Job and worker turnover in German establishments[*]

Lutz Bellmann

Institut für Arbeitsmarkt- und Berufsforschung

Friedrich-Alexander Universität Erlangen-Nürnberg

Hans-Dieter Gerner

Institut für Arbeitsmarkt- und Berufsforschung

Richard Upward

University of Nottingham

February 28, 2011

Abstract

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), 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.

Key words: Job turnover, worker turnover, hirings and separations.

JEL codes: J2, J23, J63, D22

---

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 that 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 cyclicality of unemployment inflows, which has been the subject of some empirical debate. Darby, Haltiwanger & Plant (1986) claimed 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, Shimer (2007) and Hall (2005) found that unemployment inflows were relatively acyclical, and that the increase in the stock of unemployment in a recession was mainly due to a decline in the unemployment outflow rate. Elsby, 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 US. If the received wisdom on firm adjustment is correct, we would expect to find even less cyclicality 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 2 we summarise a number of studies from around the world which compute hiring and separation rates at the firm level. For the US, Burgess, Lane & Stevens (2001, p.11) find that "employment falls are on average accomplished by raising separations, rather than reducing hiring." This is confirmed by Davis *et al.* (2006, p.17) who show that "separations increase roughly one-for-one with job loss at contracting establishments." 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.

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 US establishments described in Burgess *et al.* (2001) and Davis *et al.* (2006). 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. We are also able to investigate whether policies used extensively during the most recent economic crisis, such as working time accounts and short-time work, have an effect on the adjustment response of German establishments.

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 US, 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 almost identical 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.

The rest of the paper is structured as follows. In Section 2 we describe other studies from various countries which have looked at job and worker turnover rates. Only a small fraction of these studies have examined the relationship between employment growth and worker turnover. In Section 3 we describe the data sources and the key definitions of job and worker turnover. Section 4 presents our key descriptive evidence. Section 5 proposes a simple regression-based approach for examining how the relationship varies across time and across establishments. Section 6 concludes.

2 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.[1] 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.[2] For the US, total worker flow rates vary from 75% to almost 200% of employment per year. In contrast, estimates from other countries vary from 22% (Netherlands), 32% (Germany), 59% (France), 55% (Taiwan), and 47%–68% in Scandinavia and Finland. We note that these estimates for European countries, from linked worker-firm data, 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.

However, the key point of this article is to establish whether the relationship between employment growth and worker turnover rates is very different in Germany. For example, 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.

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 the hiring of one worker and separations of two. Because of this, they suggest that the relationship between employment growth and hiring is much stronger than the relationship with firing.

For the US, Burgess *et al.* (2001) use quarterly data from Maryland and show that,

---

[1]There 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.

[2]Note 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.

Table 1: A comparison of hiring and separation rates from the literature

Study	Country	Sectors	Time period	Sample	Time interval	Job creation	Job destruction	Hiring	Separation
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 *et al.* (1996)	Netherlands	All sectors	1988, 1990	Firm-level survey, 2204 firms	Annual	4.4%	2.6%	11.9%	10.1%
Lane *et al.* (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 *et al.* (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 *et al.* (1999)	US (Maryland)	Manufacturing	1985–1994	Employers with at least 5 employees; spells lasting at least one quarter	Quarterly			19.4%[a]	
Belzil (2000)	Denmark	All sectors	1981–1991	Sample of employees within plants with 5 to 500 primary employees	Annual			68.0%[a]	
Tsou *et al.* (2001)	Taiwan	All sectors	1987–1997	Establishment survey	Annual	6.0%	9.7%	28.6%	26.3%
Ilmakunnas & 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	7.9%	12.1%	13.6%	18.6%
Davis *et al.* (2006)	US	All sectors	2000–2005	Sample of 16,000 establishments (JOLTS)	Quarterly	3.4%	3.1%	9.5%	9.2%
Davis *et al.* (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%
Gartell *et al.* (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%

[a] Hires + separations.

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

The only 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 3), but only for the period 1993–1996. 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. They find, contrary to other evidence, that worker flow rates are *not* negatively related to the level of worker dismissal protection.

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 council in Germany.

3   Data sources and measurement issues

3.1   Measurement concepts

The basic concepts are explained by, amongst others, Hamermesh *et al.* (1996), Abowd *et al.* (1999) and Burgess *et al.* (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.[3] 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,

---

[3]We ignore the distinction between part-time and full-time jobs in this section.

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 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 $H_{it} = 5$, $S_{it} = 6$. We now have an additional 10 worker movements which (under our simplifying assumptions) were unnecessary to achieve the change in labour demand. This excess worker reallocation rate 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 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.

As is standard in the literature, we calculate the six-monthly separation and hiring

rates by dividing by average employment between t and $t-1$:[4]

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

The net job flow rate (which equals the net worker flow rate) is then $n_{it} = h_{it} - s_{it}$. 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.

3.2 Data sources

The *Institut für Arbeitsmarkt- und Berufsforschung (IAB) Establishment Panel* is an annual survey of between approximately 4,000 and 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 approximately 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, bargaining arrangements, total sales, exports, investment, wage bill, location, and industry.

Although the IAB panel is a survey of establishments, it does provide a measure of the total number of workers who were recruited and who left the establishment in the first half 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. An important advantage of the information on separations in this data is that respondents are also asked for the *cause* of the separation.[6]

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, including the most recent crisis. In total, 48,838 establishments (202,957

---

[4]Strictly speaking, one should divide by average employment between t and $t-6$ months; this makes almost no difference to our estimates.

[5]Weights 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).

[6]See Appendix A for a precise description of the relevant questions.

establishment-years) appear in the survey. We restrict the sample to those establishments in the private sector.[7] 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).[8] We also check the difference between the 12 month change in employment 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. Again, these values tend to be 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. In particular, 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. It is therefore important to consider the sample weights, and to focus on within-establishment changes which control for any changes in sample composition. Table 2 shows that the average size of establishments in the sample fell after the introduction of East German establishments in 1996, but 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

---

[7]Establishments 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. This does mean that a very few establishments in the sample change from being recorded as "private" to "public" over the sample period.

