

IZA DP No. 5358

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for the Cyclicalities of Labour Market Dynamics**

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December 2010

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Discussion Paper No. 5358

December 2010

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ABSTRACT

The Importance of Two-Sided Heterogeneity for the Cyclicality of Labour Market Dynamics^{*}

Using administrative data on individual workers' employment history and firms, we investigate the cyclicality of worker flows on the German labour market. Focusing on heterogeneities on both sides of the labour market, 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 to larger firms. Transitions between employment and unemployment at large firms are generally found to be more cyclical. However, this stylised fact disappears when the composition of the workforce is controlled for.

JEL Classification: J63, J64, J21, E24

Keywords: worker flows, accessions, separations, business cycle, job-to-job, employer-to-employer

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^{*} We are grateful to Thomas K. Bauer, Michael C. Burda, Michael Kvasnicka, Alfredo Paloyo, Fabien Postel-Vinay and Matthias Vorell, as well as to participants at the EALE 2008 Annual Conference, the SOLE 2008 Annual Meetings, the 2008 Annual Conference of the Verein für Socialpolitik, the Scottish Economic Society 2008 Annual Meeting, the XIII. Spring Meeting for Young Economists, and at seminars at Humboldt-Universität zu Berlin, IfW Kiel, Lancaster University, and RWI for helpful comments. We also thank the staff at the IAB for hospitality and for help with the data. Of course, all remaining errors are ours. Part of this research was carried out while Peggy David was visiting Humboldt Universität zu Berlin and SFB 649. Finally, we gratefully acknowledge the support of the Leibniz Association and of the Deutsche Forschungsgemeinschaft (DFG) under SFB 475.

1 Introduction

The analysis of the cyclicity 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, 2009), 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 providing empirical evidence on the cyclicity of the German labour market, with a particular focus on both the hiring and firing behaviour of establishments belonging to different size classes, and the heterogeneity of workers. We do so by using both a very rich, linked employer-employee data set, and a data set spanning three decades

¹Analyses of the dynamics of the German labour market are contained in, e.g. Schmidt (2000), Fitzenberger and Garloff (2007), and Bachmann (2005).

of workers' employment history. Both data sets are based on administrative micro data providing information on dependent-status, social security employment for West Germany. 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.² In particular, we establish five facts:

1. Large establishments hire mainly from employment (via job-to-job transitions) and non-participation, much less so from unemployment. By contrast, small establishments hire mostly previously unemployed as well as non-participating workers. Similar patterns can be observed for the destination states after a job separation.
2. Employment-to-employment transitions are procyclical, and employment-to-unemployment transitions are countercyclical.
3. In recessions, unemployment supplies relatively more workers to establishments of all sizes.
4. Hires out of unemployment, as well as employment-to-unemployment transitions, appear to be more cyclically sensitive at large establishments than at small establishments.
5. The greater cyclicity of the transitions between employment and unemployment by large establishments seems to be entirely due to composition effects.

These facts contribute to the literature on the importance of heterogeneities for the dynamics of worker flows by providing new insights, and by complementing the international picture with evidence from the German labour market. In particular, Fact 1 is related to the findings by Eriksson and Lagerström (2006) who show that, on the Swedish labour market,

²See Abowd and Kramarz (1999) for an analysis of the determinants of worker flows between different labour market states by accounting for various individual and firm characteristics, which were shown to play an important role.

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. As for separations, 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.

Fact 2 confirms evidence about the procyclicality of employment-to-employment flows (cf. Fallick and Fleischman, 2004, Nagypál, 2008, and Bjelland, Fallick, Haltiwanger, and McEntarfer, 2008) and the countercyclicality of unemployment-to-employment transitions (Yashiv, 2008, and Elsby, Michaels, and Solon, 2009), which were also found for some European economies by Burda and Wyplosz (1994). Fact 4 confirms the evidence for hirings provided by Moscarini and Postel-Vinay (2010) for the US economy as well as for Denmark, France, and Brazil, and qualifies it for separations. Finally, Fact 5 provides new econometric evidence on the importance of labour market heterogeneities for the cyclicity of labour market dynamics.

Our findings, and especially Facts 3-5, have important implications for the way we think about labour market dynamics, and thus for economic modelling, which are discussed extensively in Section 5.

The plan of the paper is as follows. The next section describes the data sets used in our analysis. The third section summarizes the descriptive empirical evidence. In particular, Section 3.1 focuses on the importance of labour market heterogeneities in steady state, Section 3.2 provides evidence on the cyclicity of aggregate labour market flows, and Section 3.3

provides stylized facts with respect to labour market heterogeneities and the business cycle. Section 4 presents an econometric analysis of the cyclicity of these dynamics in order to analyse the role of composition effects in this context. In Section 5, we summarize the empirical evidence and discuss the implications for the theoretical modelling of labour market cyclicity. The last section concludes the analysis.

2 Data and Concepts

2.1 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 2006.³ 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.⁴

The first data set we use, the IAB Employment Sample (IABS), is a 2% sample of the Employment Statistics Register for the time period 1975-2004 which also includes limited information on firms (economic sector, establishment size). The IABS is representative for

³This data base has been used, among others, by Bender and von Wachter (2006) and Dustmann and Meghir (2005).

⁴A detailed description of the Employment Statistics Register and the notification procedure is given by Bender, Haas, and Klose (2000).

all dependent-status workers, and contains information on all employment and unemployment spells of the workers covered. Given the relatively long time span of the data set, 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 1.3 million individual observations.

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, 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.⁵ Using the unique establishment 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.⁶ 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 4,856 establishments and 1.9 million individual observations.

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 point in time: employment (E) covered by social security, unemployment (U), if the worker is receiving transfer payments, and non-participation (N).⁷ Non-participants are

⁵See Kölling (2000) for a detailed description of the IAB Establishment Panel.

⁶Information on the LIAB data set is provided 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.

⁷In the IABS data, the record on unemployment benefit recipients are unreliably measured before 1980.

those individuals not recorded in the data sets. Therefore, this state includes those workers out of the labour market, as well as workers not covered by social security legislation, e.g. civil servants and self-employed workers. 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. For example, workers might report to the unemployment office only a few days after having been laid off. The latter potential measurement error is taken into account 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 C.10.

2.2 Measuring labour market transitions

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, which implies that our notion of a job is establishment-based. 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, $A_t = EE_t + UE_t + NE_t$. 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.

