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Published on: 01 Nov 2010 - Empirica (Springer US)

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Working Paper

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Dresden Discussion Paper Series in Economics, No. 02/08

Provided in Cooperation with:
Technische Universität Dresden, Faculty of Business and Economics

Suggested Citation: Fuchs, Michaela; Weyh, Antje (2008) : The determinants of job creation and destruction: plant-level evidence for Eastern and Western Germany, Dresden Discussion Paper Series in Economics, No. 02/08, Technische Universität Dresden, Fakultät Wirtschaftswissenschaften, Dresden

This Version is available at:
http://hdl.handle.net/10419/36495

TECHNISCHE UNIVERSITÄT DRESDEN

Dresden University of Technology
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Dresden Discussion Paper Series in Economics

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Dresden Discussion Paper in Economics No. 02/08

ISSN 0945-4829

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Internet:

An electronic version of the paper may be downloaded from the homepage:
http://rcswww.urz.tu-dresden.de/wpeconomics/index.htm

English papers are also available from the SSRN website:
http://www.ssrn.com

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The Determinants of Job Creation and Destruction: Plant-level Evidence for Eastern and Western Germany

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Abstract:

We examine job creation and destruction in Eastern and Western Germany for the period of 1999 to 2004, using a large dataset, which enables us to capture clearly entries and exits. There are pronounced differences between the two parts of Germany in terms of magnitude and composition of gross job flows. Considering interaction effects between all variables, weighted regressions show that job creation and destruction can be explained to a large part by plant-specific factors. The pattern found to be pervasive in descriptive studies for other countries that job reallocation rates diminish with firm size and firm age also holds true for Germany. Given that East German plants are smaller and younger than their West German counterparts, this finding largely explains the differences between the East and West German labour dynamics.

JEL-Classification: J63, O18

Keywords: Job Creation and Destruction, Job Turnover, Employment Growth, Employment-weighted Regression

Acknowledgements: We are indebted to Udo Brixy, Georg Hirte and Norbert Schanne for helpful comments on earlier versions.

1 Introduction

The number of employees liable to social insurance in Germany diminished by a yearly average of 0.4 percent from 1998 to 2006. This aggregate figure conceals pronounced gross flows of employment, which arise out of the creation and destruction of jobs on the level of individual plants. Newly founded plants enter the market and create new jobs, whereas unprofitable plants close down and thus contribute to job destruction. Existing plants, on the other hand, are in a continuous process of adaptation to technological progress, the growth and decline of markets and changes in their competitive environment. Hence, in the course of the ongoing structural change, unprofitable jobs vanish to be replaced by new, profitable jobs. The ensuing demand for labour can be analysed in detail with the concepts of job creation and destruction.

The interest in using firm-level data to study the rate at which an economy is able to create or destroy jobs has risen continuously. Influential studies on labour dynamics in the United States were undertaken by Davis and Haltiwanger (1992), Davis et al. (1996) and Davis and Haltiwanger (1999). Policy-oriented analysis was undertaken by e.g. OECD (1994).[1] The basic findings pervasive throughout the countries under study are that gross job flows greatly exceed the corresponding net changes in employment, and job creation as well as destruction vary systematically by sector and plant size (Davis et al., 1996).

This paper provides detailed empirical evidence on gross job flows and their components in Germany. While there are earlier studies dealing with gross job flows in Western Germany (Cramer and Koller, 1988; Boeri and Cramer, 1992) as well as in Eastern Germany (Lehmann, 1994; Lehmann, 1996; Brixy, 1999), to our knowledge this is the first study that analyses the job creation and destruction process for both Western and Eastern Germany in depth. Job creation is decomposed into employment generated by plants entering the market and by existing and growing plants, job destruction into existing and declining plants and exits. We also investigate the characteristics of the plants contributing to the creation and destruction of jobs other than from the regional perspective. Finally, we use an econometric approach to examine the structural determinants of job

[1] For theoretical models of the labour market focusing on job flows, see Mortensen and Pissarides (1994) or Blanchard and Diamond (1992).

creation and destruction in a multivariate framework, which takes into account the possible interaction between the various plant and regional characteristics. We conduct our analysis with the help of an extensive dataset of all plants employing at least one person subject to social security.

The remainder of the paper is structured as follows. In section 2 we describe our data set and measurement issues related to the concept of job creation and destruction. Detailed descriptive statistics of the job reallocation process in Eastern and Western Germany are presented in section 3. In section 4 we examine the determinants of the job creation and destruction process more rigorously within a multivariate framework. Section 5 concludes.

