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Job and worker turnover in German establishments

by

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Abstract

We use a simple non-parametric regression approach to measure the relationship between employment growth, hirings and separations in a large panel of German establishments over the period 1993--2009. Although it is often claimed that firms in Europe have less flexibility in their ability to hire and fire, we find that the relationship between employment growth and worker flows in German establishments is very similar to the behaviour of US establishments. The relationship is stable over time, even during the most recent economic crisis, and across different types of establishment. We verify our results with independent measures from administrative data. We suggest that this result is due to: the strong relationship between employment reductions and voluntary separations; the low level of "churning"; and the heterogeneity of jobs within establishments.

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 and 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 variability of employment and differences in hiring and separation behaviour for a given rate of employment adjustment.

The increasing availability of detailed firm- and establishment-level data, linked to records of workers' employment spells, has allowed researchers to examine how firms' hirings and separations vary with changes in employment. For the United States, Burgess, Lane and Stevens (2001, p.11) find that falls in employment are achieved by increasing separations rather than reducing hiring. This is confirmed by Davis, Faberman and Haltiwanger (2006, p.17) who show that, in shrinking establishments, separations increase approximately one-for-one with job loss. In stark contrast, Abowd, Corbel and Kramarz (1999) show that, in France, job loss in establishments is associated with a reduction in hiring rather than an increase in separations. Abowd and Kramarz (2003, p.500) argue that French firms rely on the hiring margin because of differences in employment institutions and associated adjustment costs compared to the US. Furthermore, those French institutions which cause firms to rely on the hiring margin "may be more typical of European institutions" more generally.

The main contribution of this paper is therefore 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.

The German labour market is generally regarded as having one of the highest levels of protection against worker dismissal. The OECD's employment protection index (OECD, 2013) classifies Germany as having some of the strongest Employment Protection Legislation (EPL) in the OECD. The OECD EPL index ranks Germany 4th out of 34 for protection of workers against individual dismissal, and 6th for additional provisions for collective dismissals. On both these measures, dismissal is characterised as more difficult in Germany than in France.¹ However, regulations on temporary employment are considerably less restrictive in Germany than in France. German establishments face numerous restrictions on

¹The countries with the lowest levels of EPL in the OECD index are New Zealand, USA, Canada and the UK.

their ability to dismiss workers, as documented by the OECD.² These include notification procedures, the length of notice period, severance pay, social criteria which determine who can be laid off, the definition of unfair dismissal, compensation following unfair dismissal, and additional delays and negotiation for collective dismissals. Some of these restrictions are reduced for establishments employment 10 or fewer employees, although a study by Bauer et al. (2007) finds no effect of this discontinuity on worker flow rates.

Is it then 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? Perhaps surprisingly, the answer is no. We provide evidence that the relationship between employment changes and worker flows in German establishments is very similar to the behaviour of establishments in the United States described in Burgess et al. (2001) and Davis, Faberman and Haltiwanger (2012).

To do this, we provide new evidence on the relationship between hires, separations and job flow rates using data from a large panel of German establishments over the period 1993–2009. 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 use a simple non-parametric 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 lower in Germany than in studies from the United States, as expected. Second, however, establishments which shrink rely far more on increases in separations rather than reductions in hires. This is true even for quite small falls in employment. This pattern is much more consistent with results from the United States, and quite different to those found for France. Third, this relationship between employment change and worker flows is quite 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.

We show that this phenomenon is related to three features of the data. First, there is a strong relationship between employment reductions and voluntary separations (quits). Second, the low level of churning (excess job flows) means that a reduction in hiring is not sufficient to accommodate falls in employment. Finally, establishments comprise heterogeneous jobs, so that employment reductions cannot be accommodated by moving those work-

²Taken from the OECD EPL database update 2013, available from <http://www.oecd.org/els/emp/Germany.pdf>. More detail on German EPL can be found in Bauer, Bender and Bonin (2007) and Jahn (2009).

ers whose jobs are lost to positions made vacant by workers who leave.

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 and theoretical background

Following Davis et al. (2006), the employment change of firm i , between $t - 1$ and t , is given by the difference in hires H_{it} and separations S_{it} over that period:

$$\Delta N_{it} = H_{it} - S_{it}. \quad (1)$$

Separations can further be broken down into quits (employee-initiated separations) and layoffs (employer-initiated separations). As has been established in the empirical literature, gross worker flows are often much larger than job flows because workers may join and leave a given set of jobs, or because, within firms, the composition of jobs may change.

The key feature of (1) we explore in this paper is that a given employment adjustment may be achieved either through hiring or separations. Abowd and Kramarz (2003) argue that the high costs of firing workers in France mean that falls in employment (up to a certain point) are accommodated by reductions in hires. In the US, with much lower firing costs, falls in employment lead immediately to increases in layoffs.

The standard matching model by Mortensen and Pissarides (1994) does not involve employment adjustment costs (no hiring and firing costs), does not explicitly consider quits, since they are assumed to be exogenous (on-the-job search is ruled out), and does not consider multi-worker firms. A newly created job is synonymous with a hire, and a destroyed job is synonymous with a separation. Davis et al. (2012) refer to this as an “iron-link” between job flows and worker flows. However, since employment growth represents a key feature of the empirical analysis in this paper, the standard framework should be extended to allow for multi-worker firms as in Cooper, Haltiwanger and Willis (2007). The basic prediction of the Cooper et al. model is that a firm, which faces a constant quit rate \bar{q} , can achieve a fall in employment of up to \bar{q} without increasing separations. This is preferable because separations involve some cost (e.g. severance pay). However, employment falls larger than \bar{q} can only be achieved by increasing layoffs one-for-one with job losses. Thus, the extent to which firms can rely on a reduction in hires to accommodate falls in employment depends on the extent to which firms have worker turnover in excess of job turnover, labelled as “churning” by Burgess et al. (2001).

Davis et al. (2012) discuss various ways in which one might relax the assumption of

an exogenous quit rate. First, the quit rate may vary with aggregate conditions. In a slack labour market \bar{q} is lower, so separations increase for smaller falls in employment. Second, the quit rate may vary with conditions within the firm. Faberman and Nagypál (2008) show that quit rates are constant in expanding establishments and increase rapidly in firms which are shrinking. This occurs if the relative value of outside options for workers increases when conditions within the firm worsen. Third, models of matching as an experience good (where workers and firms learn about each other's qualities after matching) suggest that the quit and separation rate may actually increase with firm growth because firms which hire more workers at $t - 1$ will have more mismatched workers at t .

We refer to the use of \bar{q} to achieve employment reductions as the “attrition channel”. As noted, the scope of the attrition channel to achieve employment reductions depends on the extent of churning. In turn, this depends on the size of hiring and firing costs, including those imposed through employment protection legislation (EPL). However, the relationship between EPL and the use of separations is likely to be complex. If EPL reduces churning, then it also reduces the scope for firms to use the attrition channel. On the other hand, if EPL makes layoffs costly, it increases the incentive to use the attrition channel.

Finally, although the theories described above assume multi-worker firms, they still assume homogeneous workers. This means that a quit reduces employment but has no other consequences for production. Thus, quits and layoffs are equivalent methods of achieving employment reduction. However, if workers are imperfect substitutes, then quits may have to be replaced even if employment is falling. This implies that separations will increase even for small falls in employment, because firms cannot rely on attrition.

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; Davis and Haltiwanger (1999) provide a literature review. Fewer papers consider the relationship between job turnover and worker turnover.

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. Abowd and Kramarz (2003) argue that the reason for this pattern is the structure of adjustment costs in France. In particular, separation costs are high for workers on permanent contracts, which gives firms an incentive to adjust on the hiring margin. Firms also have an incentive to use fixed-term contracts which do not incur such high separation costs.

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 than with 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.

Evidence from other European countries, however, does not support the idea that the use of the attrition channel varies systematically with EPL. For Denmark, Albæk and Sørensen (1998) find that when a plant shrinks (even by a small amount) only one-quarter of the job destruction is accounted for by a reduction in hires. For Portugal, Centeno, Machado and Novo (2009, Figure 1) also show that separations increase sharply with job loss. Denmark and Portugal have very different OECD EPL indices, but the relationship between job and worker flows from those countries are consistent with the results we find for Germany in this paper.