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.

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

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

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} :

$$JRR_{et} = \left| \frac{E_{et} - E_{et-1}}{(E_{et} + E_{et-1})/2} \right|, \quad (2)$$

which is called job creation rate when it is positive, and job destruction rate when it is negative. Following Burgess, Lane, and Stevens (2000) we define accession and separation rates at the establishment level as follows:

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

and

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

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, $WFR_{et} = AR_{et} + SR_{et}$. This is also equal to the sum of the job reallocation

rate and the churning flow rate, $WFR_{et} = JRR_{et} + CFR_{et}$, 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.

3 Labour Market Dynamics in Germany: Descriptive Evidence

In this section, we derive some stylized facts concerning the dynamics of job and worker flows in the West German labour market. In order to do so, in Section 3.1 we present steady-state results, both for the aggregate labour market and for flows related to different firm size classes. The cyclical features of aggregate workers flows on the one hand, and of firm size-specific worker flows on the other hand are presented in Sections 3.2 and 3.3, respectively.

3.1 Steady-state results

We first focus on the stylized facts about job and worker flows for different establishment size classes that are invariant over the cycle and can thus be regarded as steady-state results (cf. Table A.1). It becomes apparent that the job reallocation rate declines with the establishment size, ranging from 22.2% in small establishments to 8.9% in very large establishments. The same observations can be made for worker and churning flows, which are also higher in smaller establishments throughout all categories. This is also true for the accession (or hiring) rate, which falls monotonically from 27.9% per year for small establishments to 10.2% for large establishments.

As pointed out in the introduction, firms are likely to have preferences over the previous labour market state of their new hires (cf. Eriksson and Lagerström, 2006, and Nagypál, 2006). 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, 32.9% of new hires come from employment, 25.2% come from unemployment, and 41.9% from nonparticipation (cf. Table A.2). The hiring source, however, depends strongly on the size of the establishment. Small establishments hire roughly equal proportions of their new workers from employment and unemployment (29.8% and 28.6%, respectively). With growing establishment size, however, the proportion of hires from employment increases at the expense of hirings from unemployment. Very large establishments hire 36.8% of their new male workers from employment, but only 15.4% from unemployment. The larger job-to-job flows to large establishments could be explained by the fact that transitions out of an old job to a larger establishment generally lead to greater wage gains than moving to an equally-sized or smaller firm (cf. Figure B.8). 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.2). Considering all establishments, 33.0% of the separations result in a new employment relationship, 26.1% in unemployment, and 41.0% 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 (31.2%) and to unemployment (31.0%). In contrast to this, separations from very large establishments are followed by employment in 32.0% of cases, and only 17.6% are followed by an unemployment spell. The main difference is thus that many workers in large establishments exit to nonparticipation. There are two potential reasons for this: First, workers in large establishments are on average older and therefore more likely to retire than workers leaving small establishments; second, there may be more flows into self-employment and public service from large establishments - unfortunately, we cannot investigate the latter hypothesis with our data set. The preceding analysis leads us to state

Fact 1. *Large establishments hire mainly from employment (via job-to-job transitions) and nonparticipation, much less so from unemployment. By contrast, small establishments hire mostly previously unemployed as well as non-participating workers.*

3.2 Cyclical features of aggregate worker flows

The evolution of the accession and separation rates for the time period 1980-2003 is displayed in Figure B.1, with shaded areas indicating times of recession.⁸ The accession rate is clearly procyclical, as is the separation rate, but to a lesser extent than the accession rate. This 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.

In order to further investigate this matter, we split up the accession flows into EE flows, UE flows and NE flows. As one can see in Figure B.2, 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. From this, we can infer

Fact 2. *Employment-to-employment transitions are procyclical, and unemployment-to-employment transitions are countercyclical.*

The three worker flows making up separations, namely the EE flows, EU flows and EN flows, are displayed in the second panel of Figure B.2. It becomes apparent that direct job-to-job flows and the flows from employment to non-participation are procyclical, while the flow from employment to unemployment increases during recessions and decreases in periods of economic recovery. This means that we can observe a shift from employment-

⁸We also calculated the hiring and separation flows for the aggregate economy using the linked employer-employee data. The resulting time series for the time period 1997-2003 show the same pattern as those obtained from the IABS data, and are available from the authors upon request.

to-unemployment transitions to job-to-job transitions in the mature phase of the economic expansion.

3.3 Cyclical features of firm size-specific worker flows

We now turn to the question whether the cyclical features presented in the previous section vary between firms that differ in size. In order to do so, we first compute the share of a specific worker flow F in total hirings H for establishments of a specific size, i.e. the fraction F_{st}/H_{st} , with s being the establishment size class s and t the year under investigation. The results, which are depicted in Figure B.3, show that the hiring share from unemployment is countercyclical for all establishments. This leads to

Fact 3. *In recessions, unemployment supplies relatively more workers to establishments of all sizes.*

In a second step, we calculate the size-specific worker flows as a share of total worker flows, i.e. the fraction F_{st}/F_t , where F_t denotes the same, but economy-wide, flow in year t . In order to find out how these fractions are related to the business cycle, we compute their correlations with the growth rate of GDP for hirings and separations, as well as the underlying flows.

As becomes apparent in Table A.3, the hiring share of small establishments displays a strong negative correlation with GDP growth. This is due to the countercyclical UE and NE flow shares of this establishment size class, for both contemporaneous and lagged GDP growth. The hiring shares of large establishments, by contrast, are strongly procyclical for all the flows considered. Interestingly, for large establishments the correlation of the hiring shares with the different lags of GDP growth is strongest for the first lag of GDP, which can be viewed as a manifestation of the fact that larger establishments start hiring later in an economic expansion. This strong correlation is driven by the cyclical behaviour of the EE and UE flows. Thus, the cyclicity of hirings by large firms is not only due to these firms hiring employed workers, but also that they increase their hiring share from unemployment during expansions. Furthermore, the correlations are slightly larger for large establishments

than for small establishments.