[8]In theory, this could occur if a firm hires workers in the second half of $t-1$ and they then leave the firm in the first half of t, but since we have no measure of employment on 1st January each year, we ignore this possibility.

10% and 7%, with no obvious trend.

Table 2: The number of establishments, average size and other key characteristics changes over the sample period

	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.

The measures of hires and separations recorded in the establishment panel provides consistent measures of worker turnover over a long period of time which includes the most recent economic downturn. It seems possible, however, that the establishment survey undercounts worker turnover. Therefore in addition, we also use an alternative source of information on hires and separations to check the robustness of our findings.[9] The employment statistics register of the German Federal Agency for Employment (*Beschäftigungstatistik*, henceforth BS) covers all workers or apprentices registered by the social insurance system. Information on workers includes a establishment identification number.[10] We select all workers in the employment register who were employed by the surveyed plants on 30 June each year. Hires and separations can then be calculated by observing changes in establishment identifiers at the worker level.[11]

There are a number of differences between our two measures of worker turnover.

---

[9] Anderson & 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.

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

[11] The employment statistics register tracks establishments over time whether or not they are in the *Betriebspanel* in that year. Therefore an establishment which joins or leaves the *Betriebspanel* will not cause an erroneous jump in hires or separations for that year.

First, the social security measure of hirings and separations include only workers covered by the social insurance system. But almost all workers in the private sector are registered with the social insurance system, and because our sample is restricted to the private sector, the data we use covers the great majority of workers.[12] Second, the social security measure is based on a comparison between annual observations, and so 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 measure. For these reasons we would expect the survey data to provide a more complete picture of worker turnover. On the other hand, the survey data is potentially subject to measurement error and recall bias which may bias down the measured hiring and separation rates for short-term appointments. Finally, the survey data relates only to the first six months of each calendar year (see Appendix A), and may be affected by seasonal patterns of recruitment and separation.[13]

4   Descriptive evidence

4.1   Patterns of job and worker flows 1993–2009

Table 3 summarises job and worker turnover rates across different establishments, and can be compared with Davis *et al.* (2006, Table 2). Job turnover is highest in construction and other service industries, and lowest in manufacturing. Job turnover declines sharply with initial establishment size. Worker turnover appears to be significantly lower than in the US. Davis *et al.* (2006) report *monthly* worker turnover rates of 6.3%, implying a six-monthly rate of over 37%. The overall six-monthly rate for German establishments is only 11.6% (6.2%+5.4%). However, the ratio of layoffs to quits is very similar to that in the US, with layoffs being most important in the construction sector. The number of layoffs per destroyed job is slightly lower than in the US.

In Figure 1 we plot estimates of job and worker flows taken from the IAB establishment panel, over the entire sample period. Because of the large changes in the sample composition over time, we weight by sampling weights. Sampling weights can either be used to reflect the population of establishments in the economy, or the

---

[12]The establishment panel contains information on the number of employees and the number of employees subject to social security. In our sample of private sector firms 96% of employees are covered by social security.

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

Table 3: Average six-monthly job and worker flow rates by industry, location and size. Weighted by sampling weights and employment.

|	Number of obs.	Number of estab.	JC rate	JD rate	Hiring rate	Separation rate	Quit rate	Layoff rate	Layoffs per quit	Layoffs per destroyed job
All establishments	151,766	38,368	10.1	7.4	6.2	5.4	3.1	2.2	0.73	0.58
Primary industries	6,140	1,413	15.7	6.9	6.3	4.9	2.7	2.2	0.82	0.48
Manufacturing	49,942	11,300	5.9	5.1	4.0	4.1	2.3	1.7	0.74	0.56
Construction	17,946	4,415	15.6	11.6	7.8	6.0	2.7	3.3	1.22	0.68
Wholesale and retail trade	26,904	6,876	9.6	8.0	5.0	4.9	3.0	1.9	0.63	0.53
Transport and communication	6,576	1,883	9.9	7.3	7.3	5.9	3.7	2.1	0.57	0.53
Financial and business services	21,460	6,116	11.6	8.6	8.7	7.1	4.0	3.0	0.75	0.68
Other services	22,798	6,365	15.6	11.2	8.8	6.7	4.1	2.5	0.62	0.58
West Germany	92,196	24,691	9.5	7.0	6.0	5.3	3.2	2.1	0.65	0.55
East Germany	59,570	13,677	13.3	9.7	7.4	5.7	2.6	3.2	1.24	0.75
0–10 employees	57,886	15,893	25.2	23.3	6.9	5.4	3.2	2.3	0.72	0.49
11–20 employees	19,080	4,659	15.0	11.7	6.9	5.4	3.2	2.2	0.68	0.53
21–30 employees	13,308	3,141	11.2	8.7	6.6	5.1	3.0	2.1	0.69	0.57
31–50 employees	12,728	3,195	9.8	7.5	7.1	5.5	3.1	2.4	0.77	0.68
51–100 employees	14,244	3,645	7.8	5.9	6.9	5.7	3.2	2.5	0.78	0.68
> 100 employees	34,520	7,835	4.6	4.0	5.0	5.3	3.0	2.2	0.74	0.66
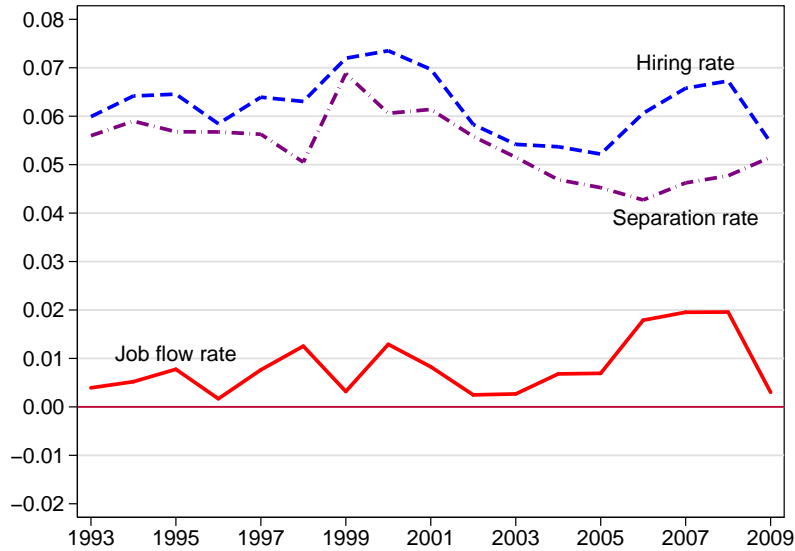
Figure 1: Average job and worker flows (6-monthly), weighted by
sampling weights and employment