Other papers which examine the relationship between employment change and worker flows using German data are Bauer and Bender (2004), Bauer et al. (2007), Alda, Allaart and Bellmann (2005) and Bachmann, Bayer, Seth and Wellschmied (2013). Bauer and 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 in small establishments. 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. Bachmann et al. (2013) use German social security data to examine the cyclical pattern of worker and job flows. They also show that in the cross-section the relationship between worker and job flows is very similar to that in the US.³

³See Bachmann et al. (2013, Figure II).

4 Data and measurement

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 approximately 7% of workers because it is weighted towards larger plants.⁴ 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. Establishments are also asked for the cause of the separation. Appendix A gives a precise description of the relevant questions.

It is standard to calculate employment growth, hiring and separation rates by dividing by average employment between t and $t - 1$:

$$h_{it} = \frac{H_{it}}{0.5(N_{it} + \tilde{N}_{i,t-1})} \quad (2)$$

$$s_{it} = \frac{S_{it}}{0.5(N_{it} + \tilde{N}_{i,t-1})} \quad (3)$$

It follows that $\Delta n_{it} = h_{it} - s_{it}$. We follow Faberman (2008) in using $\tilde{N}_{i,t-1} = N_{it} - H_{it} + S_{it}$ as a revised measure of lagged employment to ensure adding up. Because the survey records hires and separations over a six-month period, $\tilde{N}_{i,t-1}$ is estimated employment six months before t , and the rates in (2) and (3) are six-monthly rates.

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.⁵ 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, sepa-

⁴Weights 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 and Schmucker (2009).

⁵Establishments 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.

rations or 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).⁶ 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. 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% (211 observations). This leaves a final clean sample of 38,368 establishments and 151,766 establishment-years.

Only a minority of 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.⁷

In this paper we ignore establishment entry and exit. This is because our measures of worker turnover refer to hires and separations made over the first six months of each calendar year. An establishment which disappears between 30th June t and 30th June $t + 1$ does not record these measures at $t + 1$ by definition. In addition, entry is complicated by the fact that an establishment which appears for the first time in the *Betriebspanel* on 30th June t must have existed on 30th June $t - 1$ to be included in the sampling frame.

Table 1 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.⁸ We weight to the population of workers (as do Davis et al., 2012), in order to account for the fact that large establishments have greater effects on aggregate measures such as the hiring and separation rate. Gross job turnover (the sum of job creation and destruction) is highest in construction and other service

⁶In 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.

⁷Table B1 in Appendix B 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.

⁸Weights 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).

industries, and lowest in manufacturing. Job creation and to a lesser extent job destruction decline with initial establishment size.

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 for a list of all separation categories). The final four columns of Table 1 reports the estimated quit and layoff rates. The final column of Table 1 provides the first evidence that layoff 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 having 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.⁹ In addition, the establishment panel records hires and separations only for the first six months of each calendar year, and may therefore be affected by seasonal patterns of recruitment and separation.¹⁰ Therefore we also use the social security employment statistics register of the German Federal Agency for Employment to check the robustness of our findings. The *Beschäftigtenstatistik* covers all workers or apprentices registered by the social insurance system.¹¹ Information on workers includes an establishment identification number.¹²

The social security data can be used in two ways to construct measures of hires and separations. The first, which we call the *point-in-time measure*, selects all workers in the social security register who were employed by the establishments in the IAB survey at a point in time t in each year. Hires and separations can then be calculated by observing changes in establishment identifiers at the worker level between $t - 1$ and t .¹³ The point-in-time measure excludes within-period hires and separations. That is, a worker who joins an establishment after $t - 1$, and leaves that establishment before t will be excluded.¹⁴ For consistency with

⁹Anderson and 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.

¹⁰For example, apprenticeship training traditionally starts and ends in August, and so will not be included in the establishment survey measures.

¹¹From 1999 onwards the data also includes information on other types of worker; see Appendix C.

¹²A detailed description of the employment data can be found in Bender, Haas and Klose (2000). Establishment identifiers only change if there is a change of ownership or in some cases of merger. For our purposes this will not affect the calculation of job or worker flows because we exclude entry and exit from the analysis.

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.

¹⁴The calculation of hires and separations from the social security register requires a number of sampling choices to be made. We show in Section C that although these choices affect the total amount of worker

Table 1: Average annualised^a job and worker flow rates by industry, location and size, 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>Hir. rate</i>	<i>Sep. 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 ^b	150,811	38,216	6.4	4.2	12.5	10.3	6.0	4.3	0.72	1.03
Primary industries	6,047	1,397	7.5	4.4	12.5	9.5	5.2	4.2	0.81	0.95
Manufacturing	49,830	11,293	4.3	3.9	8.2	7.9	4.5	3.3	0.73	0.84
Construction	17,705	4,383	9.8	5.5	15.7	11.4	5.2	6.2	1.20	1.12
Wholesale and retail trade	26,838	6,866	5.1	4.2	10.2	9.2	5.6	3.5	0.63	0.85
Transport and communication	6,529	1,875	7.2	3.7	14.8	11.3	7.2	4.0	0.56	1.09
Finance and business services	21,363	6,085	8.3	4.2	18.0	13.9	7.9	6.0	0.76	1.43
Other services	22,499	6,317	8.1	4.0	16.9	12.8	7.9	4.8	0.61	1.19
Western Germany	91,764	24,611	6.0	4.1	12.1	10.2	6.1	4.0	0.65	0.98
Eastern Germany	59,047	13,605	8.8	4.7	15.1	11.0	4.9	6.0	1.22	1.28
1–10 employees	57,423	15,806	9.3	4.9	14.3	9.9	5.8	4.1	0.71	0.84
11–20 employees	18,922	4,634	7.6	4.4	13.5	10.4	6.3	4.1	0.66	0.93
21–30 employees	13,208	3,132	7.0	3.8	13.1	9.9	5.9	4.0	0.68	1.04
31–50 employees	12,656	3,186	6.7	3.9	13.5	10.7	6.1	4.6	0.75	1.19
51–100 employees	14,167	3,638	6.3	3.6	13.9	11.2	6.3	4.9	0.78	1.34
> 100 employees	34,435	7,820	3.7	3.9	10.1	10.4	5.9	4.3	0.74	1.11
Establishments which match to the annual social security data	116,280	31,606	6.4	4.1	12.6	10.3				
Social security data annual point-in-time measure ^c	116,280	31,606	6.1	7.4	14.4	15.7				
Social security data annual point-in-time measure (population)	25,871,222	4,814,419	8.1	5.2	18.3	15.4				
Social security data quarterly point-in-time measure ^d	136,734	34,070	5.2	3.9	9.9	8.7				
Social security data monthly point-in-time measure ^e	135,836	33,843	1.8	1.5	3.0	2.7				
Establishments which match to the social security cumulative data	14,399	1,135	5.5	3.7	10.3	8.5				
Social security data annual cumulative measure	14,399	1,135	3.4	3.8	10.6	11.1				

^a The IAB establishment panel records hires and separations over the first six months of each year. Annualised rates are obtained by doubling hires and separations and scaling by average employment over the previous 12 months. The social security data rates are all annual.

^b The sample is an unbalanced panel. The sample size is slightly less than the 151,766 establishment years on p. 7 because we remove 955 establishments which have $\tilde{N}_{i,t-1} < 0$.

^c An analysis of the effect of including non-permanent workers, and allowing for temporary lay-offs can be found in Appendix C.

^d Monthly rates are based on a comparison of establishment reference numbers on the 31st May and 30th June in each year.

^e Quarterly rates are based on a comparison of establishment reference numbers on the 31st March and 30th June each year.

other studies (in particular those from the US) we compute annual, quarterly and monthly point-in-time measures.

The second measure, which we call the *cumulative 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 2005.¹⁵ These data allow us to compute the cumulative number of hires and separations during the interval between $t-1$ and t . In principle, the cumulative measure corresponds most closely to the reported measure from the survey data, which is also a cumulative measure.