2 Data and Measurement Issues

2.1 Data Source and Coverage

For our analysis we draw on yearly data from the establishment file of the German Social Insurance Statistics for the period from 1998 to 2006. This comprehensive database covers all plants with employees liable to pay social security contributions and is collected by the Federal Office of Labour (Bundesagentur fuer Arbeit). The Social Insurance procedure was introduced in 1973 and compels employers to report every year all changes that have occurred in the number of workers who are subject to health or unemployment insurance or who participate in a pension scheme. There are legal sanctions for misreporting. This way, small and young plants are also included. All employment observations refer to June 31st of each year. Plants which are newly founded during the period between two dates are classified according to their employment levels at the end of the respective period. Individual plants included in the database are assigned an identification number even when they belong to the same firm.[2] This way, we can follow the development of

[2]In the following we define a plant as the smallest economic unit where production takes place. In general, plant-level data should be preferred on both conceptual and measurement grounds (Davis and Haltiwanger, 1999, 2716). Choosing plants instead of firms as the unit of observation has the advantage that the special features of Eastern Germany, where many West German firms established branches, can be better captured.

roughly 2.3 million plants over time and analyse simultaneously the growth and decline of incumbent plants as well as entry and exit behaviour.

In principle, the data are available from 1991 to 2006. Due to a change in the classification schemes in 1998, however, the relevant time period for our analysis starts in 1999.[3] It ends in 2004, which is again due to the particularities in defining exits. Over the observation period, the number of employees kept track of in the establishment file of the German Social Insurance Statistics fell slightly in Western Germany from 21.6 million in 1999 to 21.4 million in 2004 and from 5.9 million to 5.1 million in Eastern Germany. These numbers represent approximately 70 percent of total employment, the remaining 30 percent consisting of civil servants, self-employed and people in limited employment. Since civil servants and self-employed are concentrated in agriculture and in the public sector, we have excluded these sectors from our data set. Hence, the analysis comprises 47 sectors at the 2-digit NACE level from productive industries and services.[4]

Entries and exits of plants are identified by comparing the number of employees of each individual plant at different points in time. Entrants (exits) are defined as plants which had no (some) registered workers at $t-1$, but some (no) dependent employees at t. When applying these definitions to the establishment file of the German Social Insurance Statistics, some special features have to be noted. Not all identification numbers which are newly added to the dataset indicate that the underlying establishments are start-ups. Original start-ups, i.e. the foundation of a new establishment, cannot be separated from reorganisations and outsourcing. One way to overcome this problem is to count a new identification number as an entry only if this number has not appeared in the statistics three years before the respective date, i.e. if the plant has not reported any employees liable to pay social security contributions. The same identification problems exist with exits. Analogous to entries, identification numbers are counted as exits if they have not appeared in the database for three consecutive years. According to Brixy and Fritsch

[3]Until 1998, the industry code WS73 was in use, which was then replaced by the NACE Rev.1 classification (this classification system conforms to the ISIC Rev.3 at the 2-digit level). Since we need data from the (preceding) year $t-1$ to determine the industry a closing plant belongs to in t, 1999 is the first year which can be used for our analysis.

[4]The sectors belong to mining, manufacturing, energy supply, construction, trade, restaurants, traffic, financial services, business-oriented services and other public and private services.

(2002) the resulting bias in entries and exits is rather limited.

2.2 Definition of Job-Flow Measures

In the following we take the widely used notations and formulas of Davis and Haltiwanger (1999) as the basis for our definitions of job flow measures: (gross) job creation at time t equals the employment gains summed over all plants either entering the market or expanding between $t-1$ and t. Likewise, (gross) job destruction at time t equals the employment losses summed over all contracting or exiting plants between $t-1$ and t. Net employment change, then, is just the difference between job creation and destruction. Job reallocation at time t is the sum of all employment gains and losses in the plants that occur between $t-1$ and t and equals the sum of job creation and destruction.

Formally, let EMP_{pst} denote the number of workers at employer p in sector s at time t. S_t denotes the set of employers with positive employment in t or $t-1$. S_t^+ stands for the subset of employers that expand or enter between $t-1$ and t. We further decompose this measure of job creation into employers that newly enter the market, S_t^{N+}, and incumbent employers that expand, S_t^{X+}. Similarly, S_t^- denotes the subset of plants that contract or exit, where S_t^{C-} stands for contracting and S_t^{E-} for exiting plants.

Gross job creation in sector s at time t is

$$JC_{st} = \sum_{p \in S_t^+} \Delta EMP_{pst} = \sum_{p \in S_t^{N+}} \Delta EMP_{pst} + \sum_{p \in S_t^{X+}} \Delta EMP_{pst} \tag{1}$$

and gross job destruction is

$$JD_{st} = \sum_{p \in S_t^-} |\Delta EMP_{pst}| = \sum_{p \in S_t^{C-}} |\Delta EMP_{pst}| + \sum_{p \in S_t^{E-}} |\Delta EMP_{pst}|. \tag{2}$$

The net sectoral employment change is $NET_{st} = JC_{st} - JD_{st}$. Gross job reallocation can be expressed as

$$JR_{st} = \sum_{p \in S} |\Delta EMP_{pst}| = JC_{st} + JD_{st}. \tag{3}$$

The job flow measures are expressed as rates by dividing them by the average of employment in $t-1$ and t:

$$Z_{pst} = 0.5(EMP_{pst} + EMP_{ps,t-1}). \tag{4}$$

Summing Z_{pst} over units within sectors yields Z_{st}, the size of the sector.