population of workers. In the latter case one also weights by establishment employment. In most cases it seems more natural to weight to the population of workers, since this reflects the fact that large firms have greater effects on key aggregate measures such as the hiring and separation rate.

Figure 1 shows that combined hiring and separation rates are about 12 times larger than net job flow rates. Hiring and separation rates vary between about 9% and 14% per year, compared to net job flow rates of between 0 and 4% per year. The economic crisis of 2008-2009 is also clear from Figure 1, although it is striking that even between 2008 and 2009 the net job flow rate is still positive.[14] Hiring rates fell more sharply than separation rates increased, which is consistent with our *a priori* reasoning about employment adjustment in Germany. But, separation rates are still *lower* than in earlier periods in the data.

We carried out various robustness checks on the basic patterns observed in Figure 1. First, we compared the reported job flow rates based on hirings and separations with two other possible job flow rates based on changes in employment stocks between points in time (see Figure B.1 in Appendix B). All three measures show roughly the same time-series pattern, so we focus on our original measure which is internally consistent with our measure of hires and separations.

---

[14]Note that these job flow rates exclude firm entry and exit. It is still possible that the recession caused a large number of firms to exit, causing a larger fall in job flow rates.

Second, we compared the hiring and separation rates calculated from the establishment panel and calculated from movements of individual workers between establishments reported in the social security data. (Appendix C). Figure C.1 shows that the two series are very close, although the establishment survey data records slightly higher hiring rates and slightly lower separation rates.

One advantage which the IAB establishment panel survey data offers, compared to administrative data, is that we can distinguish between separations which are initiated by the firm, 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 employee initiated (see Appendix A for a list of all separation categories). In Figure 2 we plot separations by cause.
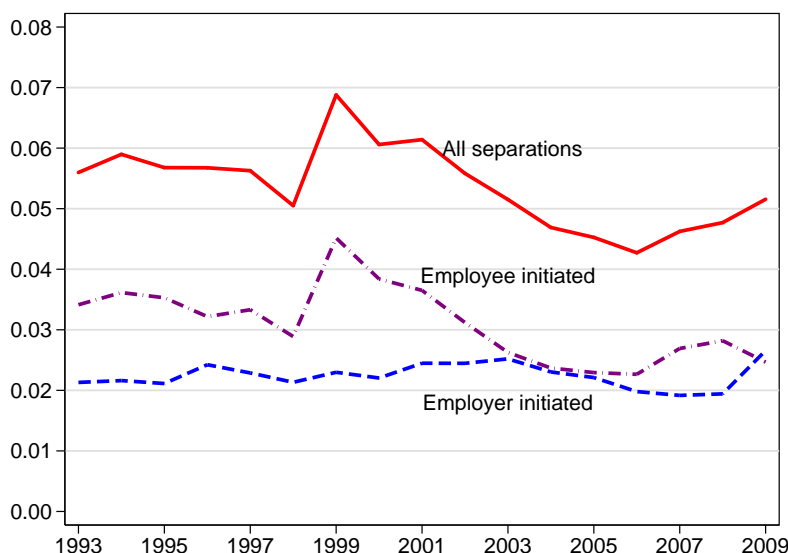

Figure 2: Separation rates by cause, weighted by sampling weights and employment

Involuntary separations average slightly over 2% per year, with the highest rate in 2009 of 2.6%. Involuntary separations are also significantly higher in 2001, 2002 and 2003. Employee initiated separations are a more important component of total separations, and show far more variability over time.[15]

---

[15]The jump in employee-initiated separations between 1998 and 1999 is a cause for concern. There is no equivalent jump in the separation rate in the social security statistics (see Figure C.1 in Appendix C). We have confirmed that the question asked in the survey is identical in both of those years. We have also examined a balanced panel to ensure that the separation rate does not increase

4.2 Relationship between job and worker flows

A key finding of Abowd *et al.* (1999, Figure 1) is that hiring and firing are not symmetrical for French establishments, whereas Davis *et al.* (2006, Figure 6) suggests a much greater degree of symmetry for US establishments. In France, hiring activity changes more in response to changes in net job flow rates. Is the same true for German establishments? In Figure 3 we plot the relationship between employment growth (net job flows) and hiring and separation rates, controlling for year and establishment fixed effects.

Figure 3: Employment growth, hiring and separations. IAB establishment panel 1993–2009, controlling for establishment and time fixed effects.

The similarity with results for US establishments is striking (Davis *et al.* 2006, Figure 6), and contrast with the results for France. The degree of "churning" in establishments which have no employment change is much lower than estimated 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. Even allowing for this, the churning rate for static establishments in France is over 20%, compared to about 8% in Germany. Second, the relationship between employment changes and worker flows is far more symmetric in the German data. The separation rate for shrinking establishments mirrors almost exactly the hiring rate for growing establishments.

because of a change in the sample characteristics of establishments; unweighted figures give similar results.

