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ABSTRACT

Job and Worker Turnover in German Establishments^{*}

We use a simple regression-based approach to measure the relationship between employment growth, hirings and separations in a large panel of German establishments over the period 1993-2009. Although the average level of hiring and separation is much lower in Germany than in the US, as expected, we find that the relationship between employment growth and worker flows in German establishments is very similar to the behaviour of US establishments described in Davis, Faberman & Haltiwanger (2006, 2011), and quite different to the behaviour of French establishments described in Abowd, Corbel & Kramarz (1999). The relationship is very stable over time, even during the most recent economic crisis, and across different types of establishment.

JEL Classification: J2, J23, J63, D22

Keywords: job turnover, worker turnover, hirings and separations

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1 Introduction

It is often claimed that a key difference between labour markets in the United States and those in continental European countries is the ease with which employers can adjust their workforce. For example, Pries & Rogerson (2005) argue that worker turnover in Europe is much lower than in the United States, even though job turnover is similar, and this can be partly explained by policy and institutional differences such as the minimum wage and dismissal costs. On the worker side, these differences manifest themselves in lower unemployment entry rates but longer unemployment durations in Europe. On the firm side, these differences manifest themselves in lower hiring and separation rates.

At the macroeconomic level, the ability of firms to lay-off workers in a recession (and to hire workers in a boom) contributes to the cyclical nature of unemployment inflows, which has been the subject of some empirical debate. Darby, Haltiwanger & Plant (1986) claim that the cyclical variation in unemployment was largely due to the cyclical variation in the inflow — in other words, unemployment increases in a recession because workers are laid-off. In contrast, Hall (2005) and Shimer (2007) find that unemployment inflows are relatively acyclical, and that the increase in the stock of unemployment in a recession is mainly due to a decline in the unemployment outflow rate. Elsbey, Michaels & Solon (2009) argue that both the inflow and the outflow matter for explaining the cyclical pattern of unemployment. All these studies relate to the United States. If the received wisdom on firm adjustment is correct, we would expect to find even less cyclical nature in unemployment inflows in Europe.

At the microeconomic level, the increasing availability of detailed firm- and establishment-level data, linked to records of workers' employment spells, has allowed researchers to examine how individual firms' hirings and separations vary with changes in employment. In Section 3 we summarise a number of studies from around the world which compute hiring and separation rates at the firm level. For the United

States, Burgess, Lane & Stevens (2001, p.11) find that falls in employment are achieved by increasing separations rather than reducing hiring. This is confirmed by Davis, Faberman & Haltiwanger (2006, p.17) who show that, in shrinking establishments, separations increase approximately one-for-one with job loss. In stark contrast, Abowd *et al.* (1999) show that, in France, job loss in establishments is associated with a reduction in hiring rather than an increase in separations. This too seems to confirm the stylised fact that employment adjustment in Europe is more difficult because of hiring and firing restrictions. Davis, Faberman & Haltiwanger (2011, p.18) note that the apparent difference between establishment behaviour “may reflect differences between France and the United States in the nature of labor adjustment.”

In this paper, however, we provide evidence that the relationship between employment changes and worker flows in German establishments is *remarkably similar* to the behaviour of establishments in the United States described in Burgess *et al.* (2001) and Davis *et al.* (2011). To do this, we describe the hirings and separations of a panel of German establishments over the last 17 years. Our data has a consistent measure of hires and separations over a long period, and separations can be decomposed into those which are employer-initiated (layoffs) and those which are employee-initiated (quits). We propose a simple regression-based approach for measuring the relationship between employment change and worker flows. In addition, we have a rich set of measured characteristics of the establishments in our sample, and therefore we can investigate whether establishments which face higher turnover costs have different hiring and separation responses to employment change.

Our main findings are as follows. First, the average level of hiring and separation is indeed much lower in Germany than in studies from the United States, as expected. Second, and despite this, separations increase almost one-for-one in shrinking establishments. The increase in separations in shrinking establishments is almost symmetric with the increase in hires in growing establishments. Third, the

relationship between employment change and worker flows is very stable over time and across different types of establishment. This too appears consistent with the behaviour of US establishments. We verify our results by comparing the survey-based measures of hiring and separation with independent measures from administrative data, which give similar results. Our results imply that cross-country differences in the unemployment response to a shock may not be due to differences in hiring and separation responses to a given amount of employment growth, but rather to shifts in the employment growth distribution itself.

2 Basic concepts

The basic concepts are explained by, amongst others, Hamermesh, Hassink & van Ours (1996), Abowd *et al.* (1999) and Burgess, Lane & Stevens (1999). We try wherever possible to use terminology and notation which are consistent with these authors.

Define N_{it} to be employment of establishment i at time t .¹ The *net job flow*, or employment change of establishment i , between $t - 1$ and t , is ΔN_{it} . If we initially make the simplifying assumptions that (a) all jobs within an establishment are identical, and (b) there are no unfilled vacancies, then the net job flow rate is a measure of total *job turnover* within the establishment. In other words, an establishment with $\Delta N_{it} = 1$ has created one job, and an establishment with $\Delta N_{it} = -1$ has destroyed one job. The empirical literature on job turnover, following Davis & Haltiwanger (1992), adds up ΔN_{it} across all establishments which have positive employment change, and across all establishments which have negative employment change.

Employment change within an establishments will almost certainly be an underestimate of worker flows, because even for a given set of jobs, there may be workers

¹We ignore the distinction between part-time and full-time jobs in this section.

joining and leaving the establishment. Let H_{it} (hires) be the number of workers who join the establishment between $t - 1$ and t , and S_{it} (separations) be the number of workers who leave the establishment. It follows that net worker flows are equal to net job flows, $\Delta N_{it} = H_{it} - S_{it}$, but gross worker flows $H_{it} + S_{it}$ may be much larger.

The minimum number of worker movements needed to accommodate a change in employment is just ΔN_{it} . For example, if a firm shrinks by one worker, the minimum number of worker movements would be $H_{it} = 0$, $S_{it} = 1$. However, now suppose that for the same change in employment we observe $H_{it} = 1$, $S_{it} = 2$. We now have an additional 2 worker movements which (under our simplifying assumptions) were unnecessary to achieve the change in labour demand. This is called excess worker reallocation or worker churning (Burgess *et al.* 2001).

If we maintain the assumption that all jobs within an establishment are identical, then worker churning reflects mismatch between individual workers and individual establishments. In this view, a separation of a worker from an expanding establishment (or an establishment with constant employment) is not associated with the destruction of a “job”. Instead, the worker is replaced with another worker who may be a better match.

If instead we relax the assumption that all jobs within an establishment are identical, then excess worker reallocation can also reflect net job flows of different types of job. For example, suppose an establishment has N_{it}^a production jobs and N_{it}^b managerial jobs. If the establishment replaces one production job for one managerial job and $S_{it}^a = 1$, $H_{it}^b = 1$, overall net job flows will be zero, with an apparent excess reallocation of two. Within each job category, however, there is no excess reallocation.

It is standard to calculate separation and hiring rates by dividing by average

employment between t and $t - 1$:

$$h_{it} = \frac{H_{it}}{0.5(N_{it} + N_{i,t-1})}$$
$$s_{it} = \frac{S_{it}}{0.5(N_{it} + N_{i,t-1})}$$

The net job flow rate (which equals the net worker flow rate) is then $\Delta n_{it} = h_{it} - s_{it}$. The gross worker flow rate is $h_{it} + s_{it}$ which will be greater than the net job flow rate by the amount of churning.

3 Existing empirical evidence

There are a large number of studies which document the behaviour of job creation and job destruction, or gross job flows, across establishments. Most of these studies adopt the methodology of Davis & Haltiwanger (1992); Davis & Haltiwanger (1999) provide a literature review. A smaller, but growing number of studies examine job and worker turnover using linked employer-employee data.² Table 1 summarises the relevant studies from a variety of countries.

A key result to emerge from Table 1 is that worker turnover varies enormously between the US and all other countries for which estimates are available, although there are also very large differences in estimates from the US itself. To simplify, we consider the annual equivalent total worker flow rate for each study.³ For the US, total worker flow rates vary from 75% to almost 200% of employment per year. In contrast, estimates from other countries range from 22% (Netherlands), 32% (Germany), 50% (Portugal), 59% (France), 55% (Taiwan), and 47%–68% in Scandinavia and Finland. These estimates for European countries, from linked worker-firm data,

²There is also a large literature which estimates worker turnover rates from worker-level data. We do not discuss this here because it does not allow one to investigate the relationship between employment change and worker flows.

