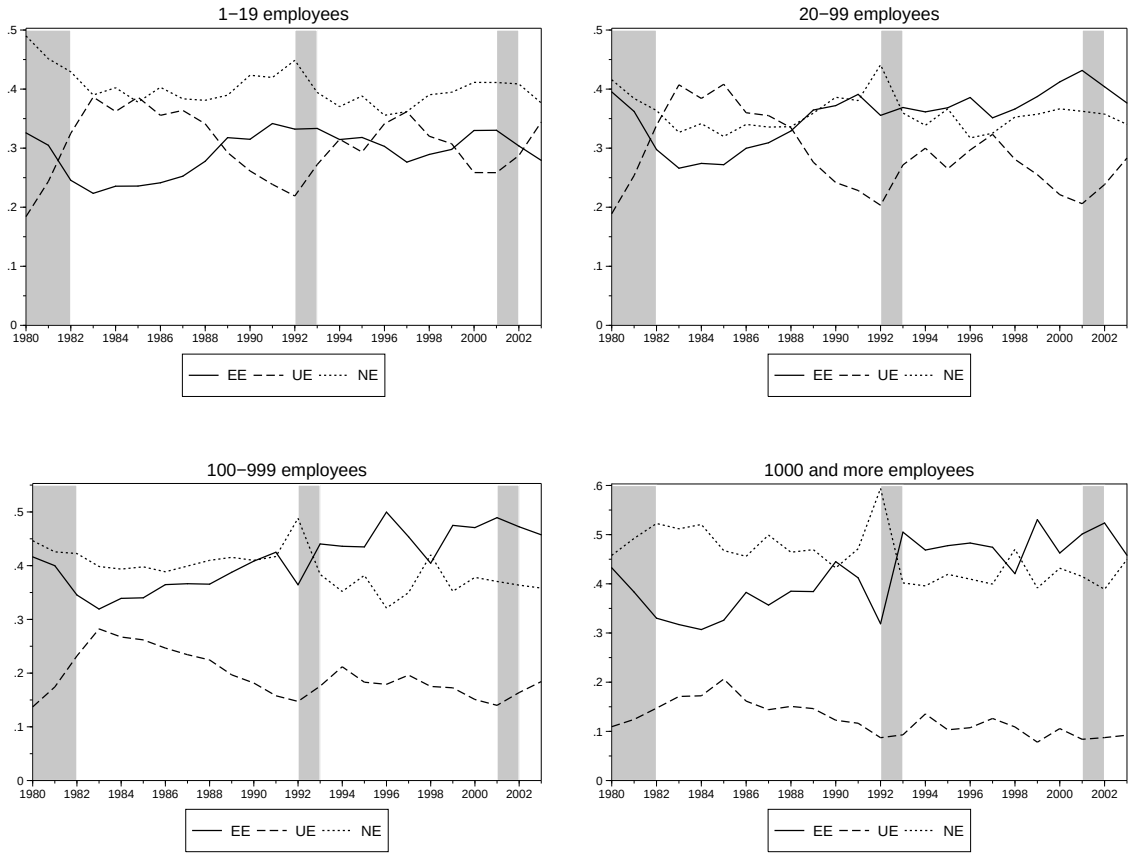
Figure B.2: The dynamics of worker flows, 1980-2003, yearly rates



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 figures are calculated as described in Section 3.2.. Shaded areas are times of recession.