There is little evidence from this that German firms adjust by changing their hiring decisions rather than their separation decisions.

Table 4 summarises the relationship. We can compare our employment-weighted results with row (B) of Abowd *et al.* (Table 1). First, we note that the net job creation and destruction rates are higher. For example, expanding firms in our sample average a job creation rate of 17%, compared to 7% in the French data. This partly reflects the fact that the employment change is measured over a six-month period and doubled. The hiring rate (25 per 100) is much closer to the total entry rate for France (35 per 100) but the separation rate (8 per 100) is much lower (29 per 100). This suggests that job churning is much lower in Germany. To increase employment by one requires hiring 1.5 workers and firing just 0.5 workers. To reduce employment by one requires hiring 0.4 workers and firing 1.4. Perhaps most strikingly, there is a substantial difference in the separation rate between growing and shrinking establishments. Expanding firms have a hiring rate some five times greater than shrinking firms, while shrinking firms have a separation rate about 2.5 times greater than expanding firms.

Table 4: Job and worker turnover rates, weighted by
cross-section weights and employment

	Annual job flow rate	Annual hiring rate	Annual sep. rate
Increasing employment $n = 39,270$	0.17 (0.19)	0.25 (0.25)	0.08 (0.14)
Stable employment $n = 69,639$	0 (0.00)	0.06 (0.14)	0.06 (0.14)
Decreasing employment $n = 40,012$	−0.13 (0.16)	0.05 (0.11)	0.18 (0.20)

One possible explanation for these differences 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. To check this, in Appendix C we compare hiring and separation rates from both the social security data and the establishment survey. Figure C.2 shows that the two measures are almost identical, suggesting that the relative lack of churning observed is not driven by the measure we use.

5 Variation in adjustment within and across establishments

In this section we compare the adjustment patterns between different establishments, and within establishments at different points in time. The almost linear relationship between worker flows and job flows illustrated in Figure 3 suggest that the following models can be used for examining adjustment patterns:

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

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

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 $n_{it} = h_{it} - s_{it}$ it is unnecessary to estimate both the hiring and separation equation, since $\beta^h - \beta^s = 1$ and $\gamma^h - \gamma^s = 1$. 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 firms 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 3, however, suggests that $\gamma^s > 0$ and there is a clear role for separations in declining firms. 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. 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.

Table 5 reports our estimates of Equations (1) and (2) for the whole sample, and also separately by broad industry. 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%.

Table 5: Estimates of Equations (1) and (2) with establishment and year fixed-effects. Standard errors in parentheses are clustered at the establishment level. Sample includes observations where job flows are in the range $(-0.19,+0.19)$ which cover 90.1% of the total sample. 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
Sample with $-0.19 \leq n_{it} \leq 0.19$	0.964 (0.008)	−0.905 (0.006)	0.034 (0.001)	136,664	0.64	[0.000]
All establishments	0.973 (0.004)	−0.963 (0.002)	0.035 (0.001)	151,766	0.86	[0.0244]
Primary industries (Agriculture, mining)	1.014 (0.050)	−0.951 (0.037)	0.031 (0.005)	5,338	0.60	[0.335]
Manufacturing	1.001 (0.009)	−0.905 (0.008)	0.022 (0.001)	46,785	0.65	[0.000]
Construction	0.922 (0.023)	−0.919 (0.019)	0.048 (0.005)	15,128	0.60	[0.936]
Wholesale and retail trade	0.948 (0.016)	−0.912 (0.013)	0.032 (0.003)	24,718	0.57	[0.047]
Transport and communication	0.911 (0.037)	−0.835 (0.032)	0.046 (0.009)	5,907	0.64	[0.066]
Financial and business services	0.982 (0.023)	−0.932 (0.020)	0.042 (0.004)	18,819	0.76	[0.064]
Other services	0.929 (0.022)	−0.867 (0.020)	0.044 (0.007)	19,969	0.61	[0.016]
Adjustment equal p-value	[0.042]	[0.001]				

β^h is significantly larger than $-\gamma^s$ (p-value < 0.0005), which means that firms 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 3), separations are by far the most important margin used by shrinking firms. There is no evidence here that German firms meet declining labour demand primarily by reducing hires.

The constant in this model is an estimate of the hiring rate (= separation rate) when firm 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 firms (as do Alda *et al.* (2005), relative to Dutch firms), which itself explains why the hiring margin cannot be used when firms shrink. If firms are only hiring at 3.4% when they have stable employment, only very small falls in employment can be accommodated by falls in hiring.

In the second row of Table 5 we increase the sample to include establishments with very high values for employment change. Doing so increases the estimates for both

β^h and particularly γ^s, but does not significantly alter our conclusion.[16]

In the rest of Table 5 we estimate the adjustment process separately by industry. Since industries differ greatly in their technology and skill requirements, we might expect to observe different responses to changing labour demand. There is some evidence of this: we reject the hypothesis that γ^s is equal across industries with p-value of 0.001. But the variation is not great, and in no industry is there evidence of a particularly small response on the separation margin. There is even less variability in the hiring response across industries.

These results are relatively robust to the imposition of linearity. In Table 6 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) clearly becomes stronger 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, showing that even quite small falls in employment are accommodated by increases in the separation rate.

Table 6: 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
$0 < |n_{it}| \leq 0.05$	0.822	−0.909
	(0.022)	(0.016)
$0.05 < |n_{it}| \leq 0.1$	0.838	−0.972
	(0.015)	(0.012)
$0.1 < |n_{it}| \leq 0.15$	0.891	−0.958
	(0.015)	(0.013)
$0.15 < |n_{it}| \leq 0.19$	0.972	−0.939
	(0.012)	(0.010)
Adjustment equal p-value	[0.000]	[0.029]
N	136,664	
R^2	0.677	

We now investigate whether these adjustment patterns are also stable across other characteristics of establishments. In Table 7 we compare β^h and γ^s between estab-

---

[16]We investigate non-linearities in more detail in Table 6.

lishments 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.