³Note that annual equivalent rates from monthly or quarterly data will tend to be higher than rates from annual data, because the latter ignores hires and separations which occur between sample dates. Nevertheless, it is a useful approximation to illustrate the overall pattern.

seem quite consistent with estimates reported in Pries & Rogerson (2005) which are based on worker transitions. They support Pries & Rogerson's conclusion that worker flows in the US are 1.5–2.5 times larger than in Europe.

The main objective of this article is to establish whether the relationship between employment growth and worker turnover rates in Germany is consistent with the idea that European firms are more restricted in their firing behaviour than firms in the United States. Is it the case that worker separation rates are lower in Germany because, for a given reduction in employment, German establishments increase separation rates by a smaller amount? Cross-country evidence on this issue is much less common.⁴

Abowd *et al.* (1999) use a linked employer-employee panel of about 1,700 French establishments with at least 50 employees for the period 1987–1990. They show that, for these establishments, the creation of one job corresponds to three hires and two separations. In contrast, the destruction of one job entails one hiring and two separations. Because of this, they suggest that the relationship between employment growth and hiring is much stronger than the relationship with firing.

For the United States, Burgess *et al.* (2001) use quarterly data from Maryland and show that, in contrast to Abowd *et al.* (1999), employment falls are associated more strongly with increases in separations rather than reductions in hires. They speculate that this difference might be due to restrictions on firing behaviour by French firms that do not apply in the US. These findings are confirmed by Davis *et al.* (2006), who show that there is a very strong, almost one-for-one relationship between separations and job loss in contracting establishments. Davis *et al.* also show that the relationship between employment change and worker turnover is very stable over the business cycle. This suggests that the driving force behind increases in layoff

⁴A number of studies consider both job- and worker-flows, but do not examine the relationship between them at the establishment level, typically because data on worker turnover comes from a different source to the data on job turnover. See, for example, Haltiwanger & Vodopivec (2002) and Bassanini & Marianna (2009).

Table 1: A comparison of hiring and separation rates from the literature. Job creation and job destruction are defined as the sum of positive and negative employment changes as a proportion of average employment between $t - 1$ and t .

<i>Study</i>	<i>Country</i>	<i>Sectors</i>	<i>Time period</i>	<i>Sample</i>	<i>Time interval</i>	<i>Job creation</i>	<i>Job destruction</i>	<i>Hiring</i>	<i>Separation</i>
Anderson & Meyer (1994)	US, selected states	All sectors	1978–1984	10–20% sample of social security data; plants employing more than 50 workers	Quarterly			16.1%	17.2%
Hamermesh <i>et al.</i> (1996)	Netherlands	All sectors	1988, 1990	Firm-level survey, 2204 firms	Annual	4.4%	2.6%	11.9%	10.1%
Lane <i>et al.</i> (1996)	US (Maryland)	Manufacturing	1985–1993	100% quarterly social security data	Quarterly	7.5%	8.8%	12.9%	14.2%
Albæk & Sørensen (1998)	Denmark	Manufacturing	1980–1991	All establishments	Annual	12.0%	11.5%	28.5%	28.0%
Abowd <i>et al.</i> (1999)	France	All sectors	1987–1990	Monthly panel data on 2,009 establishments which employ at least 50 workers	Annual	7.6%	6.9%	29.5%	29.7%
Burgess <i>et al.</i> (1999)	US (Maryland)	Manufacturing	1985–1994	Employers with at least 5 employees; spells lasting at least one quarter	Quarterly				19.4%
Belzil (2000)	Denmark	All sectors	1981–1991	Sample of employees within plants with 5 to 500 primary employees	Annual				68.0%
Tsou <i>et al.</i> (2001)	Taiwan	All sectors	1987–1997	Establishment survey	Annual	6.0%	9.7%	28.6%	26.3%
Ilmankunnas & Maliranta (2003)	Finland	All sectors	1988–1997	All establishments subject to VAT	Annual	17.2%	10.7%	28.8%	22.2%
Bauer & Bender (2004)	Germany	All sectors	1995–1996	Panel data on 1,378 establishments linked to social security records	Annual	2.5%	7.5%	13.6%	18.6%
Davis <i>et al.</i> (2006)	US	All sectors	2000–2005	Sample of 16,000 establishments (JOLTS)	Quarterly	3.4%	3.1%	9.5%	9.2%
Davis <i>et al.</i> (2006)	US, selected states	All sectors	1993–2003	All establishments (LEHD) linked to social security records	Quarterly	7.6%	5.2%	10.7%	9.2%
Centeno <i>et al.</i> (2009)	Portugal	All sectors	2000–2006	All firms covered by social security system	Annual	13.5%	11.8%	26.1%	24.4%
Gartell <i>et al.</i> (2010)	Sweden	All sectors	1986–2002	All establishments with more than 5 employees linked to social security records	Annual	10.4%	10.2%	23.5%	23.3%

Hires + separations.

rates in a recession is a shift in the cross-sectional distribution of establishment-level employment growth.

For Portugal, Centeno *et al.* (2009, Figure 1) shows that, as in the United States, the relationship between worker turnover and job turnover is quite symmetric: separations increase sharply with job loss, while hires increase sharply with job gains. They also find, however, that the increased separation response is much stronger for small firms.

Other papers which examine the relationship between employment change and worker flows using German data are Bauer & Bender (2004), Bauer, Bender & Bonin (2007) and Alda, Allaart & Bellmann (2005). Bauer & Bender (2004) use the same data as we do in this paper (see Section 4), but only for the period 1995–1996. They examine the relationship between organisational changes, job flows and worker flows. Bauer *et al.* (2007) examine the effect of changes in worker dismissal legislation on Germany job and worker flow rates. Alda *et al.* (2005) compare “churning rates” (the excess of worker turnover over job turnover) between German and Dutch establishments, and find that German establishments have much lower churning rates. They suggest that this is because of the lower share of fixed term contracts in Germany and the greater use of apprenticeships and works councils in Germany.

4 Data

The *Institut für Arbeitsmarkt- und Berufsforschung* (IAB) Establishment Panel is an annual survey of between c.4,000 and c.10,000 establishments located in West Germany (since 1993) and between 4,000 and 6,000 located in East Germany (since 1996). The sampling frame comprises all establishments in Germany with at least one worker subject to social security as of 30 June in the year before the survey. The survey currently covers approximately 1% of all plants in Germany and approx-

imately 7% of workers because it is weighted towards larger plants.⁵ Information is obtained by personal interviews with plant managers, and comprises about 80 questions per year, giving us information on, for example, total employment and total employment 12 months earlier, total sales, investment, wage bill, location, and industry.

The IAB panel provides a measure of the number of workers who were recruited and who left the establishment in the first six months of each calendar year. In some years, information is also available on the type of workers recruited in terms of their skill level and whether they are hired on fixed-term contracts. Establishments are also asked for the cause of the separation. Appendix A.1 gives a precise description of the relevant questions.

We use the longest run of data available to us, from 1993 to 2009. This enables us to compare the behaviour of German establishments over several business cycles. In total, 48,838 establishments (202,957 establishment-years) appear in the survey. We restrict the sample to those establishments in the private sector.⁶ This exclusion reduces the sample to 38,621 establishments (153,564 establishment-years).

We remove a small number of observations which have missing values for hires, separations or lagged employment (1,040 observations). We then check the consistency of information on hires, separations and employment. We remove observations where the number of separations is greater than reported employment at $t - 1$ (244 observations).⁷ We also check the difference between the 12 month change in em-

⁵Weights to ensure that the sample is representative are calculated by comparing the sample of establishments with the population of establishments in the same Federal state, size and industry cell. The population of plants is obtained from a Federal Agency for Employment establishment database. A more detailed description of the data and the weighting procedure is described in Fischer, Janik, Müller & Schmucker (2009).

⁶Establishments are excluded if they are in sectors defined as “non-industrial organisations and public administration”, if they reported being a public corporation or other non-profit making legal form, or if they reported being publicly owned. Selection is made on the basis first recorded value for each of these criteria, to ensure maximum continuity of establishments in the sample.