Using lower-case letters, the job-creation rate can be written as $jc_{st} = \frac{JC_{st}}{Z_{st}} \cdot 100$, with $n_{st} = \frac{N_{st}}{Z_{st}} \cdot 100$ the entry rate and $x_{st} = \frac{X_{st}}{Z_{st}} \cdot 100$ the expansion rate. Similarly, the job-destruction rate can be written as $jd_{st} = \frac{JD_{st}}{Z_{st}} \cdot 100$, with $c_{st} = \frac{C_{st}}{Z_{st}} \cdot 100$ the contraction rate and $e_{st} = \frac{E_{st}}{Z_{st}} \cdot 100$ the exit rate. Finally, the job-reallocation rate is expressed as $jr_{st} = \frac{JR_{st}}{Z_{st}} \cdot 100$ and the net employment change rate takes the form $net_{st} = \frac{NET_{st}}{Z_{st}} \cdot 100$.

3 Descriptive Statistics

The creation and destruction of jobs is a phenomenon that is pervasive across regions and industries. In the following, we first give an overview of the magnitude of gross job flows in Germany as compared with other industrialised countries. Since analysing gross job flows at the national level may mask a pronounced variance at a more disaggregated level, we further analyse gross job flows in Germany with respect to region, industry and plant size.

3.1 Basic Facts about Job Reallocation

Table 1 reports the magnitude of the German job flows in comparison to other industrialised countries. The rate of job creation, measured as an average over the observation period, amounts to 10.4 percent, which is somewhat higher than for the Netherlands (7.4 percent) and the U.S. (8.8 percent), but slightly lower than for Italy (11.9 percent).[5] Germany exhibits a job destruction rate which is very similar to that of Italy and Canada. Generally, job reallocation rates amount to roughly 20 percent. In contrast to the high gross job flow rates, net employment change is very modest if not negative. The further decomposition of job creation and destruction shows that in the three countries where data is available, incumbent establishments create about two thirds of the new jobs. One

[5] As Davis and Haltiwanger (1999) as well as OECD (1994) point out, direct comparisons between studies and countries can be hampered by measurement issues and conceptual differences which make them difficult to interpret. This is the case for a comparison of Germany with the Netherlands. The relatively low Dutch job flows might be due to the consideration of firms with 10 and more employees only.

in three new jobs is provided by plants entering the market. While in Austria and Italy this picture is identical for the destruction of jobs, contracting plants in Germany cut down on jobs more heavily; three out of four jobs are destroyed by incumbent plants and only one in four by plants closing down.

For Germany, detailed empirical evidence on job creation and destruction on a regional level was first provided by Cramer and Koller (1988). They analyse the four components of job turnover for the West German labour-market regions, sectors and plant size classes. The main findings are that job gains and job losses are balanced, on average, with entry rates exceeding the exit rates. Boeri and Cramer (1988) and Boeri and Cramer (1992) look at the contribution of entrants and incumbent plants to employment growth in Germany, however, without considering regional differences. Among the few studies undertaken after reunification and explicitly focusing on Eastern Germany, Lehmann (1996) and Brixy (1999) analyse gross job flows for the period from 1991 to 1996. Both studies conclude that gross job flows are much higher than in the Western part of Germany. Directly after reunification, job turnover reached a remarkable 33 percent between 1991 and 1992, reflecting the tremendous efforts in restructuring the formerly planned economy. Brixy (1999) shows that mainly incumbent plants were responsible for the destruction of jobs. Many of the large formerly state-owned enterprises were privatised and split up into smaller units, which manifests itself in a contraction rate of 38 percent. On the job creation side, more than 26 percent of new jobs were created by start-ups and incumbent plants.[6] In the following years, the high job losses were more or less offset by the creation of new jobs, but with gross job flow rates still much higher than in Western Germany.

Table 2 demonstrates that the differences in employment dynamics between Western and Eastern Germany are still clearly existent more than a decade after reunification. Two main aspects are worth noting in this respect. Firstly, labour-market dynamics are more pronounced in the Eastern part of the country, with the job reallocation rate reaching 27.4 percent. Whereas the job creation rates of 10.0 percent and 12.2 percent lie in roughly the

[6]Entries in Eastern Germany experienced a boom at the beginning of the 1990s. The existence of still relatively few firms as well as extensive public promotion instruments supported entrepreneurial activities. Hence, unlike in Western Germany, entries were very successful in terms of survival and longer-term employment growth (Brixy, 1999; Brixy and Grotz, 2004).