The evidence on separation shares is qualitatively similar (cf. Table A.4), but generally less pronounced than the evidence on the hiring shares. The most striking result for separations is that the separation share of large establishments is very strongly correlated with current GDP. This is due to the strong increase of this share of both direct employer-to-employer flows and flows from employment to nonparticipation. The former increase can be put down to the procyclicality of job-to-job transitions, which to a large extent seem to be taking place between large firms. The latter increase could be due to the fact that employed workers are more likely to become self-employed during economic upswings. Unfortunately, we cannot investigate this hypothesis further using our data set. These results can be summarized in

Fact 4. *Hires at large establishments, especially out of unemployment, appear to be more cyclically sensitive than hires at small establishments. This does not seem to be the case for separations.*

Finally, we also analysed the differences in the hiring and separation behaviour between establishments with different job turnover rates.⁹ There is some evidence that establishments with a low job turnover reduce their hiring activity during the recession and raise it in the 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 is consistent with the fact that small firms are characterised by high turnover. 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.

⁹Results are obtainable from the authors upon request.

4 Econometric Analysis

4.1 Econometric specification

The descriptive analysis indicated that two-sided heterogeneity plays an important role for the cyclical nature of labour market dynamics. We now want to analyse this issue econometrically in order to find out whether composition effects play a role in this context. For example, the increase in job-to-job transitions to large establishments during the mature phase of an economic upswing may be equally spread across all workers, which means that composition effects are not important. Alternatively, large firms may be hiring more workers of a particular type in this situation, which could be related to certain observable characteristics (e.g. skills) or certain unobservable characteristics (“high-turnover” vs. “low-turnover” workers). As both are taken into account in our empirical analysis, we obtain a composition-adjusted effect of output growth on transition probabilities, which can be viewed as the effect on the probability of transition *within worker type*.

In order to investigate the determinants of worker flows, we estimate a logit model

$$Pr[y_{it} = 1|x_{it}, \beta, \alpha_i] = \Lambda(\alpha_i + x'_{it}\beta), \quad (5)$$

where $\Lambda(\cdot)$ is the logistic cdf with $\lambda(z) = e^z/(1 + e^z)$. In doing so, we estimate two specifications, a random effects model and a fixed effects model (conditional logit).¹⁰ This allows us to explicitly take into account unobserved worker characteristics. The random effects model, which eliminates the individual-specific effect α_i by integrating over a specified distribution of this effect, which is taken to be a random variable. In our application, this model has the advantage that it allows estimation over all individuals in the sample, i.e. also those that never make a transition. However, the random effects estimators are inconsistent if fixed effects are present which are correlated with the regressors. For this reason, we also estimate a fixed effects model. Qualitatively, i.e. with respect to firm-size specific differences, the two models yield very similar results.

¹⁰As a robustness test, we also estimated semi-parametric duration models. This yielded results very similar to the random effects model.

As dependent variables, we consider separations (i.e. the probability of an employed person to separate from his employer), as well as their components (i) transitions from employment to unemployment, and (ii) transitions from employment to another job; furthermore, we estimate the hiring transitions from unemployment to employment, and direct job-to-job-transitions. 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) observable firm characteristics f_{et} (industry), and unobservable worker characteristics as described above.¹¹ The vector GDP_t , our measure of the business cycle, contains contemporaneous and lagged GDP growth (lags 1 to 4) and captures the dynamic structure of the labour market process under investigation. In order to analyse the size-specific variations in the cyclical timing of hirings and separations, we estimate both specifications for large and small firms separately.¹²

4.2 Estimation results

The estimation results for the separation probability of an existing job match are displayed in Table A.5.¹³ The results from the descriptive analysis are largely confirmed. In addition, the coefficients obtained from the random effects specification show that - irrespective of the establishment size - the probability of separation significantly declines with increasing employment duration.

Regarding the cyclical behaviour, the estimation results for small establishments indicate that initially separations are countercyclical (acyclical in the fixed effects specification), but

¹¹The fixed-effects specification only includes the time-varying characteristics.

¹²Large establishments are defined as those employing more than 100 workers. Trying alternative definitions, we find very similar estimation results.

¹³In this table, as in all the other tables, the fixed effects specification yields coefficients on GDP that are much larger than in the random effects specification. As random effects regressions performed on the reduced fixed-effects sample show, this is purely due to the sample selection that goes along with the use of the conditional logit estimator.

from the first lag on show a procyclical pattern. The same pattern can be observed for large establishments. However, they are initially less cyclically sensitive than small firms, but from the third lag on show a stronger procyclical effect. Overall, there does not seem to be a strong difference in the cyclical sensitivity between small and large firms, but the latter are slower in their response.

For the transitions from employment to employment (EE), the estimation results indicate a procyclical pattern for small establishments, with the positive impact increasing up to the second lag (A.6). Looking at large establishments, we see that this cyclical effect is contemporaneously counter-cyclical (in the random-effects specification) or insignificant (in the fixed-effects specification), but turns pro-cyclical from the first lag onwards. However, it remains quantitatively below what can be observed for small firms.

As becomes apparent in Table A.7, the counter-cyclicity of the transitions from employment to unemployment is confirmed for both small and large establishments, as well as the random and the fixed effects specifications. Furthermore, the cyclical sensitivity of employment-to-unemployment transitions in small firms seems to be larger than in large firms (in the random effects specification) or of a similar magnitude (in the fixed effects specification).

Looking at the hiring flows in more detail, the results for direct employer-to-employer transitions treated as an accession flow are very similar to EE separation flows (Table A.6).¹⁴ Regarding the transitions from unemployment to employment (Table A.8), the coefficients of the GDP variables show a contemporaneously procyclical pattern for both small and large establishments. This implies that initially, as the economy goes into recession, hirings out of unemployment decline. Interestingly, for small establishments, the correlation of the transition rate with GDP turns negative for GDP lagged by 1-3 quarters. We interpret this as a sign that small establishments start hiring out of unemployment already during a recession. For large establishments, on the other hand, this phenomenon cannot be observed as lagged GDP is insignificant at all lags.

¹⁴They are therefore not reported but are available from the authors.

4.3 Impulse response functions

We now want to summarize our estimation results, focussing on the dynamic response of the different worker flows to innovations in GDP.¹⁵ Furthermore, in order to gauge the importance of composition effects, we contrast the dynamic implications of our estimation results with the dynamics which can be obtained from the correlations between GDP growth and the transitions under investigation. While the estimation results can be used to obtain dynamic responses which are adjusted for composition effects, the correlation-based results lead to the overall dynamic response, which contains both composition and “behavioural” effects.