⁷In theory it is possible that separations are greater than reported employment at $t - 1$ if establishments have extremely high within-year turnover, but we regard this as unlikely in practice. Our robustness checks using administrative data (reported later on) suggest that within-year hires and separations are relatively unimportant.

ployment and the six-month change in employment implied by the difference between hires and separations over that period. This difference is an estimate of net hires for the last six months of $t - 1$. This difference is typically very small, with a mean of less than 2, and 98% of the observations lying in the range $(-109, 80)$. We exclude observations where the difference is in the top and bottom 0.1% of the distribution (303 observations). Finally, we check whether the reported recall value of employment for 30th June $t - 1$ is consistent with the reported value for 30th June t from the previous wave of the data. These values are also very consistent, with 98% of the sample lying in the range $(-2, 4)$. Again, we remove the top and bottom 0.1% (220 observations). This leaves a final clean sample of 38,368 establishments and 151,766 establishment-years.

The relatively long run of data presents various sample selection issues. Very few establishments are followed for the entire sample period, either because of genuine establishment entry and exit, or because of sample entry and exit. The number of establishments surveyed increases substantially over time, partly as a result of the introduction of establishments in East Germany in 1996. The average size of establishment also changes over the sample period. In our analysis we therefore focus on within-establishment changes which control for any changes in sample composition.⁸

Table 2 summarises annualised job and worker turnover rates across different establishments, and can be compared with Davis *et al.* (2006, Table 2). Because of the large changes in the sample composition over time, we use sampling weights.⁹ We weight to the population of workers, since this reflects the fact that large establishments have greater effects on key aggregate measures such as the hiring and separation rate.

⁸Table 8 in Appendix A.2 shows that the average size of establishments in the sample fell after the introduction of East German establishments in 1996, and has continued to fall since then. Despite the large change in average employment, the worker turnover rate is relatively stable. As a percentage of current employment, the total (six-monthly) worker turnover rate varies between 10% and 7%, with no obvious trend.

⁹Weights to ensure that the sample is representative are calculated by comparing the sample of plants with the population of plants recorded in social security data in the same Federal state, size and industry cell. See Fischer *et al.* (2009).

Gross job turnover (the sum of job creation and destruction) is highest in construction and other service industries, and lowest in manufacturing. Job creation and to a lesser extent job destruction decline with initial establishment size. Table 2 confirms that worker turnover in Germany is significantly lower than in the United States. Davis *et al.* (2006) report *monthly* worker turnover rates of 6.3%, implying an annual rate of over 70%. The estimated annual rate for German establishments is only 23% (12.8%+10.6%).

One advantage which the establishment survey data offers, compared to administrative data, is that we can distinguish between separations which are initiated by the establishment, and those which are initiated by the worker. We label separations as employer initiated if the respondent classified them as “Dismissal on the part of the employer”, “Leaving after termination of in-company training” or “Expiration of a temporary employment contract”. All other separations are classified as quits (see Appendix A.1 for a list of all separation categories). The final four columns of Table 2 reports the estimated quit and layoff rates. The ratio of layoffs to quits is very similar to that in the United States, with layoffs being most important in the construction sector. The final column of Table 2 provides the first evidence that lay-off behaviour in German establishments is not very different from the behaviour of U.S. establishments. The ratio of layoffs to destroyed jobs is actually slightly higher in Germany, although the pattern across industries is similar, with construction and services have higher layoff rates.

The measures of hires and separations recorded in the establishment panel are potentially subject to measurement and recall error which may bias down the measured hiring and separation rates, particularly for short-term appointments.¹⁰ In addition, the establishment panel records hires and separations only for the first six months of each calendar year, and may be affected by seasonal patterns of recruit-

¹⁰Anderson & Meyer (1994, p.184) note that a firm-level survey of hires and separations conducted by the Bureau of Labor Statistics is thought to undercount worker turnover.

Table 2: Average annualised job and worker flow rates by industry, location and size. Annualised rates are estimated by doubling actual six-monthly rates. Weighted by sampling weights and employment.

	<i>Number of obs.</i>	<i>Number of estab.</i>	<i>JC rate</i>	<i>JD rate</i>	<i>Hiring rate</i>	<i>Separation rate</i>	<i>Quit rate</i>	<i>Layoff rate</i>	<i>Layoffs per quit</i>	<i>Layoffs per destroyed job</i>
All establishments in IAB panel	151,766	38,368	6.8	4.6	12.8	10.6	6.1	4.5	0.73	0.98
Primary industries	6,140	1,413	8.9	4.8	13.9	9.8	5.4	4.4	0.82	0.92
Manufacturing	49,942	11,300	4.2	4.2	8.1	8.1	4.6	3.4	0.74	0.81
Construction	17,946	4,415	10.9	6.2	16.7	11.9	5.4	6.5	1.22	1.06
Wholesale and retail trade	26,904	6,876	5.0	4.5	10.0	9.5	5.8	3.7	0.63	0.81
Transport and communication	6,576	1,883	7.2	4.0	14.7	11.5	7.3	4.2	0.57	1.03
Financial and business services	21,460	6,116	8.1	4.6	17.7	14.1	8.0	6.1	0.76	1.32
Other services	22,798	6,365	10.4	4.4	19.1	13.1	8.0	5.0	0.62	1.12
West Germany	92,195	24,691	6.3	4.4	12.4	10.5	6.3	4.1	0.66	0.93
East Germany	59,571	13,677	9.3	5.3	15.5	11.4	5.1	6.3	1.25	1.20
1–10 employees	57,886	15,893	9.5	5.6	14.4	10.5	6.1	4.4	0.72	0.79
11–20 employees	19,080	4,659	8.7	4.8	14.6	10.7	6.4	4.3	0.68	0.89
21–30 employees	13,308	3,141	7.6	4.1	13.5	10.1	5.9	4.1	0.70	1.00
31–50 employees	12,728	3,195	7.9	4.1	14.6	10.8	6.1	4.7	0.76	1.14
51–100 employees	14,244	3,645	6.9	3.9	14.4	11.4	6.3	5.0	0.79	1.28
> 100 employees	34,520	7,835	3.7	4.1	10.1	10.5	6.0	4.4	0.74	1.07
Establishments which match to the BS annual data	116,128	31,329	6.7	4.4	12.8	10.5				
BS annual measure	116,128	31,329	4.6	4.5	11.2	11.2				
Establishments which match to the BS spell data	14,471	1,133	5.3	3.9	10.1	8.7				
BS spell measure	14,471	1,133	3.4	3.8	10.7	11.1				

ment and separation.¹¹ Therefore we also use the employment statistics register of the German Federal Agency for Employment to check the robustness of our findings. The *Beschäftigtenstatistik* (henceforth BS) covers all workers or apprentices registered by the social insurance system. Information on workers includes an establishment identification number.¹²

The BS can be used in two ways to construct measures of hires and separations. The first, which we call the *BS annual measure*, selects all workers in the BS who were employed by the establishments in the IAB survey on 30 June each year. Hires and separations can then be calculated by observing changes in establishment identifiers at the worker level.¹³ Because the annual BS measure is based on a comparison between annual observations, it will exclude within-year hires and separations. A worker who joins an establishment after 30 June in year t , and leaves that establishment before 30 June in year $t + 1$ will be excluded from the BS annual measure.

The second measure, which we call the *BS spell measure*, uses data on all spells of employment in a subsample of plants which appear in the IAB survey in every year from 1996 to 2005.¹⁴ These data allow us to compute within-year hires and separations, and also to compare hires and separations in the first and second six months of each year, in case there are seasonal effects which make our survey measure (based only on the first six months of each year) unrepresentative.

The bottom panel of Table 2 reports, for comparison, estimates of job and worker turnover which use the BS annual and spell measures. We also report estimates from the establishment survey for exactly the same sample to ensure comparability. The

¹¹For example, apprenticeship training traditionally starts and ends in August, and so will not be included in the establishment survey measures.

¹²A detailed description of the employment data can be found in Bender, Haas & Klose (2000).

¹³The employment statistics register tracks establishments over time whether or not they are in the IAB establishment panel in that year. Therefore an establishment which joins or leaves the panel will not cause an erroneous jump in hires or separations for that year.

¹⁴These data are the “LIAB longitudinal model 3”, provided by the Research Data Centre (FDZ) of the IAB.

hiring rate from the establishment survey (12.8%) is slightly higher than that from the BS annual measure (11.2%), while the separation rate is slightly lower (10.5% compared to 11.2%). The most likely explanation for this small discrepancy is that the establishment survey measure covers only the first six months of each year. Figure 8 in the Appendix shows that hires are greater in the first six months of each year, and separations are greater in the second six months. As a result, estimates of job creation rates from the establishment survey are slightly higher, and estimates of job destruction slightly lower than from the BS annual measure.