The bottom panel of Table 1 reports, for comparison, estimates of job and worker turnover which use the social security point-in-time and cumulative measures. We also report estimates from the establishment survey for exactly the same sample to ensure comparability. The hiring and separation rates estimated from the establishment survey (12.6% and 10.3%) are lower than those estimated from the social security point-in-time measure (14.4% and 15.7%). The fact that the discrepancy is larger for separations may be because the establishment survey measure covers only the first six months of each year.¹⁶ Using the entire universe of establishments in the social security data leads to an even higher estimate of worker flows (18.3% and 15.4%), suggesting that, even after weighting, the sample of establishments in the survey underestimates job and worker flows.

The next two rows report point-in-time estimates based on quarterly and monthly comparisons. These results confirm that worker turnover in Germany is somewhat lower than in the United States. Davis et al. (2006, Table 1) report three different estimates of quarterly worker turnover rates which vary from 18.7% to 49%; our estimated quarterly rate is 18.6%.¹⁷

The cumulative measure of flows 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 1 compares job and worker turnover rates from the establishment survey and the cumulative measure. The hiring and separation rates from the establishment survey are slightly lower than the corresponding estimates from the spell measure, again suggesting that there is some under-reporting of hires and separations in the recall survey data. However, we will show in the next section that this does not materially affect our main conclusion on the relationship between job and worker flows.

churning, they do not greatly affect the relationship between job and worker flows.

¹⁵These data are the “LIAB longitudinal model 3”, provided by the Research Data Centre (FDZ) of the IAB.

¹⁶A comparison of hiring and separation rates from January-June and July-December each year from the spell data confirm that hirings are slightly higher in the first six months, and separations slightly higher 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 annual measure.

¹⁷The most comparable estimate from Davis et al. is that based on “all transitions”, which is 49%. Other estimates of quarterly worker flow rates are 33% (Anderson and Meyer, 1994), 27.1% (Lane, Stevens and Burgess, 1996) and 19.4% (Burgess, Lane and Stevens, 2000).

5 The relationship between job and worker flows

To examine the relationship between job flows and worker flows, we follow Davis et al. (2012) and divide the employment growth rate Δn into a series of $g = 1, \dots, G$ intervals, with mass-point at zero (constant employment). Intervals are narrower nearer zero to reflect greater density of observations. We then regress the worker flow rate of each employer on a vector of dummy variables for the growth rate intervals. That is, we estimate

$$h_{it} = \alpha_i^h + \sum_{g=1}^G \beta_g^h D_{it}^g + \gamma_t^h + \epsilon_{it}^h \quad (4)$$

$$s_{it} = \alpha_i^s + \sum_{g=1}^G \beta_g^s D_{it}^g + \gamma_t^s + \epsilon_{it}^s, \quad (5)$$

where $D_{it}^g = 1$ if $\Delta n_{it} \in g$ and zero otherwise. It is not necessary to estimate both models because $\Delta n = h - s$, but it is convenient to refer to β^h as the estimated hiring response and β^s as the estimated separation response. The models include establishment (α_i) and year (γ_t) fixed effects, so estimates of β^h and β^s are identified only by within-establishment changes in employment. Figure 1 plots the resulting estimates of β^h and β^s , the within-establishment relationship between employment growth (net job flows) and hiring and separation rates.

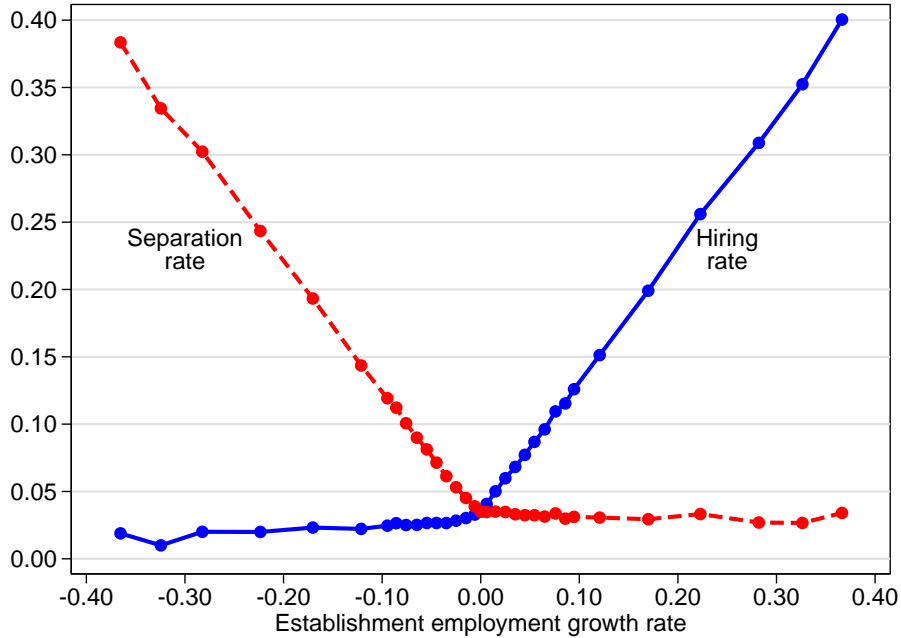


Figure 1: 6-month employment growth, hiring and separations. IAB establishment panel 1993–2009, controlling for establishment and time fixed effects. The range of employment growth shown accounts for 96% of establishments and 99% of employment in the sample.

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. Nevertheless, the annual churning rate for static establishments in France is over 40%, compared to only 14% 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. There is a sharp increase in separations even for small falls in employment. In contrast to the theoretical prediction, the attrition channel (a reduction in hiring) is not the main mechanism by which establishments shrink.

One possible explanation for the 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 Figure 2 we therefore compare the relationship between job and worker turnover from the survey and administrative data.

As expected, Figure 2 shows that there is more churning (hires and separations in excess of employment growth) when measured from both types of social security data (point in time and cumulative), but the key feature remains: separations increase quickly in response to employment falls. There is some evidence in Panel (a) of Figure 2 of hiring reductions, but the separation response is much larger. In short, both the survey data and the social security data suggest that the relationship between worker turnover and employment growth is similar in German and U.S. establishments.

To quantify the extent to which changes in hires contributes to changes in employment, it is convenient to estimate a piecewise linear-spline variant of (4)

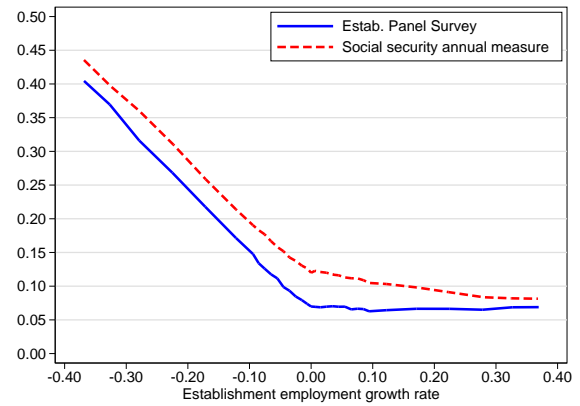
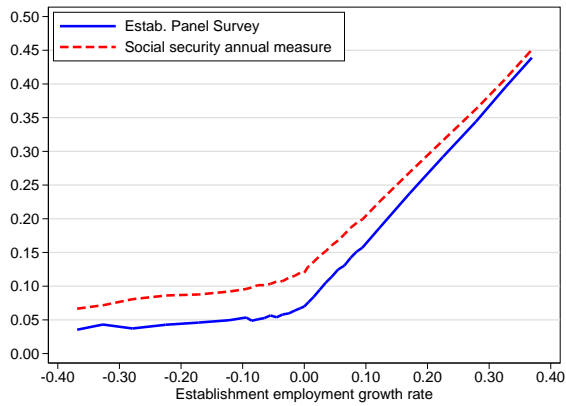
$$h_{it} = \alpha_i^h + \sum_{g=1}^G \delta_g^h (\Delta n_{it} D_{it}^g) + \gamma_t^h + \epsilon_{it}^h \quad (6)$$

In this specification, δ_g^h is the proportion of the employment change accounted for by a change in hiring within employment growth bin g .¹⁸ If establishments reduced employment entirely along the hiring margin rather than the separation margin, then we would find $\delta^h = 1$ for falls in employment which are smaller than \bar{q} (the quit rate). Because δ_g^h is estimated separately for each employment growth bin g , the model allows for the contribution of the hiring margin to vary in an unrestricted way.