First, it is useful to note that the fixed effects logit estimator yields the effect of each observable variable on the log-odds ratio

$$\log \left[\frac{\Pr(h_{it} = 1|x_{it}, \lambda_i)}{1 - \Pr(h_{it} = 1|x_{it}, \lambda_i)} \right] = \log [\exp\{x_{it}\beta + \lambda_i\}] = x_{it}\beta + \lambda_i \quad (6)$$

where x_{it} is the vector of values of observable variables associated with person i at time t and λ_i is the unobservable worker effect. We are thus able to trace out the effect of an impulse to output growth on the log-odds ratio using the regression results. In order to do so, we estimate an autoregressive model for output growth, y_t . Using data on West German GDP¹⁶ for the time period 1980- 2004, we obtain the following equation:

$$y_t = 0.319 - 0.157y_{t-1} + 0.055y_{t-2} + 0.167y_{t-3} + 0.304y_{t-4} + \hat{\epsilon}_t \quad (7)$$

We use the estimation results in order to trace out the dynamic response of output growth to a one percentage point innovation to GDP growth. Then, we combine the resulting series with (i) the correlations between the flows under investigation and GDP growth, and (ii) the coefficients (log-odds) from the fixed effects models estimated in the previous section. We thus obtain the dynamic response of different transitions to a one percentage point innovation in GDP.

We conduct this exercise for hirings from unemployment, and for total separations, and

¹⁵We are grateful to one of the referees for suggesting this representation.

¹⁶As quarterly GDP data are not readily available for West Germany after 1990, we use data from Mönch and Uhlig (2005).

separations to employment and to unemployment. Without adjusting for composition effects (left panel, “correlations-based”) for transitions between employment and unemployment, it becomes apparent that they are more cyclical for large establishments. In particular, while transitions from unemployment to employment (Figure B.4) are strongly procyclical, transitions in the reverse direction are strongly countercyclical at large establishments (Figure B.7). For small establishments, both transitions appear virtually acyclical. This leads us to

Fact 5. *Hires out of unemployment, as well as employment-to-unemployment transitions, appear to be more cyclically sensitive at large establishments than at small establishments.*

When comparing the impulse response functions displaying the overall dynamic response (left panel) with the impulse response functions adjusted for composition effects (right panel, “regression-based”), it becomes apparent that the cyclicity of job-to-job transitions (cf. Figure B.6) and of total separations (cf. Figure B.5) are not greatly affected by composition effects. By contrast, for hirings out of unemployment at large establishments, the cyclicity completely disappears when controlling for composition effects. This implies that large establishments increase their hirings out of unemployment during an economic upswing by attracting different types of workers (“high-turnover” rather than “low-turnover”), not by attracting more workers of the same type. As a consequence, the greater cyclicity of large firms relative to small firms with respect to this transition disappears when controlling for composition effects. The composition effect also seems to play an important role for transitions from employment to unemployment, and the difference between large and small firms disappears when controlling for it. We thus establish

Fact 6. *The greater cyclicity of the transitions between employment and unemployment by large establishments seems to be entirely due to composition effects.*

However, for transitions from employment to unemployment, it is the cyclicity of transitions at small establishments which is most strongly affected.

5 Summary and Discussion

The empirical evidence provided in Sections 3 and 4 yields the following picture of labour market cyclicity. As the economy enters into recession, the number of direct job-to-job transitions declines, while inflows into unemployment increase (Fact 2). The absolute number of transitions from unemployment to employment also increases, and unemployment supplies relatively more workers to establishments of all sizes (Fact 3). As the stock of unemployment rises faster, however, the exit rate out of unemployment declines. These facts can be explained by the consequences of a negative productivity shock, which leads to a reduction in the number of vacancies, thus reducing direct employer-to-employer transitions, and to a burst in job destruction resulting in increased flows into unemployment. The availability of many short-term unemployed workers as well as reduced reservation wages in turn lead to increased flows from unemployment to employment. This chain of reasoning seems to call for an out-of-steady-state analysis incorporating endogenous job destruction as well as on-the-job search, which to the best of our knowledge does not exist.¹⁷

When looking at differences between establishments of different size classes, we find that overall, large establishments hire more from employment and less from unemployment than small establishments (Fact 1). Not adjusting for composition effects, hires out of unemployment appear more cyclical at large establishments; this does not seem to be the case for separations (Fact 4). When taking into account composition effects in the econometric analysis, the differences disappear, and hirings out of unemployment by large firms become acyclical (Fact 5). This implies that worker heterogeneity, both observed and unobserved, plays a crucial role for the cyclicity of labour market dynamics. In particular, the greater cyclicity of hires at large establishments seems to be driven by composition effects, i.e. by the fact that, compared to small establishments, large establishments are more likely to hire workers of *different types* over the business cycle.

¹⁷Mortensen and Nagypal (2007) argue that comparative statics are sufficient to approximate out-of-steady-state dynamics. Their model features endogenous job destruction, but no on-the-job search. Moscarini and Postel-Vinay (2008) use a Burdett-Mortensen equilibrium search model which includes on-the-job search, but exogenous job destruction.

In order to illustrate this, we assume that there are only two worker types, “high-turnover” and “low-turnover” workers. With respect to hirings out of unemployment, large establishments seem to be attracting more high-turnover workers during an economic upswing than during a recession. This could have important implications. First, the accumulation of high-turnover workers during periods of economic upswings may be creating the basis for the next downturn, as workers with a relatively low productivity are employed at relatively high wages. Second, it may also provide a new insight into the quality of existing job matches (cf. Caballero and Hammour, 1994, and Barlevy, 2002). To the extent that high-turnover (low-productivity) workers are laid off during economic downturns, recessions exert a cleansing effect in this respect.

Finally, our results provide an empirical foundation for the inclusion of worker heterogeneity in macroeconomic models of the labour market, such as Pries (2008) who shows that worker heterogeneity can increase the volatility in the standard search-and-matching model.

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 cyclicity of worker and job flows. 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 cyclicity 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. This is in line with the model and the evidence in Moscarini and Postel-Vinay (2008, 2010). Our analysis also stresses the fact that composition effects play an important role for labour market dynamics over the cycle.