Table 1: Magnitude of German job flows and international comparison

	Country (period)											
	Germany[a] (1999 – 2004)		Austria[b] (1978 – 1998)		Italy[c] (1984 – 1993)		Netherlands[d] (1979 – 1991)		United States[e] (1973 – 1992)		Canada[f] (1973 – 1992)	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Job Creation	10.4	1.2	8.9	0.9	11.9	.	7.4	1.3	8.8	1.9	10.9	2.1
Entries	3.7	0.2	3.1	0.5	3.8	.	.	.	.	.	.	.
Expansions	6.6	1.0	5.8	0.6	8.1	.	.	.	.	.	.	.
Job Destruction	11.3	0.6	8.9	0.9	11.1	.	7.8	1.6	10.1	2.8	11.1	2.6
Contractions	8.6	0.5	6.0	0.6	7.4	.	.	.	.	.	.	.
Exits	2.7	0.1	3.0	0.4	3.7	.	.	.	.	.	.	.
Job Reallocation	21.7	0.8	17.9	1.3	23.0	1.6	15.2	2.0	18.9	2.1	21.9	2.8
Net Employment Growth	-1.0	1.7	0.0	1.2	0.8	.	-0.4	2.2	-1.4	4.4	-0.2	3.8

[a]: Our own results. *Regional coverage:* NUTS3-regions. *Sectoral coverage:* All sectors, excluding agriculture and public sector. *Data:* Establishment File of the German Social Insurance Statistics. *Unit of analysis:* plants.

[b]: Stiglbauer et al. (2003). *Regional coverage:* NUTS3-regions (local districts). *Sectoral coverage:* All sectors, excluding public sector, health services, transport, and establishments without sectoral label. *Data:* Social security records. *Unit of analysis:* Establishments.

[c]: Contini et al. (1996). *Regional coverage:* NUTS3-regions (provinces). *Sectoral coverage:* All private firms. *Data:* Social security records. *Unit of analysis:* Establishments.

[d]: Broersma and Gautier (1997): *Regional coverage:* national level. *Sectoral coverage:* manufacturing. *Data:* firm sample provided by the Netherlands Central Bureau of Statistics. *Unit of analysis:* firms.

[e]: Baldwin et al. (1998): *Regional coverage:* national level. *Sectoral coverage:* Manufacturing. *Data:* Annual Survey of Manufactures. *Unit of analysis:* plants.

[f]: Baldwin et al. (1998): *Regional coverage:* national level. *Sectoral coverage:* Manufacturing. *Data:* Annual census of the Canadian manufacturing sector. *Unit of analysis:* plants.

Table 2: Job-flow rates in regional comparison, average from 1999 to 2004

	mean	sd	min	max
	Western Germany			
Job Creation	10.0	1.3	8.6	11.8
Entries	3.5	0.3	3.3	3.9
Expansions	6.4	1.1	5.3	7.9
Job Destruction	10.5	0.8	9.4	11.4
Contractions	8.1	0.6	7.3	8.8
Exits	2.3	0.2	2.1	2.5
Job Reallocation	20.5	0.6	19.7	21.3
Net Employment Change	-0.5	2.1	-2.8	2.4
	Eastern Germany			
Job Creation	12.2	1.2	11.6	13.3
Entries	4.7	0.2	4.6	5.0
Expansions	7.5	1.0	7.0	8.3
Job Destruction	15.2	0.6	13.9	16.1
Contractions	10.9	0.5	10.1	11.6
Exits	4.3	0.1	3.8	4.5
Job Reallocation	27.4	0.8	25.4	28.8
Net Employment Change	-3.0	1.7	-3.6	-2.2

same range, the destruction of jobs is almost five percentage points higher than in Western Germany. This imbalance of job creation and destruction in Eastern Germany implies that for the jobs destroyed in the reallocation process there are not enough jobs created for net employment to remain constant. Hence, net employment changes range between -2.2 percent and -3.6 percent in the observation period. Secondly, existing plants, on the one hand, and plants entering and exiting the market, on the other, play very different roles in the two regions. As in the early phase of reunification, entries continue to create more jobs in Eastern Germany, albeit now for different reasons.[7] On the job destruction side, exits in the Eastern part of Germany counteract the positive effects generated by entries in a more pronounced manner than in the Western part of Germany. In Western Germany, in contrast, much of the dynamics in job flows is determined by gains and losses within incumbent plants.

3.2 Job Reallocation by Industry

In the process of structural change, jobs are reallocated from declining plants to growing plants within the same sector and region. Hence, one should expect a large variation in the creation and destruction of jobs when disaggregating the data according to industry. What is more, it can be expected that there are considerable differences between Eastern and Western Germany because of the large divergence in the respective industrial structures. We therefore look at the job creation and destruction rates in Eastern and Western Germany separately broken down by 2-digit NACE sectors.[8] Figure 1 plots the job creation and the job destruction rates of the 15 sectors with the highest employment shares in each region against each other. They are labeled with their NACE code (see Table A.2 in the appendix) and grouped according to their affiliation to manufacturing

[7]The favourable conditions for start-ups in the early phase of reunification ceased to exist by the middle of the 1990s, and their survival as well as their growth started to lag behind their West German counterparts (see Brixy and Grotz, 2004). Today, as Sternberg et al. (2007) note, the reasons for the higher firm formation rates can instead be found in poor labour-market prospects, which promote entrepreneurship out of need (necessity entrepreneurship).