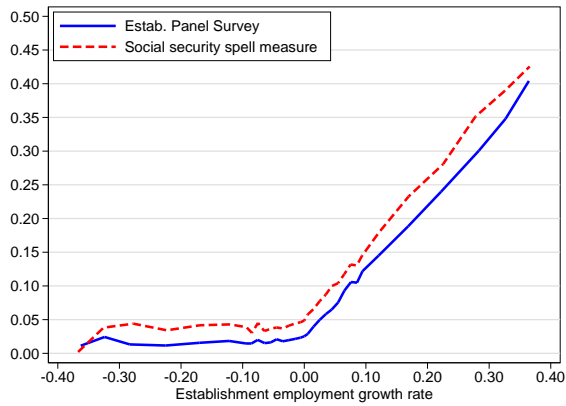
We stress that equation (6) is only descriptive; it does not attempt to identify the causal

¹⁸The model is similar to that used by Albæk and Sørensen (1998), except that it uses a more flexible linear spline rather than imposing a quadratic relationship. This is more appropriate because the theoretical prediction is that there will be a “kink” in the hiring reduction at the point where employment falls exceed \bar{q} .

(a) Hiring, survey vs. point-in-time annual measure (b) Separation, survey vs. point-in-time annual measure



(c) Hiring, survey vs. cumulative measure



(d) Separations, survey vs. cumulative measure

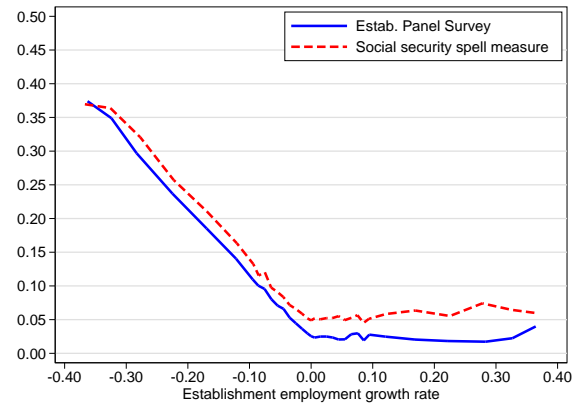


Figure 2: Employment growth, hiring and separations from the IAB establishment panel and comparable social security data, controlling for establishment and time fixed effects. Panels (a) and (b) use annualised data, panels (c) and (d) use data from the first six months of each year.

relationship between job-turnover and worker-turnover.¹⁹ Instead, this model is simply a piecewise-linear version of the non-parametric model estimated by Davis et al. (2012) which 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.

In Figure 3 we plot estimates of δ_g^h from (6) from our full sample of establishments. Panel (a) shows that for small falls in employment ($0 > \Delta n > -0.01$) almost 40% of the reduction is accounted for by a reduction in hires. Larger falls in employment (for example $-0.04 > \Delta n > -0.05$) require a larger increase in separations and so the contribution of hiring reduction is smaller. For positive employment changes, in contrast, almost the entire increase is accounted for by increases in hires, indicating that establishments which grow do not reduce separations, but rely almost entirely on the hiring margin. What is striking about Figure 3 is that, even for very small falls in employment, the role of hiring reductions is considerably less than 0.5 and falls quickly. As was clear from Figure 1, separations increase sharply when employment falls, and hence the contribution of hiring reductions is limited.

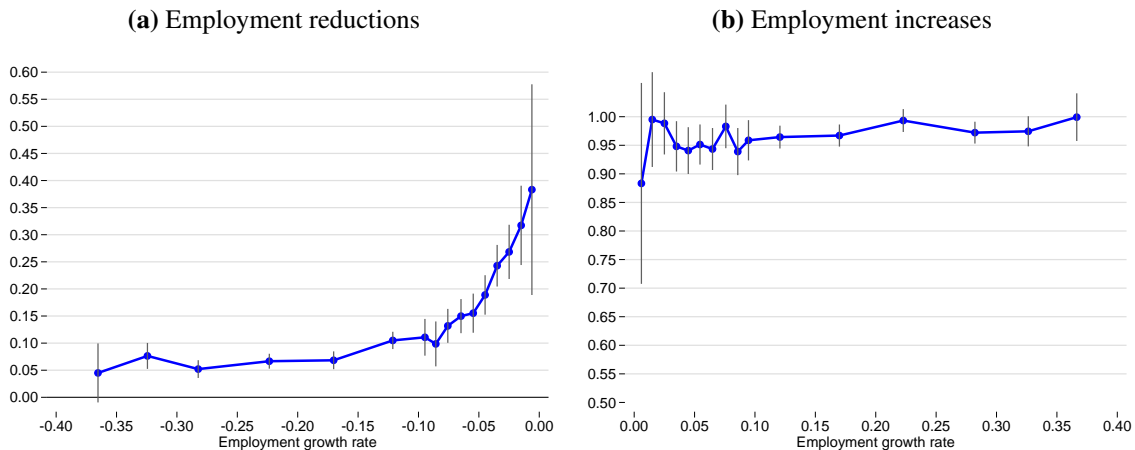


Figure 3: Estimates of δ_g^h from (6). δ_g^h measures the proportion of employment change in bin g accounted for by changes in hiring. Vertical bars indicate 95% confidence intervals based on standard errors clustered at the establishment level.

How robust is this finding? In Table 2 we report our estimates of Equation (6) for the full sample of establishments, and test whether the basic finding holds under different assumptions and different sources of data. Our focus is on small falls in employment, so for brevity in Table 2 we report estimates of δ_g^h for those values of g where $0 > \Delta n \geq -0.2$.

Row (1) reports our baseline estimate from the establishment survey. For employment falls of less than 5%, reductions in hiring account for 22% of the fall, so the remaining 78%

¹⁹For example, in the model of Faberman (2008) a firm may find it optimal to continue an existing job match, but may nevertheless choose not to replace a worker who quits because of the cost of recruitment. Firms may also temporarily shrink if it takes time to find replacement hires. Thus, some firms may contract as a result of worker quits.

Table 2: Estimates from Equation (6) with establishment and year fixed-effects. For example, $\delta_{-0.05}^h$ is the estimated proportion of employment reduction accounted for by a reduction in hiring for $0 > \Delta n \geq -0.05$. 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 point-in-time annual measures reported in rows (3), (4) and (6).

	$\delta_{-0.05}^h$	$\delta_{-0.1}^h$	$\delta_{-0.15}^h$	$\delta_{-0.2}^h$	N	R^2
(1) IAB establishment survey (6-month)	0.221 (0.014)	0.125 (0.009)	0.104 (0.008)	0.068 (0.008)	151,762	0.744
(2) Weighted by sampling weights	0.223 (0.033)	0.117 (0.020)	0.084 (0.017)	0.083 (0.014)	151,762	0.728
(3) Social security annual point-in-time measure	0.336 (0.025)	0.273 (0.013)	0.230 (0.010)	0.191 (0.009)	113,812	0.616
(4) Social security annual measure all workers, 1999 onwards	0.389 (0.034)	0.312 (0.017)	0.270 (0.013)	0.230 (0.012)	90,805	0.663
(5) Social security cumulative measure	0.292 (0.041)	0.152 (0.026)	0.059 (0.023)	0.049 (0.034)	14,464	0.699
(6) Social security annual point-in-time measure (population)	0.282 (0.004)	0.235 (0.002)	0.194 (0.001)	0.160 (0.001)	25,871,214	0.612
(7) Excluding establishments with vacancies at t	0.185 (0.016)	0.110 (0.010)	0.089 (0.009)	0.052 (0.009)	113,151	0.761
(8) Relationship over two years	0.244 (0.024)	0.197 (0.014)	0.131 (0.011)	0.098 (0.011)	109,804	0.670

is accounted for by an increase in separations. The proportion of the employment change accounted for by hiring reductions naturally falls for larger employment reductions, since it becomes more difficult for establishments to accommodate these falls without increasing separations.

In row (2) 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 δ^h varies across establishment size, then weighting will make a difference. In fact, row (2) shows that weighting makes little difference to our results.