Our results thus provide a tentative answer to the question asked in the introduction: Inflows to unemployment increase during a recession mainly because employer-employee matches in large firms are separated (although this effect comes with a certain delay). Furthermore, while small firms increase their hirings already before the beginning of an economic upswing, large firms strongly reduce their hiring activity during recessions, and only start hiring much later. As a consequence, unemployment outflows do not increase enough to keep unemployment duration from rising during a recession. A model which mirrors these crucial aspects of the cyclicity of the labour market still remains elusive.

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Appendix A Tables

Table A.1: 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 size							
1-19 employees	0.113	0.110	0.222	0.279	0.275	0.554	0.331
20-99 employees	0.084	0.072	0.156	0.213	0.207	0.420	0.264
100-999 employees	0.048	0.065	0.114	0.159	0.176	0.335	0.222
1000 and more employees	0.031	0.057	0.089	0.102	0.128	0.229	0.141

Source: Authors calculations based on LIAB 1993-2006, for West Germany.

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. Establishment size classes are based on size in the previous year. All figures are weighted averages of the seven annual values (1997-2003).

Table A.2: Distribution of sources and destinations by establishment size

Establishment size	Hirings from			Separations to		
	E	N	U	E	N	U
All observations	0.329	0.419	0.252	0.330	0.410	0.261
1-19	0.298	0.416	0.286	0.312	0.379	0.310
20-99	0.333	0.398	0.269	0.344	0.393	0.263
100-999	0.365	0.428	0.207	0.347	0.443	0.210
1000 and more	0.368	0.478	0.154	0.320	0.504	0.176

Source: Authors calculations based on IABS 1975-2004, for West Germany.

Note: Establishment size classes are based on size in the contemporaneous year. All figures are calculated as described in Section 3.2, they are weighted averages of the annual values (1980-2003).

Table A.3: Correlations between firm size-specific hiring flows and GDP growth rate

Establishment size	GDP(t)	GDP(t-1)	GDP(t-2)	GDP(t-3)	GDP(t-4)
H_s/H					
1-19	-0.096	-0.207	-0.073	-0.170	-0.203
20-99	0.023	-0.140	0.012	0.048	-0.011
100-999	0.032	0.174	0.082	0.139	0.187
1000 and more	0.091	0.233	0.002	0.062	0.099
EE_s/EE					
1-19	0.021	-0.144	-0.037	-0.085	-0.100
20-99	0.032	-0.120	0.051	0.065	0.040
100-999	-0.078	0.098	0.056	0.047	0.057
1000 and more	0.040	0.233	0.043	0.045	0.050
UE_s/UE					
1-19	-0.083	-0.176	-0.080	-0.216	-0.157
20-99	-0.092	-0.095	-0.092	0.023	-0.176
100-999	0.105	0.137	0.097	0.176	0.211
1000 and more	0.061	0.210	0.079	0.118	0.157
NE_s/NE					
1-19	-0.253	-0.145	-0.124	-0.197	-0.314
20-99	0.048	-0.079	0.036	0.026	0.091
100-999	0.148	0.181	0.111	0.190	0.287
1000 and more	0.202	0.101	0.032	0.063	0.097

Source: IABS, transformed to a quarterly data set by the authors, for West Germany 1980/I-2004/III.

Note: F_s refers to a particular flow occurring in establishment size class s , and F denotes the same, but economy-wide, flow. H indicates hirings.

Table A.4: Correlations between firm size-specific separation flows and GDP growth rate

Establishment size	GDP(t)	GDP(t-1)	GDP(t-2)	GDP(t-3)	GDP(t-4)
Sep_s/Sep					
1-19	-0.056	-0.049	-0.106	-0.174	-0.262
20-99	-0.110	-0.080	-0.052	-0.039	0.048
100-999	-0.053	0.006	0.102	0.089	0.172
1000 and more	0.161	0.092	0.062	0.150	0.107
EE_s/EE					
1-19	0.008	0.047	-0.027	0.055	-0.119
20-99	-0.106	0.012	0.048	0.100	0.060
100-999	-0.040	-0.074	0.012	-0.080	0.036
1000 and more	0.116	0.006	0.017	-0.064	0.150
EU_s/EU					
1-19	0.048	-0.017	-0.033	-0.036	-0.022
20-99	-0.045	-0.008	-0.151	-0.112	0.019
100-999	-0.059	0.007	0.052	0.038	0.016
1000 and more	-0.005	0.002	0.104	0.098	-0.031
EN_s/EN					
1-19	-0.112	-0.147	-0.109	-0.202	-0.161
20-99	-0.091	-0.156	-0.060	-0.022	0.009
100-999	0.003	0.135	0.104	0.078	0.122
1000 and more	0.151	0.164	0.061	0.167	0.048

Source: IABS, transformed to a quarterly data set by the authors, for West Germany 1980/I-2004/III.

Note: F_s refers to a particular flow occurring in establishment size class s , and F denotes the same, but economy-wide, flow. S indicates separations.

Table A.5: Logit estimation, separations

	Small establishments				Large establishments			
	RE		FE		RE		FE	
	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)
duration empl 2-5	-0.0179***	(0.0003)	0.0481***	(0.0017)	-0.0165***	(0.0002)	0.0358***	(0.0014)
duration empl 6-10	-0.0401***	(0.0004)	0.0282***	(0.0021)	-0.0266***	(0.0002)	0.0352***	(0.0017)
duration empl 11-20	-0.0519***	(0.0004)	0.0384***	(0.0024)	-0.0330***	(0.0002)	0.0470***	(0.0018)
duration empl 21-30	-0.0584***	(0.0005)	0.0488***	(0.0031)	-0.0368***	(0.0002)	0.0537***	(0.0021)
duration 30 over	-0.0678***	(0.0004)	0.1918***	(0.0031)	-0.5934***	(0.0004)	0.1549***	(0.0037)
GDP(t)	-0.0009***	(0.0001)	-0.0003	(0.0006)	-0.0007***	(0.0001)	-0.0007	(0.0005)
GDP(t-1)	0.0004***	(0.0001)	0.0062***	(0.0006)	-0.0002*	(0.0001)	0.0036***	(0.0005)
GDP(t-2)	0.0009***	(0.0001)	0.0079***	(0.0006)	0.0004***	(0.0001)	0.0063***	(0.0005)
GDP(t-3)	-0.0003**	(0.0001)	0.0021***	(0.0006)	0.0004***	(0.0001)	0.0050***	(0.0004)
GDP(t-4)	-0.0002	(0.0001)	0.0010	(0.0006)	0.0002*	(0.0001)	0.0021***	(0.0005)
No. of obs.	4,091,197		3,622,989		3,899,190		3,141,081	

Source: IABS, transformed to a quarterly data set by the authors, for West Germany 1980/I-2004/III.