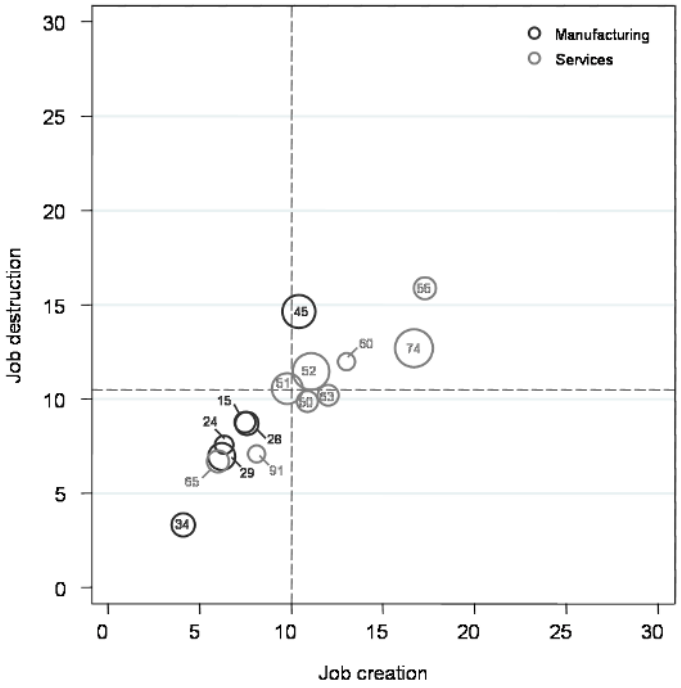
[8]Since a discussion of all 47 included industries would be too extensive, we only consider the 15 industries with the highest shares in total employment in Germany. Table A.2 in the appendix lists the corresponding industries together with their employment shares in Eastern and in Western Germany.

or to services. For a better interpretation, we also depict the average values of the job creation and job destruction rates from Table 2 as horizontal and vertical lines. The size of the dots represents the employment share of the respective industry.

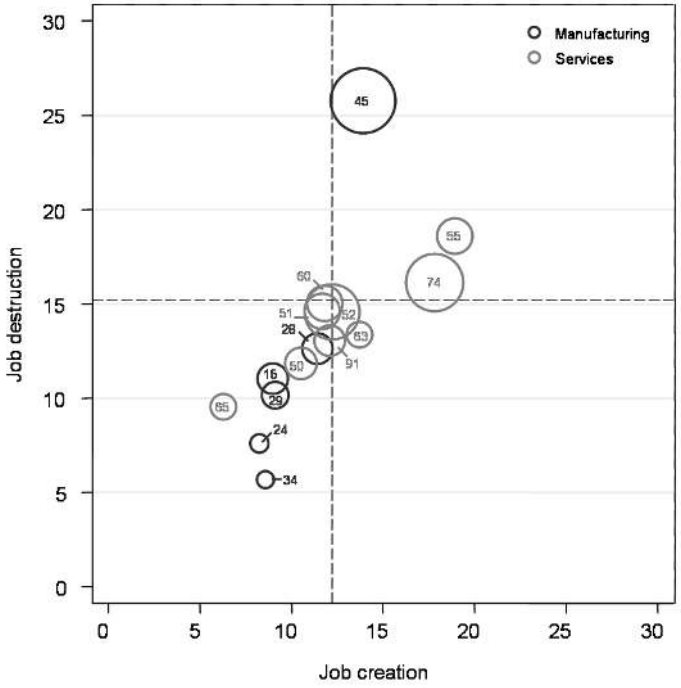
As indicated by Table 2, the magnitude of labour-market dynamics in the Eastern part of Germany is also much higher than in the Western part when disaggregated by industry. This holds especially true for construction (45), which is the most important industry in terms of employment and exhibits the largest job flows among the industries.

Although the gross job flows between Eastern and Western Germany differ in their magnitude and composition, important similarities in a sectoral respect emerge. Firstly, the creation and the destruction of jobs is a phenomenon that affects every industry, regardless of the region. Secondly, industries with high job creation tend to have high job destruction as well, resulting in high job reallocation rates. This can be clearly seen for Hotels and Restaurants (55) and Other Business Activities (74), which are the fastest growing industries in both regions, and for Construction (45). Thirdly, manufacturing and services exhibit different patterns of job flows. In general, job turnover in services is higher, contributing to a higher growth of net employment than in manufacturing. It also shows more variability, with the single service industries quite dispersed in Figure 1.

To illustrate the similarities in job flows between Eastern and Western Germany at the industry level, Table 3 provides cross-country correlations between the corresponding rates of job creation and destruction.