The BS spell measure is only available for a small subset of establishments which appear in the establishment survey every year from 1996–2005. These establishments tend to have lower rates of job and worker turnover because they are larger and more stable. The final two rows of Table 2 compares job and worker turnover rates from the establishment survey and the BS spell measure. The hiring and separation rates from the establishment survey are slightly lower than the corresponding estimates from the BS spell measure, suggesting that there is some under-reporting of hires and separations in the recall survey data, but the differences are not great.

Figures 6 and 7 in the Appendix show that the establishment panel survey and the BS measures are very close in aggregate. However, we note that at the establishment level the measures are not correlated very highly. For this reason we will also check whether our main conclusions are robust to the use of survey or administrative data.

5 The relationship between job and worker flows

In Figure 1 we plot the within-establishment relationship between employment growth (net job flows) and hiring and separation rates. To do this we regress, separately, hiring and separation rates on a set of dummy variables for establishment growth rate bands with width of two percentage points. The regressions include establishment

and year fixed effects.

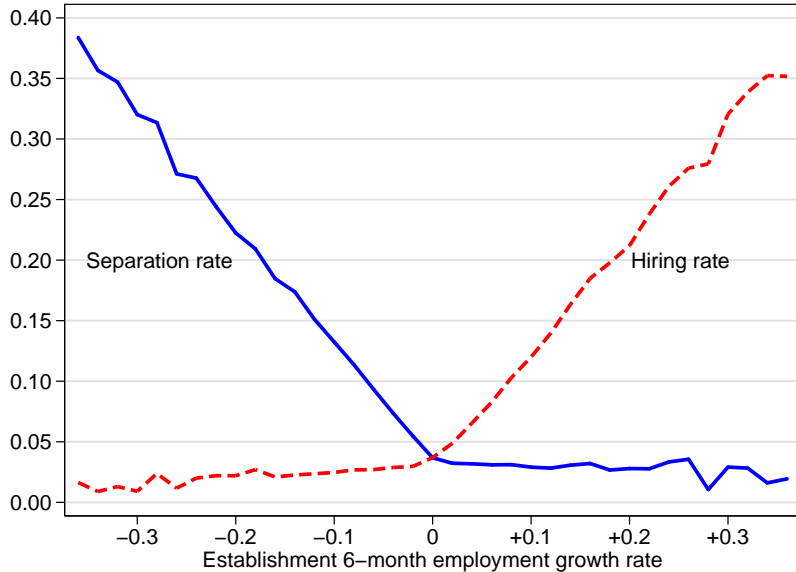


Figure 1: 6-month employment growth, hiring and separations. IAB establishment panel 1993–2009, controlling for establishment and time fixed effects.

Two key points stand out from Figure 1. First, the degree of “churning” in establishments which have no employment change is much lower than estimated for France by Abowd *et al.* (1999, Figure 1). This partly reflects the fact that we are observing flows over a six-month rather than a 12-month period. We would expect that the degree of churning reduces with the length of the reporting period, because establishments will be less likely to both hire and dismiss workers. Nevertheless, the annual churning rate for static establishments in France is over 20%, compared to only 8% in Germany. Second, and even more striking, the relationship between employment changes and worker flows appears very similar to those reported in Davis *et al.* (2006, Figure 6) for the United States, and quite different to those reported by Abowd *et al.* (1999, Figure 1) for France. The separation rate for shrinking establishments mirrors almost exactly the hiring rate for growing establishments.

One possible explanation for the great difference between our findings and those for France is that we are using six-monthly recall data from a survey, rather than

changes in establishment identifiers between two years. We would naturally expect lower churning rates in data recorded between two points closer together, and we might also suspect that recall bias might have an effect. In Figures 2 and 3 we compare the relationship between job and worker turnover from the survey and administrative data.

As expected, Figure 2 shows that there is slightly more churning (hires and separations in excess of employment growth) when measured annually, but the key feature remains: separations increase almost as fast in response to employment falls as do hires in response to employment growth. Figure 3 shows that even when we use the most detailed spell-based measure of hires and separations from the social security data, the separation response is still almost as strong as the hiring response. In short, all three datasets suggest that the relationship between worker turnover and employment growth is very similar in German establishments as in U.S. establishments.

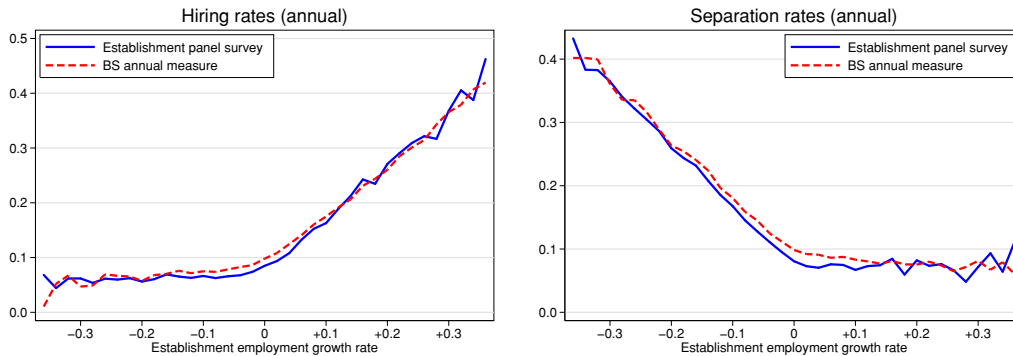


Figure 2: The relationship between (annualised) job flows and worker flows is very similar in both the establishment panel and the BS annual measure.

The almost linear relationship between worker flows and job flows illustrated in Figures 1, 2 and 3 suggest that the following models can be used for examining

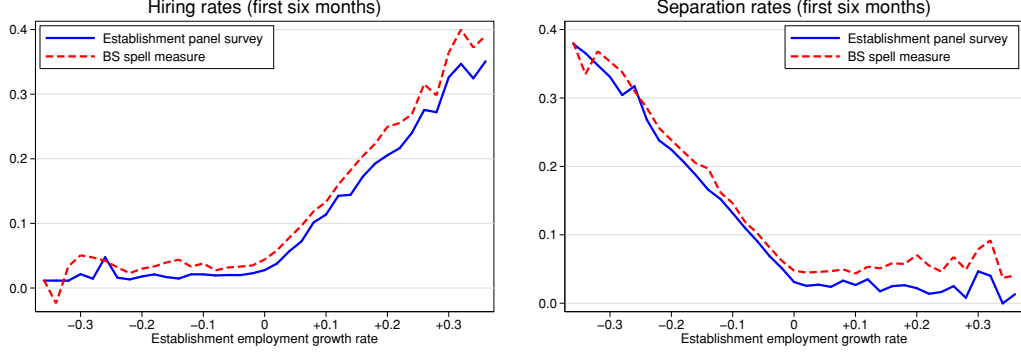


Figure 3: The relationship between job flows and worker flows is very similar in both the establishment panel and the BS spell measure.

adjustment patterns:

$$h_{it} = \alpha^h + \beta^h(\Delta n_{it} \cdot 1(\Delta n_{it} > 0)) + \gamma^h(\Delta n_{it} \cdot 1(\Delta n_{it} < 0)) + a_i^h + b_t^h + \epsilon_{it}^h \quad (1)$$

$$s_{it} = \alpha^s + \beta^s(\Delta n_{it} \cdot 1(\Delta n_{it} > 0)) + \gamma^s(\Delta n_{it} \cdot 1(\Delta n_{it} < 0)) + a_i^s + b_t^s + \epsilon_{it}^s, \quad (2)$$

where $1(\cdot)$ is the indicator function. β^h measures the responsiveness of hirings with respect to employment growth; γ^h measures the responsiveness of hirings with respect to employment falls. β^s and γ^s measure the same response with respect to separations. Because $\Delta n_{it} = h_{it} - s_{it}$ it is unnecessary to estimate both the hiring and separation equation, since $\beta^h - \beta^s = 1$ and $\gamma^h - \gamma^s = 1$. The constant in this model ($\alpha^h = \alpha^s$) is an estimate of the hiring rate (= separation rate) when establishment employment is stable over a six-month period. Both models include establishment and time fixed-effects, a_i and b_t which can either be estimated or removed by demeaning in the usual way. The inclusion of establishment fixed effects means that the estimates of β and γ are based on *within-establishment* changes in job- and worker-turnover rates.