Note: Results come from logit models estimated using random effects (RE) and fixed effects (FE) specifications. Numbers shown are marginal effects; a ***/**/* indicates a 1%/5%/10% level of significance. Base category: individuals aged 15-24, with 1 quarter of previous (un)employment. Quarterly and age group dummies included.

Table A.6: Logit estimation, separations (EE transitions)

	Small establishments				Large establishments			
	RE		FE		RE		FE	
	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)
duration empl 2-5	-0.0048***	(0.0002)	0.0022	(0.0025)	-0.0024***	(0.0001)	0.0363***	(0.0027)
duration empl 6-10	-0.0087***	(0.0002)	0.0085***	(0.0031)	-0.0052***	(0.0001)	0.0364***	(0.0031)
duration empl 11-20	-0.0118***	(0.0002)	0.0330***	(0.0035)	-0.0069***	(0.0001)	0.0601***	(0.0032)
duration empl 21-30	-0.0144***	(0.0002)	0.0593***	(0.0045)	-0.0090***	(0.0001)	0.0790***	(0.0036)
duration 30 over	-0.0178***	(0.0002)	0.1897***	(0.0045)	-0.0141***	(0.0002)	0.1690***	(0.0050)
GDP(t)	0.0004***	(0.0001)	0.0073***	(0.0010)	-0.0002***	(0.0001)	0.0003	(0.0010)
GDP(t-1)	0.0010***	(0.0001)	0.0159***	(0.0010)	0.0002***	(0.0001)	0.0050***	(0.0009)
GDP(t-2)	0.0013***	(0.0001)	0.0196***	(0.0010)	0.0007***	(0.0001)	0.0122***	(0.0009)
GDP(t-3)	0.0012***	(0.0001)	0.0173***	(0.0009)	0.0004***	(0.0001)	0.0059***	(0.0008)
GDP(t-4)	0.0010***	(0.0001)	0.0153***	(0.0010)	0.0005***	(0.0001)	0.0066***	(0.0009)
No. of obs.	4,091,197		2,145,221		3,899,190		1,565,053	

Source: IABS, transformed to a quarterly data set by the authors, for West Germany 1980/I-2004/III.

Note: Results come from logit models estimated using random effects (RE) and fixed effects (FE) specifications. Numbers shown are marginal effects; a ***/**/* indicates a 1%/5%/10% level of significance. Base category: individuals aged 15-24, with 1 quarter of previous (un)employment. Quarterly and age group dummies included.

Table A.7: Logit estimation, separations (EU transitions)

	Small establishments				Large establishments			
	RE		FE		RE		FE	
	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)
duration empl 2-5	0.0005***	(0.0001)	0.0769***	(0.0031)	-0.0005***	(0.0001)	0.1034***	(0.0058)
duration empl 6-10	-0.0047***	(0.0001)	-0.0004	(0.0034)	-0.0018***	(0.0001)	0.0428***	(0.0077)
duration empl 11-20	-0.0074***	(0.0001)	-0.0405***	(0.0038)	-0.0026***	(0.0001)	-0.0158*	(0.0088)
duration empl 21-30	-0.0086***	(0.0001)	-0.0760***	(0.0049)	-0.0030***	(0.0001)	-0.0836***	(0.0111)
duration 30 over	-0.0121***	(0.0001)	-0.0144**	(0.0064)	-0.0030***	(0.0001)	0.0616***	(0.0127)
GDP(t)	-0.0004***	(0.0000)	-0.0092***	(0.0010)	-0.0001***	(0.0000)	-0.0093***	(0.0019)
GDP(t-1)	-0.0003***	(0.0000)	-0.0057***	(0.0010)	-0.0002***	(0.0000)	-0.0108***	(0.0020)
GDP(t-2)	-0.0005***	(0.0000)	-0.0095***	(0.0010)	-0.0002***	(0.0000)	-0.0109***	(0.0019)
GDP(t-3)	-0.0009***	(0.0000)	-0.0207***	(0.0009)	-0.0002***	(0.0000)	-0.0132***	(0.0019)
GDP(t-4)	-0.0008***	(0.0000)	-0.0189***	(0.0010)	-0.0002***	(0.0000)	-0.0171***	(0.0020)
No. of obs.	4,091,197		1,447,097		3,899,190		583,157	

Source: IABS, transformed to a quarterly data set by the authors, for West Germany 1980/I-2004/III.

Note: Results come from logit models estimated using random effects (RE) and fixed effects (FE) specifications. Numbers shown are marginal effects; a ***/**/* indicates a 1%/5%/10% level of significance. Base category: individuals aged 15-24, with 1 quarter of previous (un)employment. Quarterly and age group dummies included.

Table A.8: Logit estimation, accessions (UE transitions)

	Small establishments				Large establishments			
	RE		FE		RE		FE	
	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)	Coeff.	(S.E.)
duration unempl 2-5	0.7395***	(0.0003)	0.7232***	(0.0072)	0.7254***	(0.0002)	0.8122***	(0.0131)
duration unempl 6-10	0.8057***	(0.0003)	0.6942***	(0.0078)	0.8147***	(0.0002)	0.7977***	(0.0142)
duration unempl 11-20	0.8456***	(0.0005)	0.6900***	(0.0079)	0.8688***	(0.0003)	0.7946***	(0.0145)
duration unempl 20 over	0.8802***	(0.0008)	0.6881***	(0.0080)	0.9166***	(0.0004)	0.7954***	(0.0148)
GDP(t)	0.0001***	(0.0001)	0.0029**	(0.0013)	0.00002***	(0.00001)	0.0052***	(0.0019)
GDP(t-1)	-0.0002***	(0.0000)	-0.0144***	(0.0012)	6.83e-07	(0.00001)	-0.0018	(0.0017)
GDP(t-2)	-0.0001***	(0.0001)	-0.0079***	(0.0013)	-1.77e-07	(0.00001)	-0.0030*	(0.0018)
GDP(t-3)	-0.00005**	(0.0000)	-0.0024*	(0.0013)	-9.27e-07	(0.00001)	-0.0024	(0.0018)
GDP(t-4)	0.00002	(0.0000)	0.0014	(0.0013)	-8.05e-08	(0.00001)	-0.0017	(0.0018)
No. of obs.	4,091,197		1,486,195		3,899,190		681,325	

Source: IABS, transformed to a quarterly data set by the authors, for West Germany 1980/I-2004/III.