Table 7: Estimates of Equations (1) and (2) separately by location of establishment.

	β^h	γ^s	Constant	N	R^2	$\beta^h = -\gamma^s$ p-value
West Germany	0.968	−0.889	0.034	84,531	0.6729	[0.000]
	(0.010)	(0.008)	(0.001)			
East Germany	0.961	−0.929	0.038	52,133	0.6111	[0.016]
	(0.012)	(0.010)	(0.011)			
p-value H_0: Adjustment equal	[0.609]	[0.002]				

In Table 8 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 firm size category do we find that separations are unimportant.

Table 8: Estimates of Equations (1) and (2) separately by size of establishment in the first period.

	β^h	γ^s	Constant	N	R^2	$\beta^h = -\gamma^s$ p-value
0–10 employees	0.940	−0.930	0.035	48,453	0.5447	[0.539]
	(0.013)	(0.013)	(0.005)			
11–20 employees	0.942	−0.913	0.033	17,217	0.6447	[0.074]
	(0.015)	(0.012)	(0.005)			
21–30 employees	0.939	−0.917	0.038	12,398	0.6492	[0.339]
	(0.021)	(0.018)	(0.005)			
31–50 employees	0.953	−0.904	0.047	11,912	0.7166	[0.070]
	(0.022)	(0.020)	(0.005)			
51–100 employees	0.961	−0.882	0.041	13,414	0.7807	[0.008]
	(0.024)	(0.023)	(0.004)			
> 100 employees	1.073	−0.875	0.030	33,270	0.7949	[0.000]
	(0.021)	(0.011)	(0.001)			
p-value H_0: Adjustment equal	[0.000]	[0.008]				

In Table 9 we compare the adjustment path across the business cycle, using sub-

---

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

periods based on the aggregate unemployment rate (see Figure D.1 in Appendix D). 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).

Table 9: Estimates of Equations (1) and (2) separately over the business cycle. Periods chosen are identified from Figure D.1 in Appendix D.

	β^h	γ^s	Constant	N	R^2	$\beta^h = -\gamma^s$ p-value
1993–1995	0.946 (0.038)	−0.876 (0.027)	0.030 (0.001)	8,389	0.744	[0.0771]
1996–1999	0.965 (0.024)	−0.880 (0.021)	0.032 (0.001)	22,706	0.735	[0.0031]
2000–2002	0.952 (0.022)	−0.874 (0.018)	0.029 (0.001)	30,032	0.789	[0.0015]
2003–2006	0.953 (0.016)	−0.928 (0.013)	0.022 (0.001)	42,814	0.752	[0.1871]
2007–2009	0.933 (0.021)	−0.889 (0.019)	0.022 (0.001)	32,723	0.787	[0.081]
p-value H_0: Adjustment equal	[0.7133]	[0.0338]				

Our results so far show that German establishments rely almost as heavily on the separation margin as it does on the hiring margin. The majority (over 80%) of employment reduction is accommodated by increased separations, and this result is robust across establishment industry, location, size and time. Why is γ^s so large? Why do German firms who shrink rely so heavily on increasing separations, when our initial hypothesis is that, because layoffs are difficult and expensive in Germany, firms would rely more on the hiring margin?

One possible explanation is that these separations are not in fact layoffs, but instead are employee-initiated separations. Recall (Figure 2) that more than half of separations are "quits" as opposed to "layoffs". In Figure 4 we plot the relationship between employment change and separations separated between voluntary and involuntary separations, as defined earlier.

As would be expected, 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 establishment 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 use Equation (2) to estimate the relationship para-
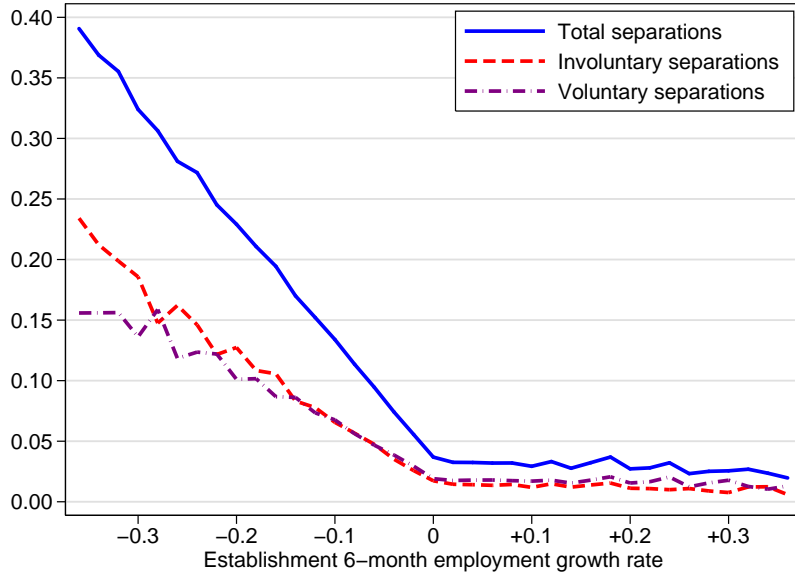
Figure 4: Relationship between voluntary and involuntary separations and job flows

metrically, and this is reported in Table 10.

Table 10: 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.

	γ^s	β^s	Constant	N	R^2
Employer initiated	−0.470	−0.014	0.012	136,664	0.5711
	(0.008)	(0.006)	(0.001)		
Employee initiated	−0.432	−0.022	0.021	136,664	0.5035
	(0.008)	(0.005)	(0.001)		

In firms with static employment there are twice as many voluntary as involuntary separations: the quit rate in static firms is 2.1% compared to a layoff rate of 1.2%. If quits were unrelated to firms' 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 firms 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) might in fact be better thought of as a layoff. A second possibility is that the direction of causality is reversed. In the very short run, a quit is likely to lead to a one-for-one fall in employment (and presumably the creation of a vacancy). A third possibility is that employment reductions are managed by "voluntary redundancy" or that workers choose to leave shrinking establishments, perhaps because shrinking establishments offer worse opportunities. 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.[18]

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 the adjustment mechanism varies systematically across establishment types. In Table 11 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[19] and female workers in the establishment. If these workers have weaker employment protection then establishments with a higher proportion of them may have a higher separation response.