In row (3) we estimate the same model using the social security point-in-time data (for those establishments which match to the survey data). Figure 2 showed that there was substantially more churning in the social security data, and also that hires appear to fall slightly more when establishments shrink. The result is that the estimated contribution of hiring to employment reductions is larger ($\delta_{-0.05}^h = 0.336$), but hires still contribute significantly less than half of the total fall in employment.

In Appendix C we describe various issues in the calculation of worker flows from the social security data. In particular, we note that from 1999 onwards the social security data include records for more marginal workers (for example, those with temporary contracts). The inclusion of these workers in measures of worker flows increases the churning rate, and as a result might be expected to increase the contribution of hiring reductions to employment falls. The idea is that an establishment with temporary workers which wishes to reduce employment can simply not renew contracts. Row (4) shows that the inclusion of all workers from 1999 onwards does increase the estimate of δ_g^h , but does not alter our conclusion that the majority of employment reductions are accomplished by increasing separations, not reducing hires.

In row (5) we use the cumulative measure from spell-based social security data. This makes little difference to the estimated contribution of hiring reductions. Using the entire population of establishments in row (6) also results in a similar estimate.

A potential concern is that the strong relationship between separations and small employment reductions is the result of reverse causality. Perhaps, in the short-run, establishments which lose workers via quits also shrink because it takes time to find a suitable replacement. We can investigate this possibility because the survey asks whether establishments have any unfilled vacancies. To eliminate the possibility that short-term fluctuations in employment are driven by quits, in row (7) we report estimates based on a sample of establishment which report having no vacancies. Arguably, establishments which reduce employment and which have no vacancies cannot have reduced in size because of quits. Excluding establishments

with vacancies actually reduces the estimates of δ_g^h . In other words, the relationship between separations and employment reductions is stronger in these establishments.

Another similar check is provided in row (8). If short-term fluctuations in employment are caused by worker quits, then the relationship between separations and employment reductions should be less strong over a two-year interval. This does not seem to be the case, since the estimated hiring response is still small.

Overall, estimates of δ_g^h are quite stable across all these different samples. In every case, the contribution of hiring reductions to even small employment falls is considerably less than one-half, confirming that German establishments which shrink do indeed increase separations, despite the institutional constraints they face.

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 3 estimates (6) 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, although the estimates of $\delta_{-0.05}^h$ do vary significantly across industries (p -value=0.010), in no case does the estimated hiring response exceed one-third of the total employment fall. The hiring response is largest, and hence the separation response smallest in Transport and Communication, Manufacturing and Other Services. There appears to be even less difference in the hiring response for larger falls in employment. Thus, although industries vary significantly in terms of their average worker turnover rates (see Table 1), this does not seem to be caused by a different response to a given change in employment.

In the second panel of Table 3 we compare the adjustment path between establishments of different sizes.²⁰ The highest estimates of $\delta_{-0.05}^h$ are for the two smallest establishment size categories, although note that there are few observations in these categories and these estimates are rather imprecise. For establishments with more than 20 employees $\delta_{-0.05}^h$ increases with establishment size, although there is no significant difference in the hiring response for larger falls in employment. But, even for the largest size category the hiring response is still only one-quarter of the total employment fall.

In the third panel of Table 3 we compare δ_g^h between establishments located in West and East Germany.²¹ Establishments in West Germany have a significantly higher hiring response and therefore a smaller separation response, but the size of the difference is quantitatively

²⁰We use establishments' initial size to avoid a contemporaneous relationship between size categories and changes in employment.

²¹Establishments in West Berlin are included in the East German sample for consistency over time.

Table 3: Estimates of Equations (6) 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.

	$\delta_{-0.05}^h$	$\delta_{-0.1}^h$	$\delta_{-0.15}^h$	$\delta_{-0.2}^h$	N	R^2
Primary industries (Agriculture, mining)	0.134 (0.093)	0.050 (0.066)	0.084 (0.063)	0.050 (0.049)	6,140	0.795
Manufacturing	0.251 (0.015)	0.138 (0.011)	0.091 (0.011)	0.072 (0.013)	49,942	0.754
Construction	0.057 (0.063)	0.105 (0.027)	0.088 (0.023)	0.041 (0.022)	17,946	0.789
Wholesale and retail trade	0.187 (0.027)	0.138 (0.017)	0.110 (0.017)	0.060 (0.017)	26,902	0.694
Transport and communication	0.302 (0.070)	0.134 (0.046)	0.125 (0.035)	0.139 (0.043)	6,576	0.751
Financial and business services	0.184 (0.054)	0.083 (0.030)	0.091 (0.027)	0.047 (0.027)	21,459	0.718
Other services	0.292 (0.060)	0.117 (0.041)	0.152 (0.024)	0.103 (0.023)	22,797	0.735
<i>p</i> -value H_0 : Adjustment equal	[0.010]	[0.384]	[0.315]	[0.257]		
0–10 employees	0.314 (0.220)	0.118 (0.030)	0.096 (0.016)	0.060 (0.013)	57,883	0.742
11–20 employees	0.302 (0.054)	0.102 (0.019)	0.098 (0.016)	0.072 (0.017)	19,080	0.746
21–30 employees	0.118 (0.035)	0.102 (0.024)	0.091 (0.025)	0.039 (0.029)	13,308	0.796
31–50 employees	0.171 (0.042)	0.137 (0.023)	0.094 (0.025)	0.049 (0.034)	12,728	0.779
51–100 employees	0.181 (0.036)	0.096 (0.031)	0.156 (0.030)	0.091 (0.037)	14,243	0.778
> 100 employees	0.252 (0.018)	0.149 (0.014)	0.108 (0.016)	0.100 (0.018)	34,520	0.678
<i>p</i> -value H_0 : Adjustment equal	[0.004]	[0.191]	[0.550]	[0.354]		
West Germany	0.241 (0.015)	0.143 (0.010)	0.109 (0.010)	0.082 (0.011)	92,192	0.730
East Germany	0.179 (0.027)	0.091 (0.016)	0.095 (0.013)	0.049 (0.013)	59,570	0.759
<i>p</i> -value H_0 : Adjustment equal	[0.044]	[0.007]	[0.411]	[0.057]		
1993–1995	0.400 (0.044)	0.217 (0.032)	0.138 (0.024)	0.089 (0.036)	8,985	0.698
1996–1999	0.292 (0.037)	0.137 (0.023)	0.138 (0.023)	0.082 (0.022)	25,639	0.744
2000–2002	0.182 (0.041)	0.176 (0.023)	0.149 (0.021)	0.094 (0.016)	33,409	0.726
2003–2006	0.177 (0.025)	0.092 (0.015)	0.086 (0.014)	0.029 (0.018)	47,559	0.781
2007–2009	0.215 (0.039)	0.098 (0.027)	0.105 (0.022)	0.084 (0.021)	36,170	0.716
<i>p</i> -value H_0 : Adjustment equal	[0.000]	[0.000]	[0.453]	[0.097]		

small. This finding is consistent with the fact that the separation and layoff rate is higher in East Germany (see Table 1).

The final panel of Table 3 compares the adjustment path across the business cycle, using sub-periods based on the aggregate unemployment rate.²² If the quit rate is pro-cyclical, then firms which need to reduce employment in a boom will be able to shrink more easily without making layoffs and we would expect δ_g^h to be pro-cyclical. However, although $\delta_{-0.05}^h$ does vary across the periods (p -value < 0.000), there is little evidence that it does so in a way which is systematically related to the business cycle.

Overall, our results clearly indicate that German establishments rely heavily on the separation margin when they reduce employment. 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 split between voluntary and involuntary separations, as defined in Section 4.

The relationship between layoffs and Δn is stronger than the relationship between quits and Δn only for large ($> 30\%$) falls in employment. For establishments with employment growth, 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). To quantify these effects more precisely, we estimate (6) but with separations as the dependent variable:

$$s_{it} = \alpha_i^s + \sum_{g=1}^G \delta_g^s (\Delta n_{it} D_{it}^g) + \gamma_t^s + \epsilon_{it}^s. \quad (7)$$

The coefficients δ_g^s tell us the proportion of the employment fall accounted for by separations.²³ The first row of Table 4 reports estimates from (7) for all separations, so this replicates the base model with $\delta_g^s = \delta_g^h - 1$. From Table 2 we know that the hiring response to a fall in employment of less than 0.05 is 0.221, so the separation response must be 0.779.