Note: Results come from logit models estimated using random effects (RE) and fixed effects (FE) specifications. Numbers shown are marginal effects; a ***/**/* indicates a 1%/5%/10% level of significance. Base category: individuals aged 15-24, with 1 quarter of previous (un)employment. Quarterly and age group dummies included.

Appendix B Figures

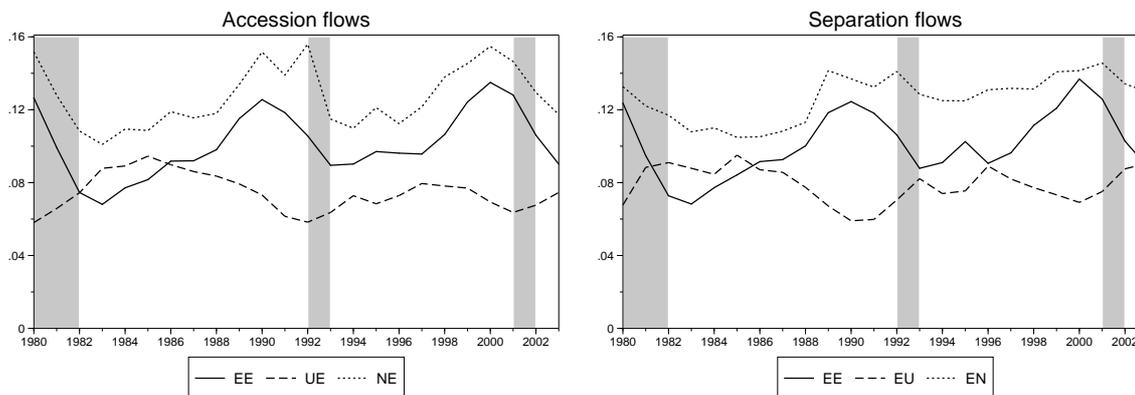
Figure B.1: Accessions and separations, 1980-2003, yearly rates



Source: Authors calculations based on IABS 1975-2004, for West Germany.

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

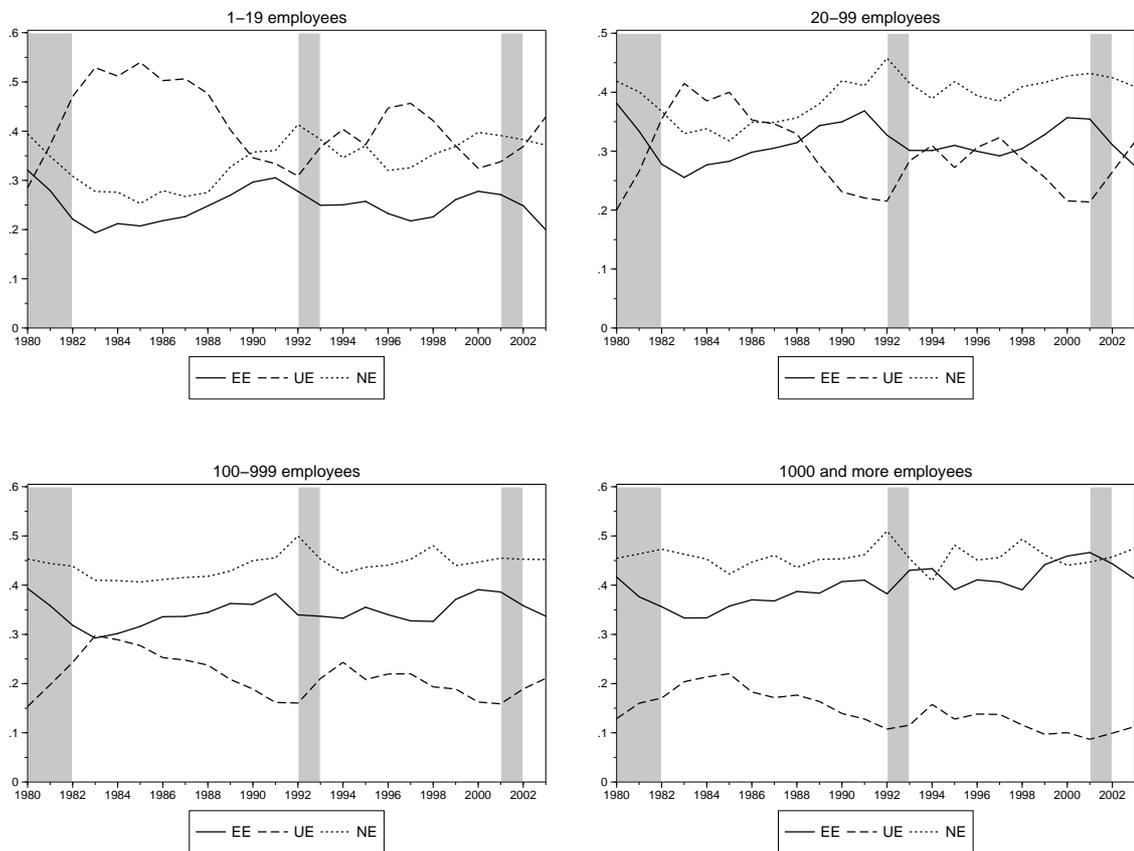
Figure B.2: The dynamics of worker flows, 1980-2003, yearly rates



Source: Authors calculations based on IABS 1975-2004, for West Germany.

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 2.2. Shaded areas are times of recession.