If establishments reduced employment entirely along the hiring margin rather than the separation margin, then we would find $\gamma^h = 1$, which implies $\gamma^s = 0$. Figure 1, however, suggests that $\gamma^s < 0$ and there is a clear role for separations in declining establishments. If there was complete symmetry in the response of hiring

and separation to employment change, then we would find $\beta^h = -\gamma^s$, and therefore by construction $\beta^s = -\gamma^h$.

Equations (1) and (2) are only descriptive; they do not attempt to identify causal relationships between job-turnover and worker-turnover. For example, it seems possible that worker separation, at least in the short-run could cause changes in employment. In our robustness checks we will examine this by instrumenting Δn_{it} . Nevertheless, this simple model allows us to examine and test in a parsimonious way whether the margin of employment adjustment varies systematically between different types of establishment and different time periods.

Row (1) of Table 3 reports our estimates of Equations (1) and (2) for the sample of establishments with employment growth in the range $(-0.19, +0.19)$, which covers over 90% of the total sample. The basic results can be summarised as follows: if an establishment shrinks by 10% in a six-month period, it achieves this by increasing separations by 9% and reducing hires by 1%. If an establishment grows by 10% in a six-month period, it achieves this by increasing hires by 9.6% and reducing separations by 0.4%. β^h is significantly larger than $-\gamma^s$ (p -value < 0.0005 reported in the final column), which means that establishments do adjust more on the hiring margin than on the separation margin. However, γ^s is still large and highly significant, confirming that (as shown in Figure 1), separations are by far the most important margin used by shrinking establishments.

As noted, the constant is an estimate of the hiring rate (= separation rate) when employment is stable over a six-month period. This estimate is far smaller than observed in the French data used by Abowd *et al.* (1999), even after taking into account the fact that the observation period is six rather than 12 months. This suggests that “churning” of workers is low in German establishments (as do Alda *et al.* (2005), relative to Dutch firms), which itself explains why the hiring margin cannot be used when establishments shrink. If establishments are only hiring at 3.3% when they have stable employment, only very small falls in employment can

Table 3: Estimates of Equations (1) and (2) with establishment and year fixed-effects. Standard errors in parentheses are clustered at the establishment level. Job flows and worker flows are measured over the first six months of each calendar year, with the exception of the annual measures reported in rows (3) and (4). The 2SLS estimates use establishment investment in the previous calendar year to instrument for Δn_{it} in the first six months of the current year.

	β^h	γ^s	$\alpha^h = \alpha^s$	N	R^2	$\beta^h = -\gamma^s$ p -value
(1) Sample with $-0.19 \leq \Delta n_{it} \leq 0.19$	0.962 (0.008)	-0.902 (0.006)	0.033 (0.001)	136,805	0.65	[0.000]
(2) All establishments	1.014 (0.034)	-0.948 (0.024)	0.033 (0.002)	151,766	0.84	[0.077]
(3) Establishments which match the BS annual data	0.952 (0.013)	-0.844 (0.011)	0.064 (0.003)	93,324	0.64	[0.000]
(4) BS annual measure	0.878 (0.009)	-0.805 (0.007)	0.094 (0.002)	96,728	0.75	[0.000]
(5) Establishments which match the BS spell data	0.978 (0.019)	-0.925 (0.015)	0.028 (0.003)	13,498	0.55	[0.014]
(6) BS spell measure	1.093 (0.020)	-0.931 (0.019)	0.041 (0.003)	13,177	0.57	[0.000]
(7) Weighted by sampling weights	0.941 (0.014)	-0.916 (0.015)	0.034 (0.003)	136,805	0.60	[0.172]
(8) 2SLS	0.973 (0.010)	-0.847 (0.010)	0.035 (0.001)	131,579	0.65	[0.000]

be accommodated by falls in hiring.

In the rest of Table 3 we examine the robustness of our key result in a number of ways. In row (2) we increase the sample to include establishments with very high values for employment change. Doing so increases the estimates for both β^h and γ^s , but does not significantly alter our conclusion.¹⁵

In row (4) we estimate the same model using the BS annual measure. For comparison, row (3) reports comparable estimates from the establishment survey. Using the BS annual measure leads to significantly higher estimates of churning when $\Delta n_{it} = 0$ ($\alpha^h = \alpha^s = 0.094$), and estimates of γ^s are slightly lower using the BS annual measure. Nevertheless, using this measure does not alter our main conclusion that the increase in separations accounts for the majority of falls in employment in shrinking establishments. In row (6) we estimate the same model using the BS spell measure, and row (5) reports comparable estimates from the establishment survey. Estimates of β^h and γ^s are even higher using the BS spell measure. Thus, all three measures (survey data, annual administrative data and spell-based administrative data) lead us to conclude that when German establishments shrink, this is accompanied by a near one-for-one increase in separations, rather than a fall in hires.

In row (7) we use the cross-section weights which ensure that the distribution of employment in the establishment survey is representative of the distribution of employment in the population as a whole. As noted in Section 4, the survey is heavily weighted towards large establishments. If the separation response γ^s varies across establishment size, then weighting will make a difference. In fact, row (7) shows that weighting makes little difference to our results, and in this case we cannot reject complete symmetry in the hiring and separation response ($\beta^h = \gamma^s$).

Finally in row (8), we examine the extent to which the very strong relationship between worker flows and job flows is the result of reverse causality. It seems possible

¹⁵We investigate possible non-linearities in more detail in Table 4.

that, over a short period of time, a worker’s decision to leave or join the establishment will affect employment growth, rather than *vice versa*. To test this we instrument Δn_{it} with a measure of investment by the establishment in the previous calendar year. For this to be a valid instrument, we require that investment in the previous calendar year is correlated with employment growth over the first six months of the current year, but not directly correlated with workers’ decisions to join or leave the establishment. Instrumenting Δn_{it} has little effect on the hiring response but does cause the separation response to fall slightly. Nevertheless, the key result remains.

These results are robust to the relaxation of linearity. In Table 4 we report results from a model which allows β^h and γ^s to vary across narrower ranges of employment growth. Although we reject the hypothesis that β^h and γ^s are equal across the whole range, relaxing this assumption does not greatly change our conclusions. The hiring response (β^h) becomes larger as employment growth increases, presumably because reductions in the separation rate cannot be used to cope with large increases in employment. However, the relationship between separations and employment decline is less straightforward. γ^s is smallest for small employment falls, but is still over -0.9 . Thus, even quite small falls in employment are associated with significant increases in the separation rate.

Table 4: Estimates of Equations (1) and (2), allowing for β^h and γ^s to vary across narrower ranges of employment growth.

	β^h	γ^s
$0 < n_{it} \leq 0.05$	0.835 (0.022)	-0.905 (0.015)
$0.05 < n_{it} \leq 0.1$	0.847 (0.015)	-0.979 (0.012)
$0.1 < n_{it} \leq 0.15$	0.887 (0.017)	-0.967 (0.013)
$0.15 < n_{it} \leq 0.19$	0.955 (0.012)	-0.928 (0.010)
Adjustment equal p -value	[0.000]	[0.001]
N	136,805	
R^2	0.68	

5.1 Variation across establishment characteristics

We now consider whether the hiring and separation response varies systematically across different types of establishment in terms of their industry, size, location and in relation to the business cycle. The top panel of Table 5 estimates (1) and (2) separately by industry. Since industries differ greatly in their technology and skill requirements, we might expect to observe different responses to changing labour demand. In fact, the estimates of β^h and γ^s are very stable across industries. The separation response is smallest in Transport and Communication, Manufacturing and Other Services, but we cannot reject the hypothesis that γ^s is equal across sectors. There is slightly more variability in the hiring response across industries (p -value=0.077). Thus, although industries vary significantly in terms of their average worker turnover rates, this does not seem to be caused by a different response to a given change in employment. For example, the construction sector has an average separation rate nearly 50% higher than the manufacturing sector (see Table 2). However, the difference in γ^s between these sectors reported in Table 5 is small and insignificantly different from zero.