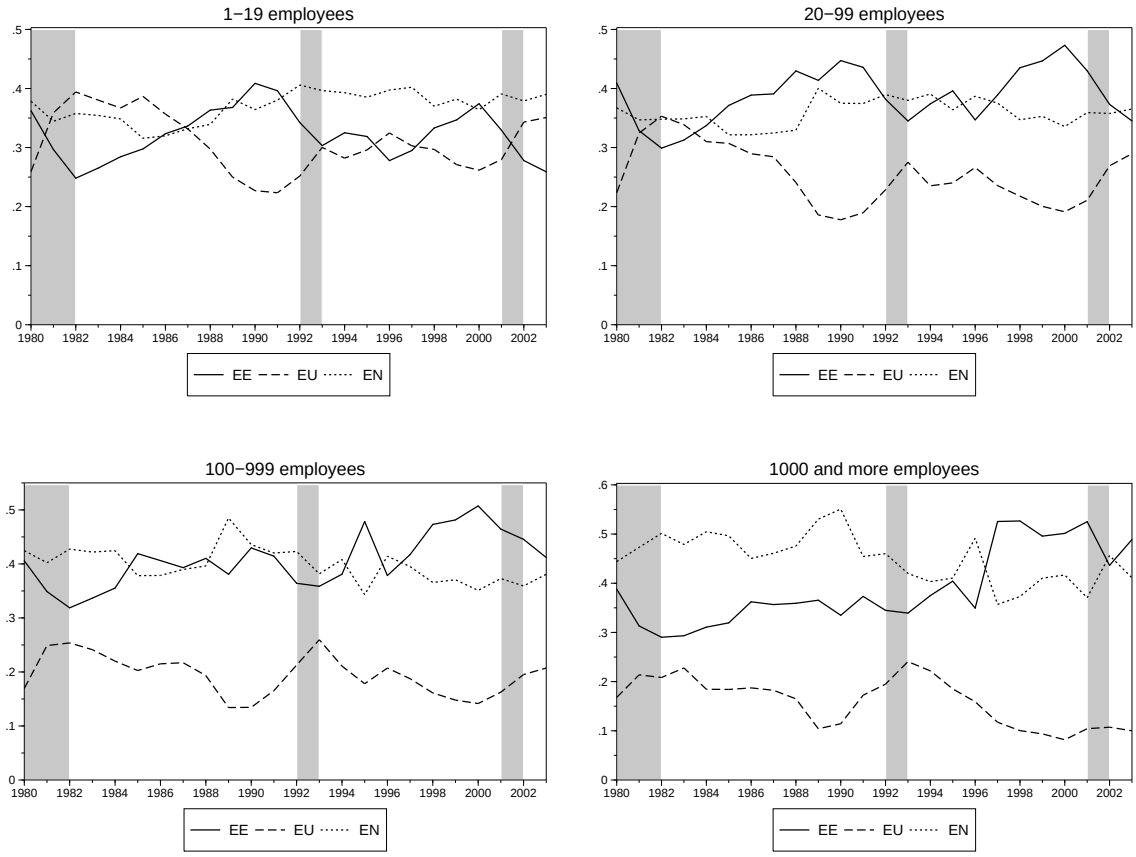
Figure B.3: The shares in hirings by establishment size, 1980-2003, yearly rates



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

Note: For each establishment size class the flows are computed as share of total 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.

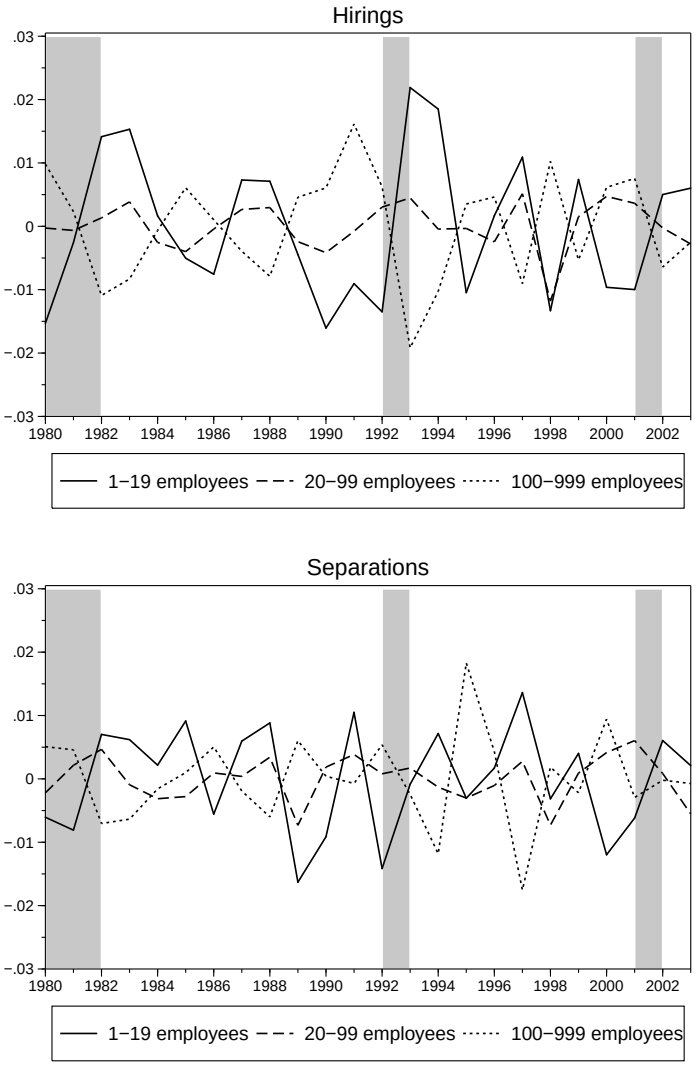
Figure B.4: The shares in separations by establishment size, 1980-2003, yearly rates