In rows (2) and (3) we split total separations into those classified as quits and layoffs. As was clear from Figure 4, there is an increase in both quits and layoffs. For small falls in employment ($0 > \Delta n \geq -0.05$) slightly more than half of all separations are classified

²²Periods 1996–1999 and 2003–2006 had higher than average aggregate unemployment.

²³ δ_g^s will be negative because separations increase when Δn_{it} is negative.

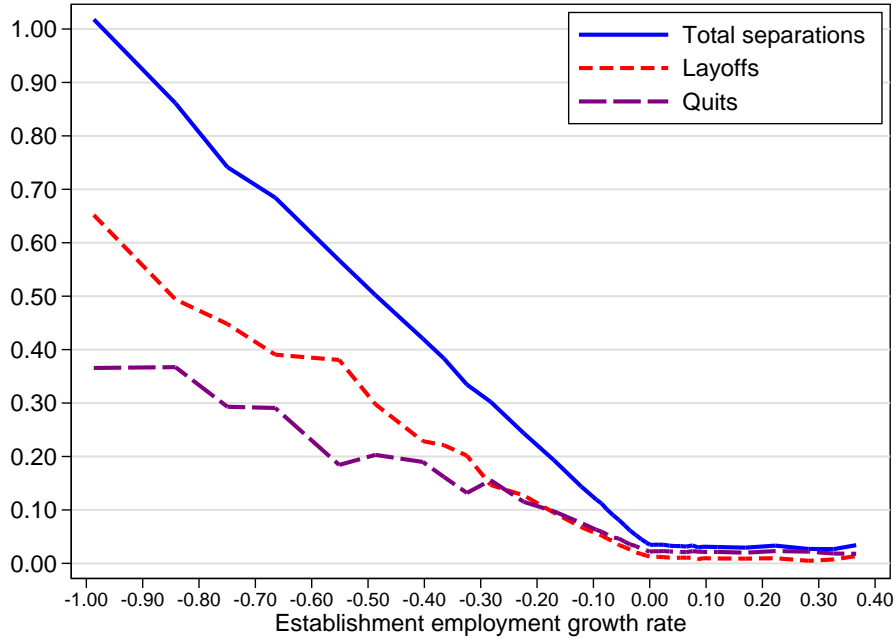


Figure 4: Relationship between layoffs, quits and job flows. We label separations as employer initiated if the respondent classified them as “Dismissal on the part of the employer”, “Leaving after termination of in-company training” or “Expiration of a temporary employment contract”. All other separations are classified as quits (see Appendix A for a list of all separation categories).

Table 4: Estimates of Equations (7) with different definitions of separation. Standard errors in parentheses are clustered at the establishment level. See Figure 4 for a definition of “All layoffs” and “All quits”. “Dismissals only” are defined as cause 2 and “Resignations only” are defined as cause 1 in Table A1.

	$\gamma_{-0.05}^s$	$\gamma_{-0.1}^s$	$\gamma_{-0.15}^s$	$\gamma_{-0.2}^s$	$\gamma_{-0.3}^s$	$\gamma_{-0.4}^s$	N	R^2
(1) All separations (Quits + layoffs)	-0.779 (0.014)	-0.875 (0.009)	-0.896 (0.008)	-0.932 (0.008)	-0.948 (0.008)	-0.955 (0.028)	151,762	0.735
(2) All layoffs	-0.374 (0.014)	-0.445 (0.010)	-0.453 (0.011)	-0.484 (0.012)	-0.474 (0.015)	-0.572 (0.043)	151,762	0.423
(3) All quits	-0.409 (0.014)	-0.429 (0.009)	-0.441 (0.010)	-0.444 (0.012)	-0.475 (0.016)	-0.382 (0.036)	151,762	0.301
(4) Dismissals only	-0.213 (0.013)	-0.292 (0.009)	-0.332 (0.010)	-0.362 (0.011)	-0.374 (0.015)	-0.484 (0.043)	151,762	0.384
(5) Resignations only	-0.250 (0.011)	-0.225 (0.008)	-0.224 (0.008)	-0.244 (0.010)	-0.250 (0.014)	-0.157 (0.026)	151,762	0.103

as quits. For larger employment reductions the contribution of layoffs increases, although it is striking that quits still contribute one-third of the total employment reduction for $-0.3 > \Delta n \geq -0.4$.

To some extent our classification of separations into quits and layoffs is arbitrary.²⁴ For example, cause 5 (“termination by mutual agreement” – see Appendix A) might in fact be better thought of as a layoff. To be clear about what is driving the result in Table 4, in rows (4) and (5) of we also report the relationship between job flows and those separations defined as “Dismissal on the part of the employer” and “Resignations on the part of the employee”. Here we see a larger difference in the response between the two types of separation. But, even when quits are more narrowly defined, they still account for about one-quarter of the employment reduction for small falls in employment and about one-sixth for larger falls in employment. Narrowly-defined layoffs only account for one-fifth of small falls in employment, but nearly half of large falls in employment.

Table 4 thus shows that part of the explanation for the fact that separations increase rapidly with employment falls is that the quit rate also increases rapidly. (Recall that in the basic theoretical framework \bar{q} was constant.) German establishments can reduce employment via separations because a substantial fraction of those separations are classified as “voluntary”. Thus, employment reductions are managed by “voluntary redundancy” or workers choosing to leave shrinking establishments because shrinking establishments offer worse opportunities.²⁵ Thus quits, or voluntary redundancies, an important margin which firms can use to meet reduced labour demand.

5.3 Variation across labour market institutions

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 5 we examine how δ_g^s varies across different types of establishment. The establishment characteristics we examine are all expected to be correlated with hiring and firing costs for the establishment:

²⁴Indeed, McLaughlin (1991) argues that there is no meaningful distinction.

²⁵Davis et al. (2012) call this the “abandon-ship” effect; the model of Faberman (2008) predicts that workers at less successful firms are more likely to quit.

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 and 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.²⁶ 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). Establishments with more fixed-term workers will have a higher churning rate, and therefore reductions in employment can more easily be accommodated by the attrition channel.
5. The proportion of freelance 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 in the establishment.²⁷ 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 (6) 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 the interaction term means that the hiring response is larger; these establishments therefore rely less on separations when they shrink.

Table 5 shows that the largest difference is for establishments with a higher proportion of fixed-term workers, whose hiring response is significantly larger for small falls in employment. The baseline hiring response (Row 1 of Table 2) is 0.221, so this suggests that the hiring response of establishments with a higher proportion of fixed-term workers is twice as

²⁶The definition of “part-time” is not made explicit in the questionnaire.

²⁷Skilled workers are defined as workers in jobs which require a vocational qualification, university degree or higher.

Table 5: Variation in adjustment by plant-level characteristics. Estimates of Equation (7), involuntary separations only. The estimated coefficients represent the change in the separation response for establishments with and without that characteristic.

	<i>Change in:</i>			
	$\delta_{-0.05}^h$	$\delta_{-0.1}^h$	$\delta_{-0.15}^h$	$\delta_{-0.2}^h$
Firm-level bargaining agreement	0.047 (0.031)	0.030 (0.019)	-0.014 (0.017)	0.006 (0.018)
Sectoral-level bargaining agreement	0.156*** (0.050)	0.071* (0.036)	0.006 (0.032)	-0.009 (0.028)
Works council	0.072** (0.028)	0.040** (0.016)	-0.017 (0.014)	0.022 (0.015)
Prop. part-time workers > median	0.011 (0.027)	0.003 (0.017)	-0.010 (0.016)	0.002 (0.017)
Prop. female workers > median	0.050* (0.028)	0.017 (0.018)	-0.002 (0.016)	0.016 (0.016)
Prop. fixed-term workers > median	0.232*** (0.030)	0.069*** (0.019)	0.025 (0.019)	0.006 (0.025)
Prop. freelance workers > median	0.020 (0.029)	0.034* (0.018)	-0.001 (0.018)	0.023 (0.020)
Prop. agency workers > median	0.026 (0.032)	0.068*** (0.022)	-0.000 (0.023)	-0.010 (0.050)
Prop. skilled workers > median	-0.093*** (0.029)	-0.019 (0.019)	-0.036** (0.016)	-0.016 (0.016)

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

large. Establishments with a higher proportion of fixed-term workers can shrink simply by not replacing these workers, hence the hiring response is larger. This result goes some way to explaining the difference in the hiring response of French establishments, who have a larger proportion of fixed-term workers.