In the second panel of Table 5 we compare the adjustment path between establishments of different sizes. Here, a fairly clear pattern emerges: β^h increases with establishment size, while γ^s decreases with establishment size. The differences across size groups are highly significant. This means that larger establishments rely more on variation in hiring to adjust to changes in labour demand. But the difference between the largest and smallest establishment sizes is still quite small, and in no size category do we find that separations are unimportant. This result seems to contrast with the findings of Centeno *et al.* (2009, Table 4), who find a much smaller separation response for large firms.¹⁶

¹⁶We can only speculate why there is this apparent difference between large and small firms in Portugal, but not in Germany. It might reflect institutional differences in the treatment of large and small firms between the two countries, although our examination of the within-country effect of institutions (see 5.3 below) does not find much role for institutions in explaining differences in the separation response. It is striking that the overall relationship between worker turnover and job

Table 5: Estimates of Equations (1) and (2) separately by industry, establishment size, location and time periods. Standard errors in parentheses are clustered at the establishment level. Job flows and worker flows are measured over the first six months of each calendar year.

	β^h	γ^s	Constant	N	R^2	$\beta^h = -\gamma^s$ p -value
Primary industries (Agriculture, mining)	0.963 (0.041)	-0.945 (0.043)	0.030 (0.004)	5,331	0.68	[0.745]
Manufacturing	0.995 (0.012)	-0.897 (0.009)	0.022 (0.001)	46,771	0.63	[0.000]
Construction	0.928 (0.023)	-0.912 (0.018)	0.048 (0.006)	15,088	0.63	[0.553]
Wholesale and retail trade	0.954 (0.016)	-0.909 (0.013)	0.033 (0.003)	24,773	0.57	[0.013]
Transport and communication	0.935 (0.037)	-0.857 (0.032)	0.045 (0.009)	5,916	0.63	[0.054]
Financial and business services	0.977 (0.023)	-0.929 (0.018)	0.040 (0.004)	18,872	0.77	[0.065]
Other services	0.928 (0.022)	-0.874 (0.020)	0.043 (0.007)	20,054	0.61	[0.040]
p -value H_0 : Adjustment equal	[0.077]	[0.229]				
0–10 employees	0.944 (0.013)	-0.923 (0.012)	0.035 (0.005)	48,814	0.57	[0.210]
11–20 employees	0.944 (0.020)	-0.906 (0.013)	0.033 (0.005)	17,173	0.63	[0.049]
21–30 employees	0.929 (0.021)	-0.924 (0.019)	0.038 (0.004)	12,357	0.65	[0.844]
31–50 employees	0.950 (0.025)	-0.906 (0.020)	0.047 (0.005)	11,863	0.72	[0.108]
51–100 employees	0.969 (0.024)	-0.873 (0.021)	0.040 (0.004)	13,387	0.79	[0.001]
> 100 employees	1.051 (0.019)	-0.869 (0.011)	0.031 (0.001)	33,211	0.80	[0.000]
p -value H_0 : Adjustment equal	[0.000]	[0.000]				
West Germany	0.969 (0.010)	-0.888 (0.008)	0.034 (0.001)	84,701	0.68	[0.000]
East Germany	0.954 (0.013)	-0.922 (0.010)	0.037 (0.011)	52,104	0.62	[0.022]
p -value H_0 : Adjustment equal	[0.314]	[0.010]				
1993–1995	0.935 (0.038)	-0.868 (0.028)	0.031 (0.001)	8,397	0.77	[0.095]
1996–1999	0.966 (0.024)	-0.881 (0.021)	0.032 (0.001)	22,721	0.76	[0.003]
2000–2002	0.959 (0.022)	-0.868 (0.018)	0.029 (0.001)	30,060	0.79	[0.000]
2003–2006	0.948 (0.016)	-0.928 (0.013)	0.022 (0.001)	42,850	0.76	[0.300]
2007–2009	0.921 (0.027)	-0.889 (0.020)	0.023 (0.001)	32,777	0.77	[0.266]
p -value H_0 : Adjustment equal	[0.407]	[0.031]				

In the third panel of Table 5 we compare β^h and γ^s between establishments located in West and East Germany.¹⁷ Establishments in West Germany have a significantly smaller separation response, but the size of the difference is small. There is no significant difference in the hiring response.

The final panel of Table 5 compares the adjustment path across the business cycle, using sub-periods based on the aggregate unemployment rate (see Figure 9 in the Appendix). An establishment which is expanding in a tight labour market may find it harder to hire; thus we would expect β^h to be counter-cyclical. Differences over the business cycle may also reflect a compositional effect. Establishments which are shrinking in a boom (or growing in a recession) are atypical, and may behave differently to those which are more typical. However, estimates of β^h are extremely stable over the sub-periods, and we cannot reject the hypothesis that they are equal ($p=0.71$). Estimate of γ^s are slightly more variable (we reject equality with $p = 0.03$), but all lie in the range (-0.87,-0.93).

Overall, our results clearly indicate that German establishments rely almost as heavily on the separation margin as they do on the hiring margin. The majority of any employment reduction is accommodated by increased separations, and this result is robust across establishment industry, location, size and time.

5.2 Quits and layoffs

Our results thus far would seem to contradict the conventional wisdom that European firms are restricted in their use of separations to adjust labour demand. One possible explanation is that establishments are allowing quits rather than layoffs to accommodate falls in employment. In Figure 4 we plot the relationship between employment change and separations separated between voluntary and involuntary separations, as defined in Section 4.

turnover in Portugal (Centeno *et al.* 2009, Figure 1) is very similar to that in Germany.

¹⁷Establishments in West Berlin are included in the East German sample for consistency over time.

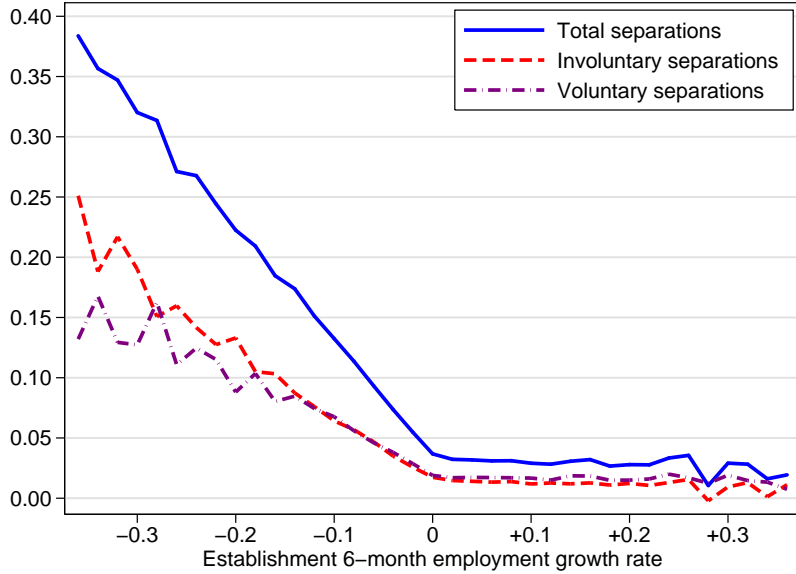


Figure 4: Relationship between voluntary and involuntary separations and job flows

The relationship between layoffs and employment change is stronger for shrinking establishments, but this is only the case for establishments which shrink by more than about 15% over the 6-month period. For establishments with positive employment change, quits are a larger proportion of total separations than layoffs. These patterns are extremely similar to those observed by Davis *et al.* (2006, Figure 7). We can also estimate Equation (2) separately for layoffs and quits to estimate the relationship parametrically, shown in Table 6.

Table 6: Estimates of Equation (2) separately by cause of separation. Employer initiated separations are causes 2,3,4 and employee initiated are causes 1,5–10 shown in Appendix A.1.

	γ^s	β^s	Constant	N	R^2
Layoffs (employer initiated)	-0.470 (0.008)	-0.015 (0.006)	0.012 (0.001)	136,805	0.57
Quits (employee initiated)	-0.440 (0.008)	-0.022 (0.005)	0.021 (0.001)	136,805	0.50

In establishments with static employment there are nearly twice as many voluntary as involuntary separations: the quit rate in static establishments is 2.1%

compared to a layoff rate of 1.2%. If quits were unrelated to establishments' job flow rates then we would expect that $\gamma^s = 0$, but this is far from the case. Although the layoff response is larger than the quit response, both are highly significant. When establishments shrink, they achieve only slightly more of the employment reduction by layoffs than by quits. A firm which shrinks by 10 workers will lay off $4.7 + 0.12 = 4.8$ and another $0.43 + 0.21 = 4.5$ workers will quit.