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

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

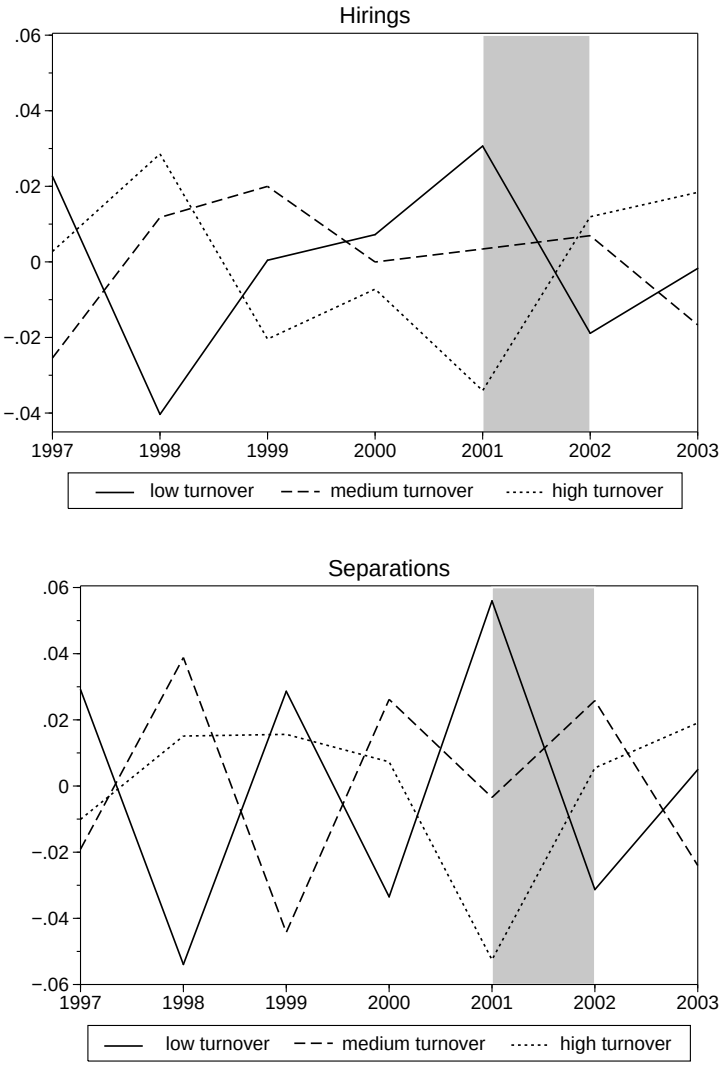
Figure B.5: Timing of hirings and separations by establishment size, 1980-2003



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.