Western Germany



Eastern Germany

Figure 1: Job creation and job destruction by industry

Table 3: Cross-industry correlations between East and West German employment flows

	Correlation coefficients
Job Creation	0.866***
Job Destruction	0.821***
Net Employment Change	0.650***
Job Reallocation	0.869***

***significant at the 1% level.

All the correlation coefficients are strongly positive. The correlation coefficients between Eastern and Western cross-industry job creation and job destruction are 0.866 and 0.821, respectively. This result implies that industries with high (low) job reallocation in Western Germany also have high (low) job reallocation in Eastern Germany. Hence, there may be important industry-inherent or technological characteristics common across the two regions at work that help determine the patterns of intersectoral job flows.[9]

3.3 Job Reallocation by Plant Size

One phenomenon which can be observed in many countries consists in the large differences in gross labour flows according to plant size. As Davis et al. (1996) report for the United States and Cramer and Koller (1988) and Wagner (1995) for Germany, job turnover is highest in small establishments and diminishes with increasing plant size.[10]

Our data yield the same results as the other studies on gross job flows. Table 4 shows the net employment change as well as the summarizing measure of job turnover for nine plant size classes. The size classes are very detailed for plants with less than 50 employees,

[9]As Baldwin et al. (1998) note, if primarily market structure or institutional differences are at work, then the two regions may exhibit different sectoral patterns. They find the same pattern than for the two parts of Germany for a comparison of the U.S. with Canada.

[10]One measurement problem in this respect is the familiar regression fallacy. Measurement error or transitory fluctuations of employment imply that plants classified as small at time t are more likely to have experienced a negative fluctuation in that year, while plants classified as large are more likely to have experienced a positive fluctuation. Thus, between $t-1$ and t small plants are likely to grow and large plants to shrink. Since we use the average plant size over two years in our calculations, this problem should be of little relevance in our analysis.

taking into account the dominance of smaller plants in the Eastern part of Germany.[11] Both the change in net employment as well as the job-turnover rate are highest for plants with less than five employees and lowest for plants employing 1000 and more workers. This reflects the generally lower growth of young and very small establishments, which often stay small.[12] A positive net effect is evident for medium-sized and large plants with 50 to 999 employees. In Western Germany this is already the case for plants with 20 and more employees.

The differences in the job-flow patterns between the East and the West German regions manifest themselves also in the analysis by plant size. The magnitude of the net employment change is larger in the Eastern part not only for the smaller plants (for which it is negative), it is also larger for the plants with more than 100 employees. Correspondingly, the East German job-turnover rates are higher. It has to be taken into account, however, that the plant size classes show a different distribution between Eastern and Western Germany. In the new federal states of Germany the smaller plants predominate (see Table A.1 in the appendix). Hence, the relatively larger positive net employment growth of the larger plants in Eastern Germany can not compensate the losses in the smaller plants.

4 Structural Determinants of Job Flows

The descriptive analysis has shown that the job flows in Eastern and Western Germany vary to a large extent by industry and plant size. In the following, we assess the influence of several plant characteristics more rigorously with the help of econometric techniques. The focus lies not only on the general determinants of the magnitude of job creation and destruction, but also on their interaction explaining the differences in job flows between Eastern and Western Germany.

Most studies centering upon gross job flows are purely descriptive. Davis and Haltiwanger (1999), Contini et al. (1996), Baldwin et al. (1998) and Stiglbauer et al. (2003) furthermore apply econometric techniques. Contini et al. (1996) conduct an analysis of

[11] See Table A.1 in the appendix for the employment shares in the respective plant size classes.

[12] Fritsch and Weyh (2006) show in a cohort analysis for Western Germany that only one half of the start-ups in a given year survives more than five years. The majority of the surviving plants stays small.

Table 4: Job flows by plant size

	Eastern Germany		Western Germany	
	net_{st}	jr_{st}	net_{st}	jr_{st}
<5 employees	-28.37	23.19	-20.73	19.43
5 – 9 employees	-4.24	12.86	-1.98	11.78
10 – 19 employees	-1.81	10.38	-0.48	9.26
20 – 49 employees	-0.49	8.70	0.18	7.65
50 – 99 employees	0.45	7.55	0.61	6.64
100 – 249 employees	1.10	6.87	0.99	5.69
250 – 499 employees	1.71	6.67	0.69	4.83
500 – 999 employees	1.19	5.89	1.11	4.33
>1000 employees	-1.02	4.76	0.59	3.04

variance in order to explain the entry, expansion, contraction and closing of firms. They show that job turnover declines with increasing firm size and find pronounced regional and sectoral differences. Baldwin et al. (1998) formally investigate the nature and source of the Canada-United States differences by regressing year, country and industry effects on the job turnover components. They conclude that although the two countries differ in many respects, the common technology as well as other common elements dominate the long-run structural relationships between the two countries. Stiglbauer et al. (2003) regress structural characteristics of Austrian establishments on the creation and destruction of jobs. They argue that establishment size and age represent the most important determinants for the magnitude of the gross job flows, while the sectoral affiliation as well as regional differences play a minor role.