The second largest difference comes from differences in bargaining arrangements. Establishments with sectoral-bargaining agreements have a significantly higher separation response, and again the difference between these establishments and those with no union bargaining is qualitatively large. Works councils have a similar, but smaller effect. This difference is consistent with the idea that separations are more costly (either financially or in terms of time) for establishments which must negotiate layoffs with unions or works councils.

However, other differences in Table 5 do not appear to have much impact on the use of hiring as opposed to separations. It is also striking that those differences which are significant only matter for small falls in employment (less than 10%). For larger falls almost none of the effects are significantly different from zero. This reflects the fact that separations are unavoidable for larger falls in employment.

6 Why do German establishments use separations?

The key finding in this paper is that German establishments' separation rates increase strongly when they shrink. We have shown that this result is quite robust across data sources, establishment types and different institutional arrangements in place in the establishment. Part of the explanation for this phenomenon is the fact that voluntary redundancies or the quit rate can be used to achieve employment falls. Nevertheless, a substantial part of the employment adjustment is still achieved via layoffs.

A second potential explanation for our finding is that the churning rate in German establishments is low, and therefore establishments which need to reduce employment cannot rely on attrition. To illustrate this, Figure 5 shows the result of a simulation in which establishments face a random negative shock to labour demand. Each establishment has an IID steady-state churning rate, and adjusts to the new level of labour demand within one period by utilising quits where possible. We then calculate churning as $h_{it} + s_{it} - |\Delta n_{it}|$, separate the sample into high- and low-churn establishments, and calculate δ_g^h using (6).

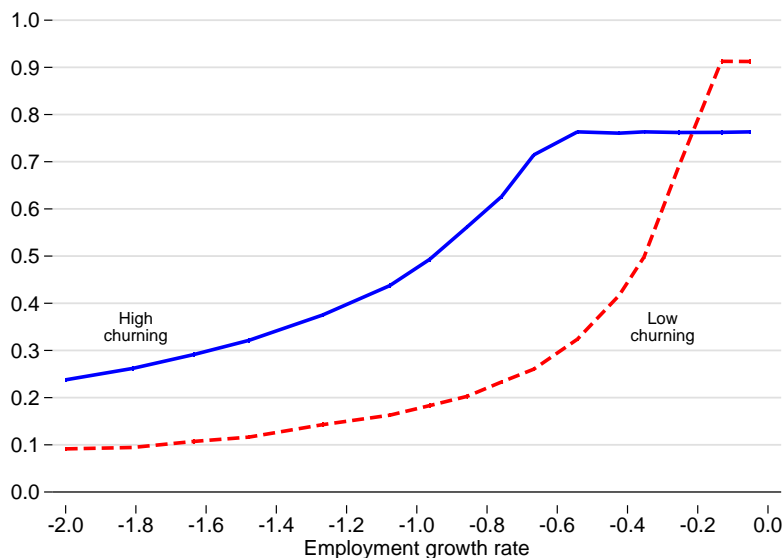


Figure 5: Proportion of employment reduction accounted for by falls in hiring. Figure is based on a simulated sample of 10,000 establishments whose churning rate is randomly drawn. Each establishment is given a randomly drawn employment reduction and accommodates that reduction using falls in hiring where possible.

Figure 5 illustrates that, if establishments rely on hiring reductions to achieve small falls in employment, δ_g^h will be high (and constant) up to the point where the desired employment reduction equals the steady-state quit rate (\bar{q}).²⁸ For high-churn establishments this allows

²⁸The reader may wonder why δ_g^h is not equal to one up to this point. The reason is that all rates are calculated with $0.5(N_t + N_{t-1})$ in the denominator, as in (2) and (3). When an establishment shrinks in this simulation,

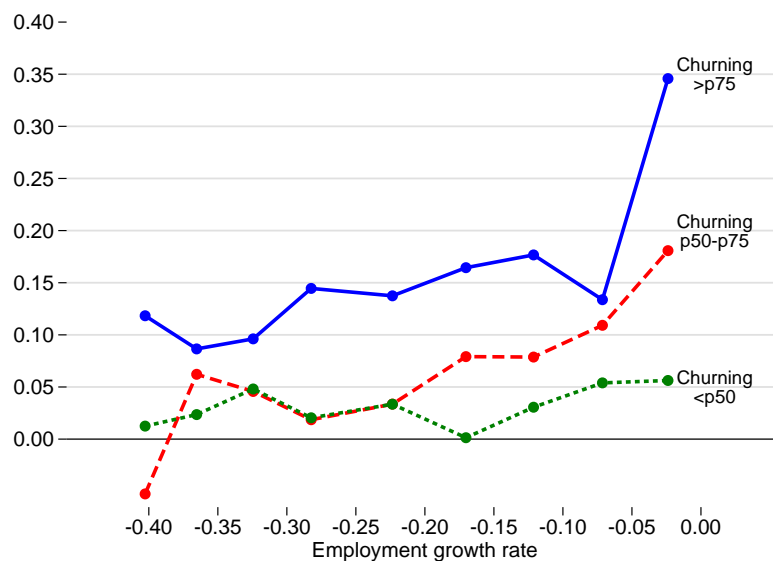


Figure 6: Proportion of employment reduction account for by falls in hiring, establishment survey. Churning is calculated as the average of $h + s - (\Delta n)$ for periods $t - 1$, $t - 2$ and $t - 3$, so the first three periods of data are lost for each establishment.

for larger falls in employment without any increase in separations. Once \bar{q} is exceeded, separations must be used, and hence δ_g^h must fall.

We then repeat the exercise using the establishment survey data. For each establishment we compute the churning rate for the three previous years and separate into low (below the median), medium (median to 75th percentile) and high (above 75th percentile) churning establishments. Results are reported in Figure 6. As in the simulation, the use of hiring reductions increases with the churning rate. However, even for high churning establishments we do not observe anywhere near the rates of hiring reduction predicted by a model in which establishments use the attrition channel wherever possible. It is clear that, even for high-churn establishments, separations are an essential part of employment reduction.

The prediction that establishments should rely on the attrition channel relies on the assumption that jobs and workers within the establishment are homogeneous. In this case, workers who quit can be used to achieve the new level of employment. However, if the establishment comprises many different jobs, workers whose jobs are destroyed cannot be re-allocated to the positions of those workers who quit.²⁹ Thus, even when an establishment is shrinking it must still make replacement hires because these jobs are still required.

The social security data allows us to test this by examining the pattern of hires and separations are constant (because establishments initially reduce hiring) but the separation rate increases because N_t falls. Hence the fall in hiring does not account for 100% of the fall in employment.

²⁹Albæk and Sørensen (1998) make exactly this point: “. . . most workers are specialised and not easily reshuffled from vanishing jobs to jobs of otherwise separating workers”, although they do not provide direct evidence of this.

tions within narrowly defined occupations within the establishment. The social security data contains 369 three-digit occupation codes.³⁰ Mean establishment employment is 147, while mean employment within an occupation within an establishment is just 11. It seems plausible therefore that jobs and workers within occupations are much more homogeneous than within establishments. We create a panel of occupations within establishments, and calculate the same decomposition i.e. $\Delta N_{ijt} = H_{ijt} - S_{ijt}$, where i indexes establishment as before and j indexes occupation.

ΔN_{ijt} and its constituent hires and separations may now be driven by within- and between-establishment movement of workers. For example, a worker who moves from occupation $j = a$ to $j = b$ within establishment i will cause N_{iat} to fall by one and N_{ibt} to increase by one with $S_{iat} = 1$ and $H_{ibt} = 1$. In fact, however, 86% of hires and separations at the occupation-establishment level are the result of between establishment worker movements. Thus, to reallocate employment between jobs, firms must hire and separate rather than simply reshuffle existing workers.

As noted in Section 2, churning may be driven by workers joining and leaving a given set of jobs, or by changes in the composition of jobs. For example, an establishment may destroy a job in occupation a and create a job in occupation b . Our occupation-establishment level panel allows us to calculate the extent to which churning is driven by the former or the latter. In Figure 7 we plot the coefficients from a fixed-effects regression of the churning rate on the employment growth rate.