How should we interpret this finding? One possibility is that many separations which are recorded as quits are actually layoffs. For example, cause 5 (“termination by mutual agreement” – see Appendix A.1) might in fact be better thought of as a layoff. A second possibility is that the direction of causality is reversed, as discussed earlier. A third possibility is that employment reductions are managed by “voluntary redundancy” or that workers choose to leave shrinking establishments because shrinking establishments offer worse opportunities.¹⁸ If this was the case, then quits, or voluntary redundancies, are another margin which firms can use to meet reduced labour demand. These distinctions matter, because unemployment outflow rates vary significantly between workers who quit and those who are laid-off.¹⁹

5.3 Variation across labour market institutions

As noted earlier, it has been claimed that different countries have different adjustment responses because of institutional and legal differences between them. Firms in the US are able to lay-off workers more easily than firms in France, for example. But it is difficult to make precise comparisons across countries because there are so many other possible differences, not least in terms of data comparability.

The fact that we have survey data on establishments means that we have a detailed set of establishment-level characteristics which can be used to examine whether

¹⁸Davis *et al.* (2011) call this the “abandon-ship” effect; the model of Faberman (2008) predicts that workers at less successful firms are more likely to quit.

¹⁹See Davis *et al.* (2006, p.14).

the adjustment mechanism varies systematically across establishment types. In Table 7 we focus only on involuntary separations, and examine how γ^s and β^s vary across different types of establishment which we might expect would vary in the relative costs of hiring and separation. The characteristics we examine are all expected to be correlated with hiring and firing costs for the establishment:

1. The bargaining arrangements in place. Establishments are asked whether negotiations over wages are bound by (a) an industry-wide agreement; (b) a company-level agreement; (c) no collective agreement.
2. Whether the establishment has a works council (*Betriebsrat*). Addison, Bellmann & Kölling (2004) note that works councils are often the main form of worker representation in Germany, and that they have consent rights on “engagement, ... and individual dismissals ... or collective layoffs.” (p.128). It seems plausible that works councils increase firing costs, and so weaken the separation response to employment falls.
3. The proportion of part-time and female workers in the establishment.²⁰ If these workers have weaker employment protection then establishments with a higher proportion of them may have a higher separation response.
4. The proportion of fixed-term workers in the establishment (not including trainees). The predicted effect on separation response will be positive if establishments with more fixed-term workers face lower separation costs. However, these establishments may also have higher rates of worker turnover when employment growth is small, and so may be able to use this to reduce hires when employment growth is negative.
5. The proportion of freelance and agency workers in the establishment. We expect that an establishment with a greater proportion of external workers

²⁰The definition of “part-time” is not made explicit in the questionnaire.

will have *lower* separation rates for a given fall in employment, because they can use these external workers as a buffer to protect permanent employees.

6. The proportion of skilled workers in the establishment.²¹ Establishments with a greater proportion of skilled workers are expected to have higher hiring and firing costs. So we predict that a fall in employment in a skill intensive establishment would have a smaller increase in separations and a larger decrease in hiring.

We estimate Equation (2) for involuntary separations with interaction terms between the linear spline in job flow rates and the particular characteristic. The coefficient on that interaction term tells us whether establishments with that characteristic have significantly different adjustment responses. A positive coefficient on γ^s means that the separation response is smaller (less negative); establishments therefore rely less on separations when they shrink. To illustrate this, in Figure 5 we plot the implied separation response for establishments with no formal bargaining agreement and those which have local bargaining agreements. Establishments with firm-level bargaining agreements have significantly less separations for a given level of employment reduction, but the difference is small.

Most of the estimated changes in γ^s shown in Table 5 are small, and in some cases are also statistically insignificant. Establishments with more skilled workers than average, for example, do *not* have a smaller separation response to employment declines. The largest difference in γ^s comes from establishments with more agency, part-time and female workers than the median (smaller separation response) and from establishments with more fixed term workers (larger separation response). The latter result is unsurprising, since our definition of involuntary separations includes the end of fixed-term contracts. One initially surprising finding is that establishments with a greater proportion of agency workers have a *smaller* separation response

²¹Skilled workers are defined as workers in jobs which require a vocational qualification, university degree or higher.

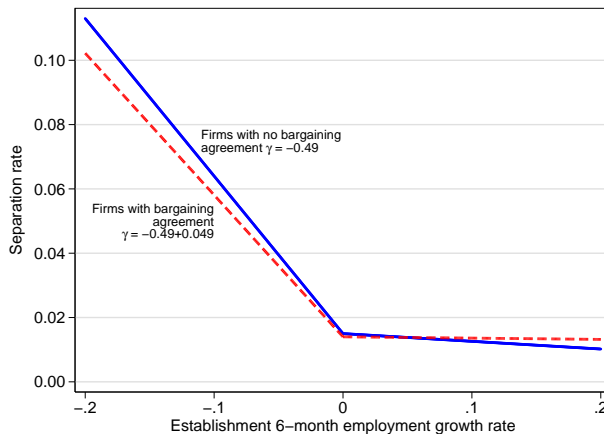


Figure 5: Establishments with firm-level bargaining agreements have a significantly flatter involuntary separation adjustment path, but the effect is quantitatively small

($\hat{\gamma}^s = 0.072$ (0.027)). We assume this arises because respondents only include their own employees in the count of separations, and so this suggests that employing agency workers reduces separations for the establishment's own employees.

6 Conclusions

In this paper we use survey and administrative data to examine the relationship between employment growth and worker flows at the establishment level. This relationship is potentially a key explanation for differences in unemployment responses to aggregate shocks.

Our first finding confirms the received wisdom that hires and separations are much lower in Germany than in the US. This finding is not the result of using recall data from a survey, since we get very similar estimates from administrative data. Our second finding is more surprising. The relationship between employment growth, hires and separations is remarkably similar to that found in the US. Establishments which grow increase hirings almost one-for-one with increased employment, and establishments which shrink increase separations almost one-for-one with reduced

Table 7: Variation in adjustment by plant-level characteristics. Estimates of Equation (2), involuntary separations only. The estimated coefficients represent the *change* in the hiring and separation response for establishments with and without that characteristic.

	Change in β^s	Change in γ^s	Change in Constant
Firm-level bargaining agreement	0.020* (0.012)	0.049** (0.017)	-0.001 (0.001)
Sectoral bargaining agreement	0.020 (0.022)	0.002 (0.029)	-0.002* (0.001)
Works council	0.038** (0.011)	0.030* (0.015)	-0.003*** (0.001)
Prop. part-time workers > median	0.005 (0.011)	0.057*** (0.015)	0.002*** (0.001)
Prop. female workers > median	0.017 (0.011)	0.059*** (0.016)	0.001 (0.001)
Prop. fixed-term workers > median	-0.012 (0.011)	-0.047*** (0.017)	0.005*** (0.001)
Prop. freelance workers > median	0.000 (0.013)	0.005 (0.018)	0.001 (0.001)
Prop. agency workers > median	0.019 (0.015)	0.072*** (0.027)	0.000 (0.001)
Prop. skilled workers > median	-0.023** (0.011)	0.001 (0.015)	-0.001 (0.001)

***, **, * Significantly different from base group at < 1%, < 5%, < 10%.

employment. The hiring margin is slightly more important than the separation margin, but the difference is much smaller than that found for France. One reason for this appears to be the low level of churning exhibited by establishments with small values of employment growth.

Our data allow us to distinguish quits from layoffs, and we again find very similar patterns of behaviour as from US data. Small employment falls are accommodated by almost equal increases in quits and layoffs, while larger employment falls cause greater increases in layoffs.

We find that a simple linear spline parameterises the relationship quite well, and allows us to test more formally the stability of the relationship over time and across different types of establishment. The employment growth-worker turnover relationship is very stable across the business cycle, across plant location and across plant size. Differences in establishment-level characteristics and policies which might be expected to lower the separation response have only a small impact.

It is important to realise that our findings are not inconsistent with the view that recessions in Europe are characterised by an acyclicity in unemployment inflows compared to the US. The cyclicity of unemployment inflows (or layoffs) also depends on the position and movement of the cross-sectional distribution of employment growth (Davis *et al.* 2006). If the mass of the employment growth distribution remains positive, weak business cycles can still cause large fluctuations in hiring rates but not in separation rates, because it is the hiring rate which matters in this part of the distribution.

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A Appendices

A.1 Questions used in the IAB establishment panel on worker turnover

The following questions are used to determine hires and separations:

1. Did you recruit staff in the first half of <current year>?
2. Please indicate the total number of workers recruited.
3. Did you register any staff leaving your establishment/office in the first half of <current year>?
4. Please indicate the total number of workers who left your establishment.