---

[18]See Davis *et al.* (2006, p.14).

[19]The definition of "part-time" is not made explicit in the questionnaire.

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 workers and agency workers in the establishment. We expect that an establishment with a greater proportion of external workers 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[20] in the establishment. 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 split 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 have plotted 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 11 are small, and in some cases are also statistically insignificant. Establishments with works councils, for example, do *not* have a smaller separation response to employment declines. The largest difference in γ^s comes from establishments with more part-time and more 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 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 ($\hat{\gamma}^s = 0.048$ (0.024)). We presume this

---

[20]Skilled workers are defined as workers in jobs which require a vocational qualification, university degree or higher.
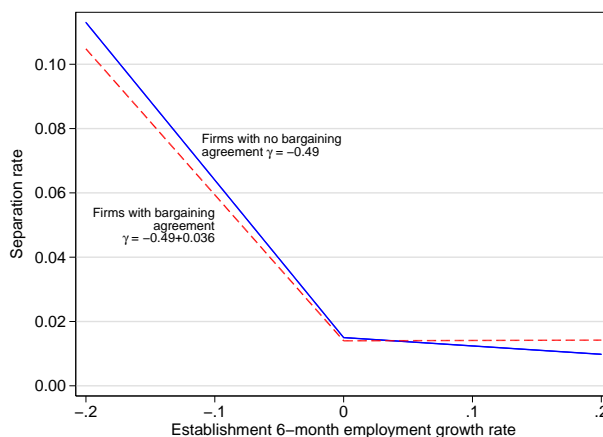
24

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

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.

Germany's generally robust response to the recent financial crisis has led many to suggest that policies which encourage "labour hoarding" may have been successful, such as the use of working time accounts and short-time work.[21]

Working time accounts are firm-level agreements which allow actual working hours to vary from agreed working hours within defined limits. Working-time accounts also specify the period over which compensation of working time must occur; this is most commonly one year (Seifert 2005), but may be longer or shorter. Total pay does not vary with actual hours worked, so in effect hourly wage rates vary inversely with actual hours worked. This means that establishments can save on labour costs when there is a short-term increase in demand, while for workers, working time accounts act as an insurance against lower income during a short-term economic downturn. The use of working time accounts in Germany is widespread, although it is not clear to what extent these are short-term "flexitime" arrangements or longer-term accounts which would allow firms to adjust to demand shocks. Recent estimates (Morley, Sanoussi, Biletta & Wolf 2009) suggest that 50% of establishments in Germany operate working time accounts, while a survey of German works councils (Bogedan, Brehmer & Herzog-Stein 2009) found that changes in working time accounts were the most common cost-saving method, short of redundancies, used by

---

[21]See for example Möller (2010).

Table 11: Variation in adjustment by plant-level characteristics

	Change in β^s	Change in γ^s	Change in Constant
Firm-level bargaining agreement	0.026**	0.036**	−0.001
	(0.012)	(0.016)	(0.001)
Sectoral bargaining agreement	0.020	0.002	−0.002*
	(0.022)	(0.029)	(0.001)
Works council	0.039**	0.013	−0.003***
	(0.011)	(0.015)	(0.001)
Prop. part-time workers > median	0.001	0.067***	0.002***
	(0.011)	(0.015)	(0.001)
Prop. female workers > median	0.026**	0.060***	0.001
	(0.011)	(0.016)	(0.001)
Prop. fixed-term workers > median	−0.006	−0.053***	0.005***
	(0.012)	(0.017)	(0.001)
Prop. freelance workers > median	0.003	−0.002	0.000
	(0.013)	(0.017)	(0.000)
Prop. agency workers > median	0.028*	0.048**	0.000
	(0.017)	(0.024)	(0.001)
Prop. skilled workers > median	−0.030***	−0.024	−0.001*
	(0.011)	(0.015)	(0.001)

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

German establishments in the second half of 2009.

Short-time work is a measure relaunched by the German Federal Government in the light of the current economic crisis. Under this measure, employers reduce the working time of their employees, if they are faced with a strong negative demand shock for example. Simultaneously, the wages are reduced proportionally to the cut in hours worked. Employees are compensated by the German Federal Employment Agency for around 60% of the difference between their net income before and their net income after the working time reduction. Besides payment for the hours still worked, the employers have to pay the full social security contribution for the employees' income before the cut in working time took place. There is one exception and this is the innovation of this renewed policy measure: If the employers are combining the short time work with further training, the Federal Employment agency also bears the social security contributions for the difference in the wages before and after the working time reduction. The maximum duration of short time work is 24 months. It is claimed that the renewed short time work program acts as an important stabilizer

for the labour market within the current economic crisis (Möller 2010). As of March 2009, 55,000 establishments employing 1,250,000 employees were using short-time work. Crimmann, Wießner & Bellmann (2010) estimate that the employment effect of this policy amounted to around 362,000 full time equivalents.

It seems likely that the *primary* effect of working time accounts and short-time work will be on the distribution of employment growth. But it is also possible that these policies have additional effects on the adjustment mechanism conditional on job flows. Table 12 shows that establishments which operated working-time accounts or short-time work policies actually had significantly *higher* separation rates for a given rate of job destruction. These results should be interpreted with some caution, however. In particular, selection into these policies is highly non-random. For example, establishments which applied for the short-time work policy were those which experienced greater (negative) demand shocks. Again, we would stress that the primary effect of these policies should be to encourage establishments to moderate falls in employment, rather than separations conditional on a particular employment growth rate.