Taking the approach of Stiglbauer et al. (2003) as starting-point, we analyse job creation and job destruction with weighted regressions. As independent variables we further include interaction effects. The data are grouped by Eastern and Western Germany, 3 region types, 47 sectors, 6 age groups and 9 size classes, resulting in a total of 91,368 observations. Because many cells are empty on this fine disaggregation level, there remain 44,137 observations. For each cell characteristic we build dummies and examine their influence on job creation and job destruction. The interaction effects are captured

by interaction dummies (ID). In order to keep the number of combinations at a moderate level, we further reduce the characteristics.[13] For statistical reasons the observations are weighted with the average employment in t and $t-1$. In order to control for any remaining heteroscedasticity, consistent standard errors are computed with the Huber-White-Sandwich procedure (see Greene, 2003, 199–200). The regressions take the following form and are estimated separately for Eastern and Western Germany:

$$y = D_{size}\beta_{size} + D_{age}\beta_{age} + D_{sector}\beta_{sector} + D_{type}\beta_{type} + D_{ID}\beta_{ID} + \epsilon \tag{5}$$

, where y represents jc_{st} or jd_{st}.

Table 5: Weighted regression results for Eastern Germany

	job creation		job destruction	
	Western	Eastern	Western	Eastern
average plant size (Base: > 1000 employees)				
< 5 employees	-0.489*	0.486	26.085***	37.855***
5 – 9 employees	3.212***	3.800***	7.714***	12.675***
10 – 19 employees	2.108***	3.179***	3.690***	7.559***
20 – 49 employees	2.140***	3.883***	0.793	3.717***
50 – 99 employees	2.620***	3.860***	4.855***	4.001***
100 – 249 employees	2.216***	3.574***	3.427***	2.654***
250 – 499 employees	1.381***	3.322***	2.309***	1.892***
500 – 999 employees	1.093***	2.284***	1.265***	0.489
age (Base: > 5 years)				
= 1 year	23.925***	23.456***	-8.463***	-17.938***
> 1 to ≤ 2 years	10.784***	10.150***	-3.703***	-11.259***
> 2 to ≤ 3 years	8.115***	7.190***	-1.948***	-9.302***
> 3 to ≤ 4 years	6.596***	5.226***	-1.930***	-8.991***
> 4 to ≤ 5 years	5.697***	4.199***	-1.698***	-9.020***

to be continued on the next page ...

[13] We aggregate the variables in the following way: plants with less than 50 employees are denoted as small, and those with 250 and more employees as large. Plant age are referred to as young when they are up to five years old, otherwise they are old. We sum up the 47 sectors to manufacturing and to services, respectively. Finally, the region types stay as they are.

Table 5: continued

	job creation		job destruction	
	Western	Eastern	Western	Eastern
sector (Base: Other business services)				
Food and beverages (15)	-6.005***	-3.161***	-1.073**	-3.519***
Chemical products (24)	-5.899***	-1.819**	1.750	-1.975*
Metal products (28)	-6.471***	-2.395***	-0.603	-3.583***
Machinery and equipment (29)	-6.254***	-3.072***	0.399	-2.505***
Motor vehicles(34)	-5.424***	-0.858	0.451	-2.239**
Construction (45)	-6.971***	-3.509***	-0.307	4.110***
Maintenance and repair of motor vehicles (50)	-4.234***	-4.182***	-3.218***	-3.662***
Wholesale trade (51)	-4.290***	-3.326***	-0.422	-0.043
Retail trade (52)	-4.399***	-3.648***	-2.080***	-2.972***
Hotels and Restaurants (55)	-3.079***	-2.345***	-1.943***	-2.293***
Land transport (60)	-2.297***	-1.717***	0.280	2.894***
Auxiliary transport activities (63)	-2.715***	-1.224***	0.023	-0.065
Financial intermediation (65)	-4.740***	-3.377***	0.241	1.388
Activities of membership organization (91)	-3.880***	-0.515	-4.116***	1.515**
region type(Base: Agglomerations)				
Moderately congested regions	-0.117	-0.796***	-1.379***	-0.620
Rural Areas	-0.014	-0.857***	-1.895***	-1.694***
ID-large-young	6.998***			
ID-small-old			5.239***	
ID-small-manufacturing	1.970***		2.372***	5.726***
ID-young-manufacturing	2.927***	1.759***		4.634***
ID-young-moderately congested			2.917***	
ID-young-rural			4.160***	2.319**
ID-services-agglomeration			0.909**	
ID-manufacturing-agglomeration		-1.047***		
constant	9.440***	7.155***	1.418**	4.431***
number of observations	23,630	20,507	23,630	20,507
F-Value	573,08***	362.96***	139.63***	80.38***
R^2	0.9251	0.9019	0.5419	0.6026

The results in Table 5 underscore the dominant role of plant size and age for the

determination of gross job flows. Basically, in Eastern Germany there is a large deviation of the different size classes from the basic group emphasising the smaller size structure in this part of the country. Firstly, it can be stated that the smaller the plant, the higher the job destruction rate in both parts of Germany. Small plants with less than five employees have a job destruction rate which is in Eastern Germany 37.855 percentage points higher than in large plants with more than 1,000 employees. In the Western part of Germany it is also the small plants that exhibit the highest job destruction rate, although the coefficient is not as high as in the Eastern part. Secondly, turning towards the creation of jobs, such a clear pattern is not as visible as for destruction. In both parts of the country the plants with five to nine employees have relatively high coefficients. Additionally, in Eastern Germany the plants with between 10 and 499 employees show similar magnitudes of the coefficients. Stiglbauer et al. (2003) give several reasons for the smaller magnitude of job turnover in larger plants: Generally, larger plants have more product lines and many sales regions, which makes them more immune against sectoral shocks. They can also shift jobs from one unit to another without changing the actual firm size.