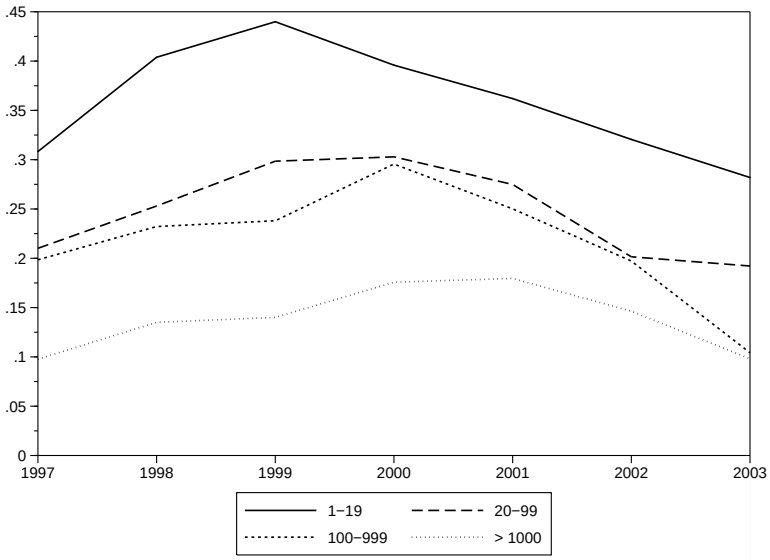
Figure B.6: Timing of hirings and separations by turnover size, 1997-2003



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.

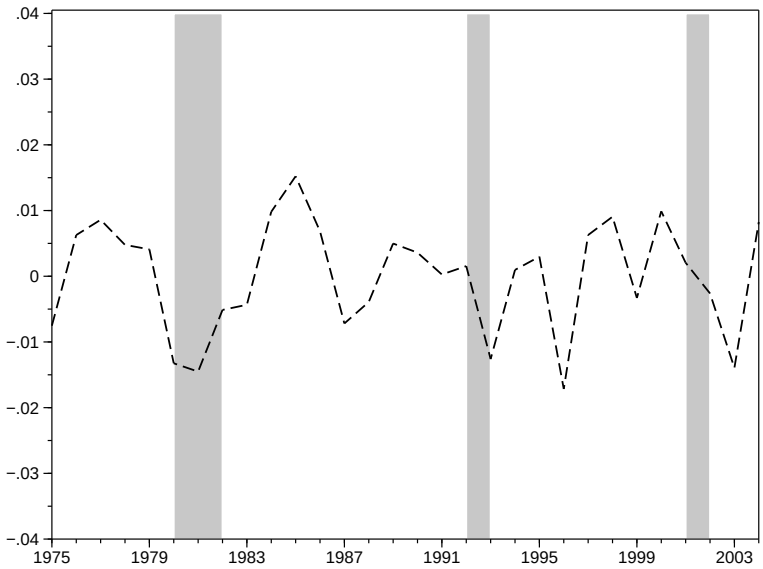
Figure B.7: Churning rates by establishment size, 1997-2003



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

Note: The churning rates are calculated as described in Section 3.2.

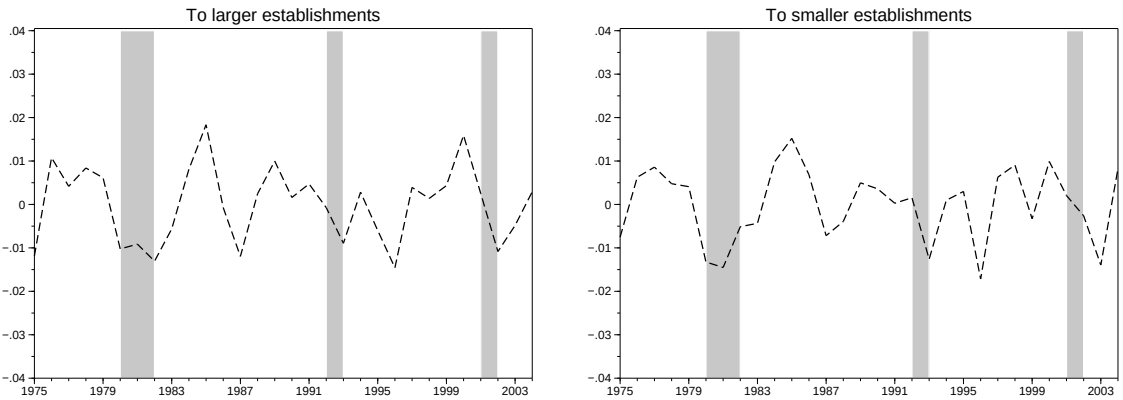
Figure B.8: The fraction of job-to-job transitions, which are leading to a higher wage



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.9: 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.8.

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