Table 12: Differences in adjustment across firms with working-time accounts and short-time work policies

	Change in β^s	Change in γ^s	Change in Constant
Working time accounts	-0.018	-0.086^{***}	0.000
	(0.025)	(0.029)	(0.001)
Short-time work	0.072	-0.089^{**}	-0.004^{**}
	(0.087)	(0.043)	(0.002)

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

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 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 even across plant size. Differences in establishment-level characteristics and policies which might be expected to lower the separation response have only a small impact. This is consistent with the fact that although establishments in Germany might face much greater firing costs than establishments in the US, their behaviour is very similar.

It is important to realise that our findings are not inconsistent with the view that recessions in Europe are characterised by an acyclicality in unemployment inflows compared to the US. The cyclicality 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.

References

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

Addison, J., Bellmann, L. & Kölling, A. (2004), "Works councils and plant closings in Germany", *British Journal of Industrial Relations* **42**(1), 125–148.

Albæk, K. & Sørensen (1998), "Worker flows and job flows in Danish manufacturing", *Economic Journal* **108**, 1750–1771.

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

Anderson, P. & Meyer, B. (1994), "The extent and consequences of job turnover", *Brookings Papers: Microeconomics* .

Bauer, T. & Bender, S. (2004), "Technological change, organizational change and job turnover", *Labour Economics* **11**(3), 265–291.

Bauer, T., Bender, S. & Bonin, H. (2007), "Dismissal protection and worker flows in small establishments", *Economica* **74**, 804–821.

Belzil, C. (2000), "Job creation and job destruction, worker reallocation and wages", *Journal of Labor Economics* **18**(2), 183–203.

Bender, S., Haas, A. & Klose, C. (2000), "The IAB employment subsample 1975–1999", *Schmollers Jahrbuch* **120**(4), 649–662.

Bogedan, C., Brehmer, W. & Herzog-Stein, A. (2009), "Betriebliche Beschäftigungssicherung in der Krise", Kurzauswertung der WSI-Betriebsrtebefragung 2009.

Burgess, S., Lane, J. & Stevens, D. (1999), "Job flows, worker flows and churning", *Journal of Labor Economics* **18**(3), 473–502.

Burgess, S., Lane, J. & Stevens, D. (2001), "Churning dynamics: an analysis of hires and separations at the employer level", *Labour Economics* **8**, 1–14.

Crimmann, A., Wießner, F. & Bellmann, L. (2010), "The German work-sharing scheme: an instrument for the crisis", International Labour Organisation Conditions of work and employment working paper series no. 25.

Darby, M., Haltiwanger, J. & Plant, M. (1986), "The ins and outs of unemployment: the ins win", NBER working paper 1997.

Davis, S., Faberman, R. & Haltiwanger, J. (2006), "The flow approach to labor markets: new data sources and micro-macro links", *Journal of Economic Perspectives* **20**(3), 3–26.

Davis, S. & Haltiwanger, J. (1992), "Gross job creation, gross job destruction and employment reallocation", *Quarterly Journal of Economics* **107**, 819–863.

Davis, S. & Haltiwanger, J. (1999), "Gross job flows", *in* O. Ashenfelter & D. Card, eds, *Handbook of Labor Economics*, Vol. 3, Elsevier Science, 2711–2805.

Elsby, M., Michaels, R. & Solon, G. (2009), "The ins and outs of cyclical unemployment", *American Economic Journal: Macroeconomics* **1**(1), 84–110.

Fischer, G., Janik, F., Müller, D. & Schmucker, A. (2009), "The IAB Establishment Panel — things users should know", *Schmollers Jahrbuch* **129**(1), 133–148.

Gartell, M., Jans, A.-C. & Persson, H. (2010), "The importance of education for the reallocation of labor: evidence from Swedish linked employer-employee data 1986–2002", *Labour Economics* **17**, 206–214.

Hall, R. (2005), "Job loss, job finding, and unemployment in the US economy over the past fifty years", *NBER macroeconomics annual* **20**, 101–137.

Hamermesh, D., Hassink, W. & van Ours, J. (1996), "Job turnover and labor turnover: a taxonomy of employment dynamics", *Annales D'Economies et de Statistique* (41/42), 21–40.

Ilmakunnas, P. & Maliranta, M. (2003), "The turnover of jobs and workers in a deep recession: evidence from the Finnish business sector", *International Journal of Manpower* **24**(3), 216–246.

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

Möller, J. (2010), "The German labor market response in the world recession — de-mystifying a miracle", *Journal for Labour Market Research (Zeitschrift für Arbeitsmarkt Forschung)* **42**(4), 325–336.

Morley, J., Sanoussi, F., Biletta, I. & Wolf, F. (2009), "Comparative analysis of working time in the European Union", Mimeo, European Foundation for the Improvement of Living and Working Conditions.

Pries, M. & Rogerson, R. (2005), "Hiring policies, labor market institutions and labor market flows", *Journal of Political Economy* **113**(4), 811–839.

Seifert, H. (2005), "Flexibility through working time accounts: reconciling economic efficiency and individual time requirements", *in* A. Hegewisch, ed., *Working time for working families: Europe and the United States*, Friedrich-Ebert-Stiftung.

Shimer, R. (2007), "Reassessing the ins and outs of unemployment", NBER working paper 13421.

Tsou, M.-W., Liu, J.-T. & Hammitt, J. (2001), "Worker flows and job flows in taiwan", *Economics Letters* **73**, 89–96.

Appendices

A   Questions 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

B Three measures of job flows

The IAB panel provides three potential measures of net job flows. First, we have a measure which is internally consistent with hiring and separation. JF^A is simply the difference between hirings and separations over the previous six months, multiplied by two:

$$JF^A = 2(H_t - S_t)$$

Second, we have a measure based on reported employment at t and $t - 1$ on 30th June:

$$JF^B = N_t - N_{t-1}$$

Third, we have a measure based on the difference between reported employment at on 30 June t and *recalled* employment on 30 June $t - 1$:

$$JF^C = N_t^t - N_{t-1}^r$$

where N_{t-1}^r is employment at $t - 1$ reported at t.