Respondents are also asked to distribute the total number of employees who left among the following categories:

1. Resignation on the part of the employee
2. Dismissal on the part of the employer
3. Leaving after termination of the in-company training
4. Expiration of a temporary employment contract
5. Termination of a contract by mutual agreement
6. Transfer to another establishment within the organization
7. Retirement after reaching the stipulated pension age
8. Retirement before reaching the stipulated pensionable age
9. Occupational invalidity/ disability
10. Other

A.2 Additional tables and figures

Table 8: The number of establishments, average size and other key characteristics changes over the sample period, mainly due to the inclusion of additional establishments in the sample. Establishments in East Germany joined the sample in 1996.

	Total no. of estab- lishments	West Germany	East Germany ^a	Average emp- loyment	Hires ^b		Separations ^b	
					Av. no.	%	Av. no.	%
1993	2,913	2,844	69	532	11	2.0	30	5.7
1994	3,010	2,934	76	461	13	2.8	24	5.2
1995	3,062	2,989	73	418	16	3.8	19	4.6
1996	5,796	2,944	2,852	257	8	3.0	14	5.4
1997	6,280	2,900	3,380	214	7	3.1	11	5.1
1998	6,580	2,946	3,634	199	9	4.7	8	4.2
1999	6,986	2,956	4,030	175	8	4.4	10	5.6
2000	10,407	6,096	4,311	138	7	5.0	7	5.2
2001	11,597	7,060	4,537	134	7	5.5	7	5.3
2002	11,405	7,201	4,204	128	5	4.3	6	5.0
2003	11,976	7,350	4,626	114	4	3.8	6	4.8
2004	11,843	7,325	4,518	126	4	3.4	5	4.0
2005	12,004	7,381	4,623	127	4	3.5	5	4.1
2006	11,736	7,172	4,564	120	5	4.0	5	3.9
2007	12,087	7,453	4,634	109	5	4.7	4	4.0
2008	11,987	7,251	4,736	106	6	5.5	5	4.3
2009	12,097	7,393	4,704	101	3	3.4	5	4.9

^a Includes West Berlin.

^b Hires and separations for the first six months of the calendar year.

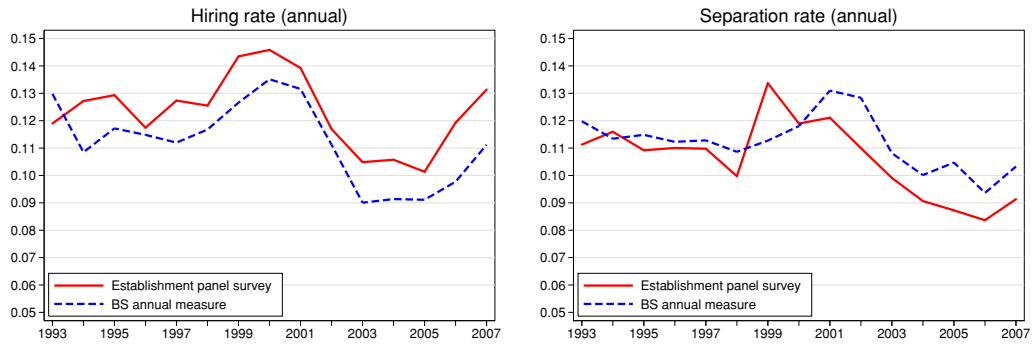


Figure 6: Hiring (left-hand panel) and separation rates (right-hand panel) are similar in the establishment panel survey and the BS annual measure. The higher estimates of hiring and the lower estimates of separations from the establishment panel may be caused by the seasonal pattern of hiring (see Figure 8). Hiring and separation rates from the establishment panel are scaled by two to get annual equivalent rates. At the establishment level, the correlation of hiring rates is 0.24 and the correlation of separation rates is 0.18.

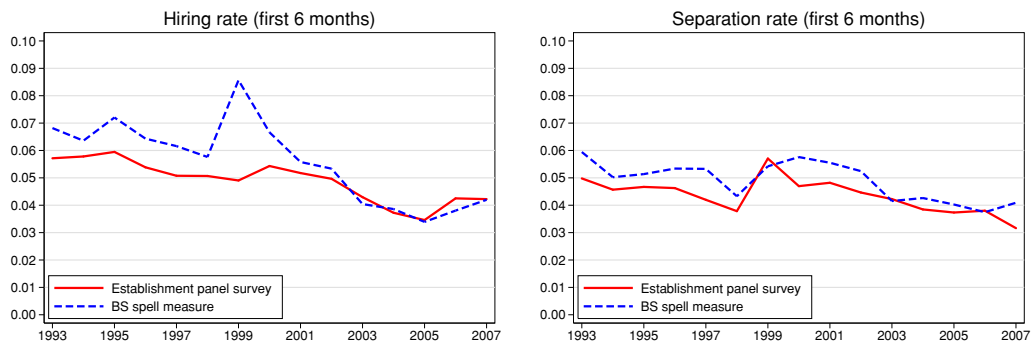


Figure 7: Six-monthly hiring and separation rates are similar in the establishment panel survey and the BS spell measure. The apparent downward trend in both series is the result of using a much smaller balanced panel of establishments. At the establishment level, the correlation of hiring rates is 0.41 and the correlation of separation rates is 0.48.

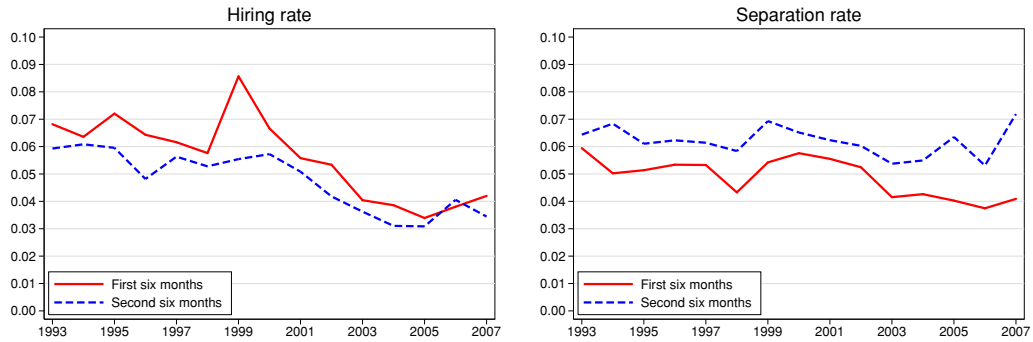


Figure 8: Comparison of hiring and separation rates from January-June and July-December in each year, from BS spell data. Hirings tend to be concentrated in the first six months; separations in the second six months. This implies that our estimates from the establishment panel survey will overstate hirings and understate separations somewhat.

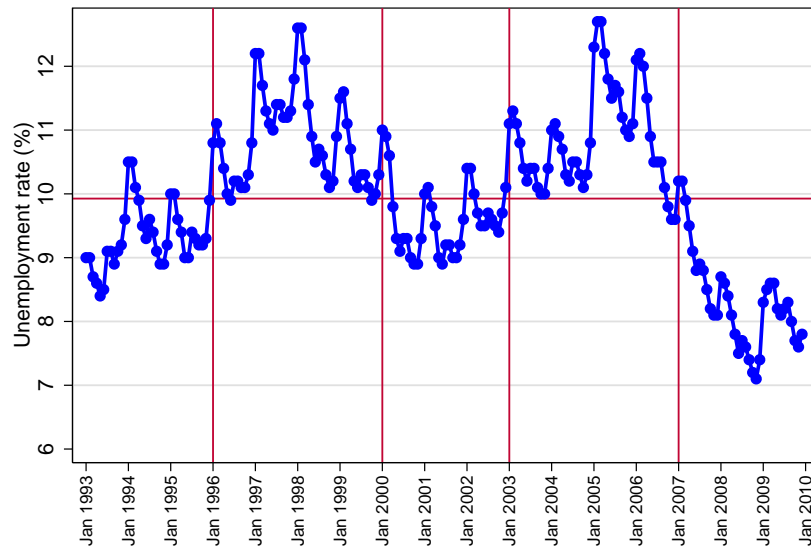


Figure 9: German monthly unemployment rate 1993-2009. Source: *Bundesagentur für Arbeit*. The sub-periods used to estimate Equations (1) and (2) in the last panel of Table 5 are indicated by vertical lines.