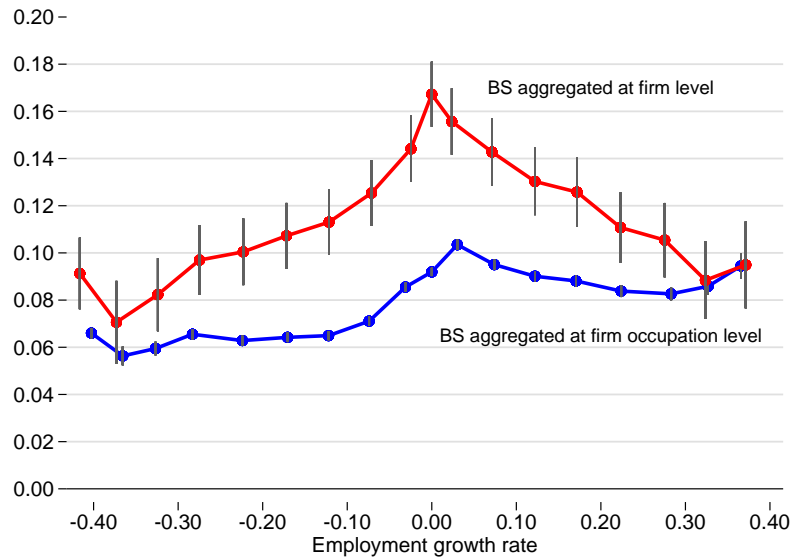


Figure 7: Churning at the occupation level and the establishment level as a function of employment growth, computed from the point-in-time social security data (BS). Churning is defined as $h_{ijt} + s_{ijt} - |\Delta n_{ijt}|$ at the occupation level and $h_{it} + s_{it} - |\Delta n_{it}|$ at the establishment level. Vertical bars indicate 95% confidence intervals based on standard errors clustered at the establishment level.

³⁰The occupational classification used is the *Klassifizierung der Berufe, Ausgabe 1992 (KldB 92)*

Figure 7 shows that churning is indeed much lower at the occupation-establishment level. At zero employment growth, more than 40% of the establishment-level churning is the result of changes in occupational composition within the establishment. If workers cannot easily be reallocated across occupations (as we have shown) then this provides an explanation for the continued hiring behaviour of shrinking establishments, and the fact that there is such a strong separation response. Essentially, an establishment which wishes to reduce employment in one occupation cannot use attrition from another occupation to achieve that reduction.

7 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 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 immediately with reduced employment. Even small falls in employment are associated with significant increases in separations, and the separation margin is more important than the hiring margin in almost every case we examine. This result is robust across survey and administrative data and across different types of establishment.

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 evidence that more formal bargaining arrangements increase the extent to which establishments use the attrition channel to reduce employment. This is consistent with a model in which increases in separation costs lead to greater use of the attrition channel. We also find that the share of fixed-term contracts increases the attrition channel. The very different pattern of behaviour observed by French establishments in Abowd et al. (1999) may therefore be due to the larger fraction of fixed-term contracts in that country.

Why do German establishments need to make use of increased separations when they reduce employment? We propose three explanations. First, a large fraction of separations are classified as voluntary by establishments. Second, the level of churning is low, and so

the scope for reduced hiring is limited. Third, the heterogeneity of jobs within establishments prevent “reshuffling” of existing workers into those positions which are made vacant by attrition.

Finally, despite the fact that we find a strong relationship between separations and employment reductions, 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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Appendix A 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 10 different categories, shown in Table A1.

Table A1: Six-month separation rate by type of separation. Table shows the mean separation rate across all establishments and all years, \bar{s} , the fraction of establishment-years with positive separations, $\Pr(s_{it} > 0)$, and the average separation rate for those establishment-years with any separations of that type, $\bar{s} \mid s_{it} > 0$. Weighted by sampling weights and employment.

	\bar{s}	$\Pr(s_{it} > 0)$	$(\bar{s} \mid s_{it} > 0)$
All separations	5.31	51.07	8.53
1. Resignation on the part of the employee	1.90	29.22	4.52
2. Dismissal on the part of the employer	1.54	24.68	4.89
3. Leaving after termination of the in-company training	0.20	6.96	1.98
4. Expiration of a temporary employment contract	0.49	12.36	2.59
5. Termination of a contract by mutual agreement	0.39	9.77	2.41
6. Transfer to another establishment within the organization	0.12	3.66	1.76
7. Retirement after reaching the stipulated pension age	0.30	12.82	1.42
8. Retirement before reaching the stipulated pensionable age	0.05	3.26	1.04
9. Occupational invalidity/ disability	0.02	1.35	0.63
10. Other	0.27	4.83	3.61

Appendix B Basic sample characteristics

Table B1: 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.

Appendix C Calculating worker flows from the social security data

The worker-level social security data can be used to identify when individuals join and leave establishments. However, the precise measure of hires and separations is affected by (a) the choice of which workers to include and (b) the treatment of gaps in individuals' social security records.

Until 1999 the social security data contained information (predominantly) on permanent workers subject to social security. From 1999 onwards the data include records for other more marginal types of worker. Figure C1 shows that the hiring and separation rate is about 3.5 percentage points higher if we include all workers in the calculation as opposed to just permanent workers covered by social security. Figure C1 additionally shows that gaps in individuals' social security record also increase the measure of hires and separations. A “gap” occurs if an individual works for establishment j in period t and at j in period $t + k$ ($k > 1$) without an intervening spell of employment. If temporary layoffs are an important feature of the data, the inclusion of these gaps could make a difference. Including these gaps increases the measured hiring and separation rate by about 2.7 percentage points.

In order to achieve a consistent series over the whole time period our measure of worker flows reported in the paper is based only on permanent workers covered by the social security system, and does not count a gap as a separation and hire. Note that none of these decisions changes our key conclusion as to the relationship between worker flows and job flows.

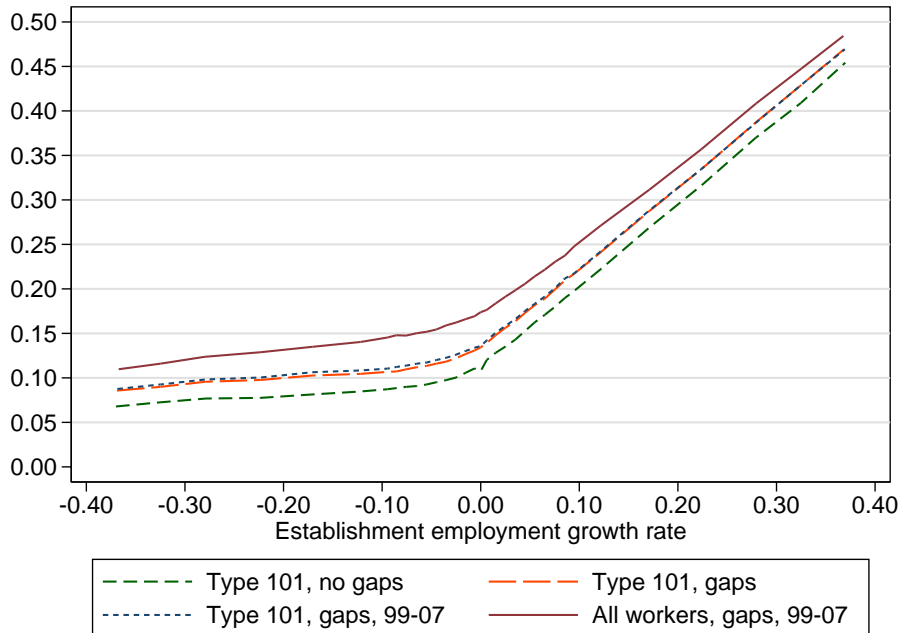


Figure C1: Annual employment growth, hires and separation calculated from social security statistics. “Type 101” indicates that the sample includes only permanent workers subject to social security. “Gaps” indicate that workers who temporarily leave and rejoin the same establishment because of a gap in their social security record are included as hires and separations. “99-07” indicates that the data cover the period 1999–2007 only.