Figure B.1 compares these three measures, weighted by sampling weights and employment. All three series are quite similar, and all of them pick up the effect of the most recent crisis on job flow rates. Given the similarity of these three measures, it appears reasonable to focus on our first measure, JF^A, since that is internally consistent with our measure of hires and separations.
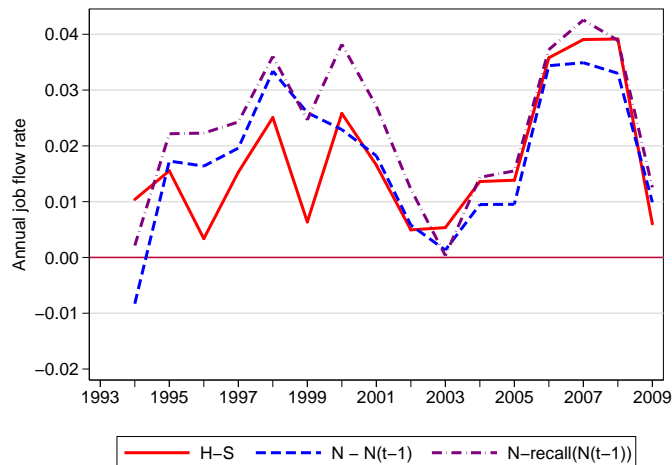

Figure B.1: Comparison of three net job flow measures, weighted by sampling weights and employment

C Comparison of hires and separations from Establishment-level data and individual-level social security data

In Figure C.1 we compare two independent measures of hiring and separation rates. The first is the survey measure from the establishment panel (scaled by two to get annual rate); the second is the rate at which workers in the social security data join and leave establishments. The social security data is available up to 2007 at the time of writing, so we cannot compare both series beyond that point. As expected, the establishment panel records a slightly higher hiring rate, presumably because it includes all workers and not just those covered by the social security system. However, the establishment survey records slightly lower estimates of separations; this might indicate that some movements of workers between establishments are not recorded as "leaving the establishment", perhaps because they are temporary or agency workers. In Figure C.2 we compare the relationship between job- and worker-turnover using the establishment panel and the social security data.
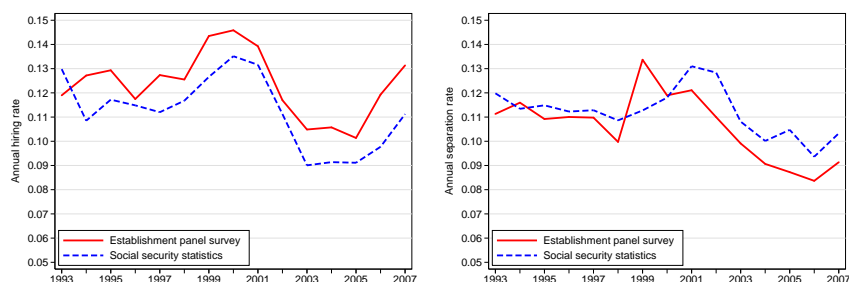

Figure C.1: Hiring (left-hand panel) and separation rates (right-hand panel) are similar in both the establishment panel and the social security statistics
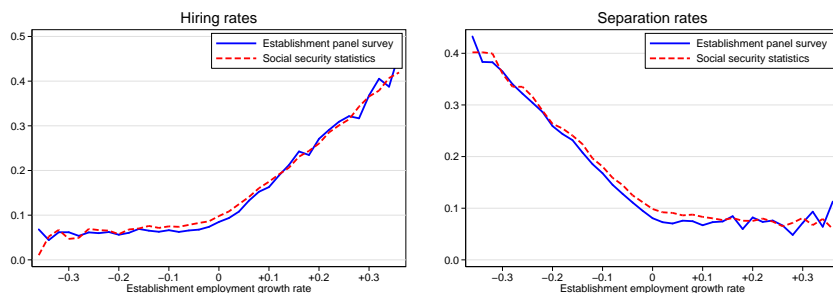

Figure C.2: The relationship between job flows and worker flows is very similar in both the establishment panel and the social security statistics
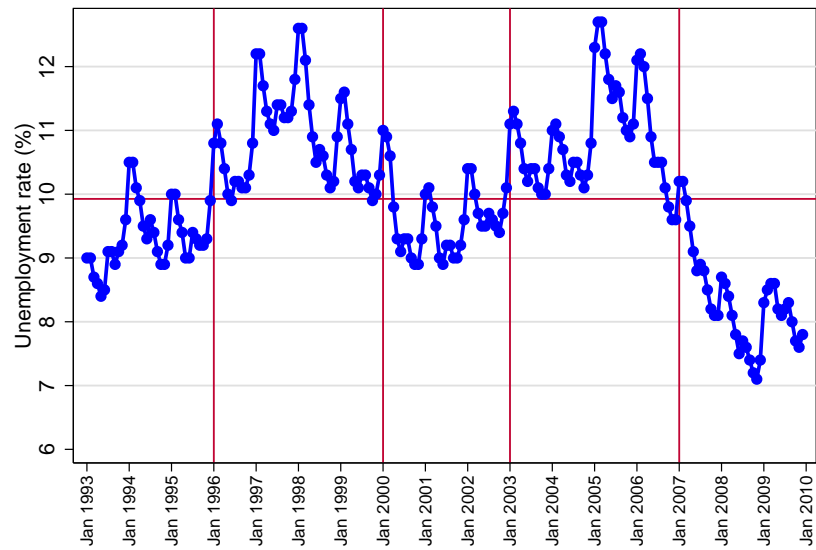
33

D German unemployment rate 1993–2009

Figure D.1: German monthly unemployment rate 1993–2009. Source: *Bundesagentur für Arbeit.*