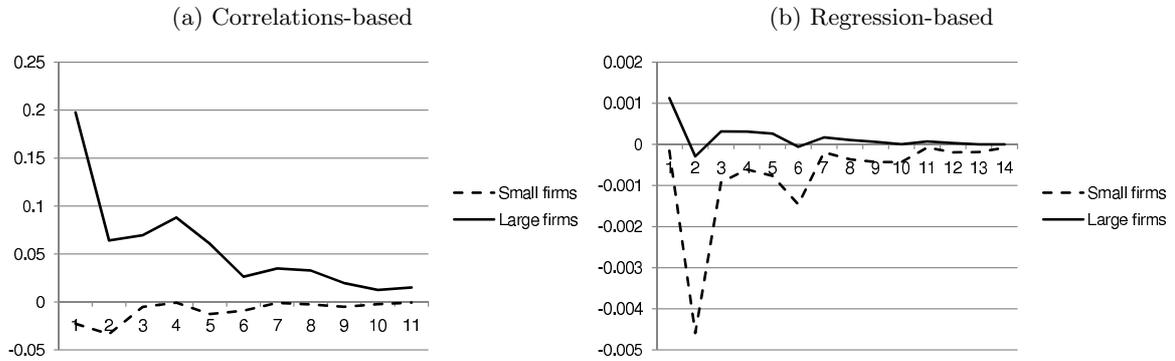
Figure B.3: The shares in hirings by establishment size, 1980-2003, yearly rates



Source: Authors calculations based on IABS 1975-2004, for West Germany.

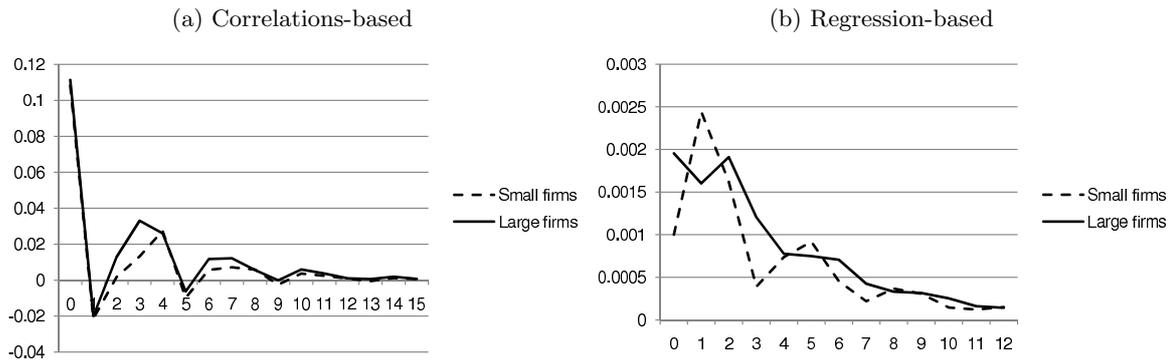
Note: For each establishments size class the flows are computed as share of total hirings. Establishment size classes are based on size in the contemporaneous year. EE: Employer-to-employer flows; NE: Nonparticipation-to-employment flows; UE: unemployment-to-employment flows; EN: Employment-to-nonparticipation flows; EU: Employment-to-unemployment flows.

Figure B.4: Impulse response functions for UE hirings



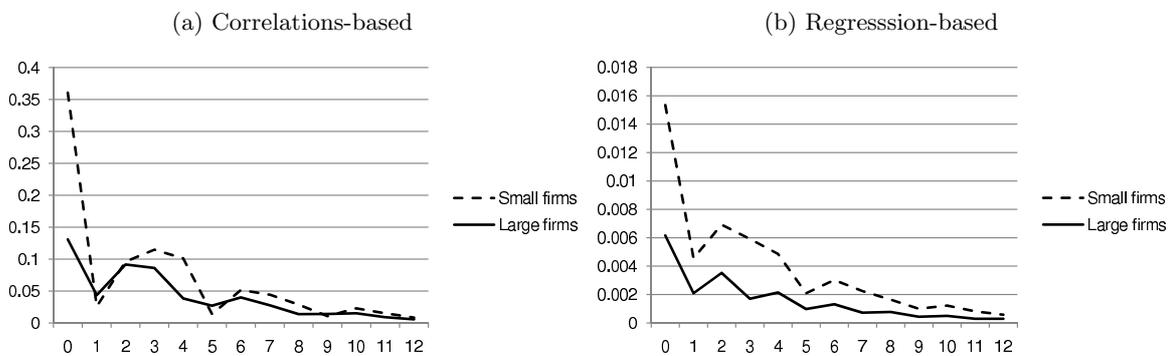
Source: Authors calculations based on IABS 1975-2004, for West Germany.
 Note: Impulse responses computed as described in Section 4.3.

Figure B.5: Impulse response function for separations



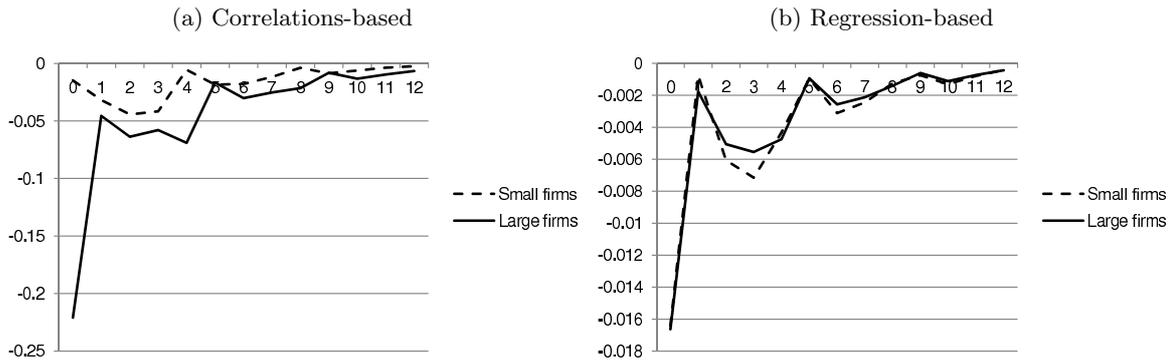
Source: Authors calculations based on IABS 1975-2004, for West Germany.
 Note: Impulse responses computed as described in Section 4.3.

Figure B.6: Impulse response functions for EE separations



Source: Authors calculations based on IABS 1975-2004, for West Germany.
 Note: Impulse responses computed as described in Section 4.3.

Figure B.7: Impulse response functions for EU separations



Source: Authors calculations based on IABS 1975-2004, for West Germany.
 Note: Impulse responses computed as described in Section 4.3.

Figure B.8: Wage growth for different types of job-to-job transitions



Source: Authors calculations based on IABS 1975-2004, for West Germany.
 Note: This figure shows the log wage growth which is associated with a job-to-job transition.