Likewise, the results on plant age point to an influence on job turnover which continually diminishes with age. Plants between four and five years old have a job creation rate about 18 percentage points lower than one-year old plants, regardless of their location in Western or in Eastern Germany. With growing age, however, West German plants create relatively more jobs and at the same time destroy relatively fewer jobs than their East German counterparts. Like for plant size, descriptive analyses (Davis et al., 1996; Davis and Haltiwanger, 1999) show that the decreasing influence of a plant's age is valid for other countries and independent from sector or region. Davis et al. (1996) point out that there seems to be a systematic mechanism which generates a stable positive relationship between the stability of jobs and the plant age.

Although it is not directly tested, the results for plant size and age suggest a validity of the liability of smallness and the liability of newness theses. The younger and smaller a firm, the higher the probability of failure is (Aldrich and Auster, 1986; Geroski et. al., 2002).

The influence of the affiliation to a certain sector is not very clear and not always significant, especially when it comes to the destruction rate. One remarkable fact for

the creation of jobs are the higher coefficients in Western Germany, i.e. all large sectors other than the basic group "Other business services" create a much lower number of jobs. Secondly, in the case of job destruction the highest deviation from the basic group with a positive sign can be noted for the Construction sector (45) in Eastern Germany. Surely, this is still due to the not finished convergence process between Eastern and Western Germany in this sector (Berlemann and Thum, 2006).[14] Additionally, the overall unclear results on the sectoral influence rather imply that the destruction of jobs is more driven by plant characteristics like size and age than job creation (Davis and Haltiwanger, 1999). This finding is supported by the remarkable similarity of gross job flows at the industry level between the two regions as shown in Table 3. Hence, differences in the industrial characteristics cannot be responsible for the differences in the respective labour-market dynamics as a whole.

The regional district types are of relatively low explanation power for gross job flows as compared to plant characteristics. Results for gross job gains in Western Germany are insignificant. However, they are relevant for the destruction of jobs. In Eastern Germany, in contrast, the creation and destruction of jobs is significantly lower in moderately congested areas and in rural regions in comparison to densely agglomerated regions. Seemingly, the advantages like a lower degree of competition or the unique selling proposition outweigh the disadvantages like infrastructure or a worse access to the market.

We now turn towards the bivariate analysis of the single characteristics that are captured by the interaction dummies.[15] West German plants which are both large and young have a very high job creation rate. On the one hand, this is not surprising as a market entry with a high number of employees has exactly created these jobs. On the other hand, here we also count plants as young that are under five years old. Surely, the size combined with the dynamics of the new plant is a factor for success measured by job creation. The destruction of jobs is very pronounced in small and old plants. Herewith it can be shown that the combination of a liability of smallness with a liability of aging[16] is exceedingly

[14] In order to assess the influence of the construction sector, we ran the regressions without it, but the results hardly deviated from the ones with the inclusion of construction.

[15] Only those results are reported which are significant and where there is no multicollinearity between the combined characteristics.

[16] For more information about different liability theses and some explanations see e.g. Aldrich and

problematic and leads to a further increase of the job destruction rate.[17]

Being a small manufacturing plant affects positively the job creation rate in Western Germany, but also the job destruction rate in both parts of Germany. Young manufacturing plants show high job creation rates in both parts of Germany. This is probably due to the fact that manufacturing plants in general grow more than plants in services. On the other side, the signs for the two interaction dummies are also positive for job destruction. Presumably, although manufacturing plants are stable, they often reduce the number of jobs by investing in new machinery and equipment.

Four interaction dummies that include region types turn out to be significant mainly in explaining gross job destruction. It seems that for young plants in Western Germany it is particularly difficult in the moderately congested regions and in rural areas to promote net employment growth. As became visible in the regressions according to region type, agglomerations exhibit the highest job turnover rates. This is intensified for the destruction of jobs in plants belonging to the West German service sector, since here there is more competition among the plants. Belonging to manufacturing in Eastern Germany, by contrast, reduces the job creation rate. This might be due to the higher barriers for entering the market in this sector.

To sum up the estimation results, the variance in gross job gains can be quite well explained by the characteristics discussed above. By contrast, the fit of the regression on gross job losses is much lower. This hints at the relevance of other factors internal as well as external to the plants which are not included in the regression, but are relevant for the destruction of jobs.[18]

Auster (1986), Bruderl and Schuessler (1990), Baum and Mezias (1992), Barron et. al. (1993).

[17]The mostly known combination "liability of newness" and "liability of smallness" (see Aldrich and Auster, 1986 and Geroski et. al., 2002) is also tested in our model, but we suppress the results as we only include non-correlated interaction dummies.

[18]We adopted the growth rates of overall employment in the single cells in order to account for more general economic effects external to the plants. But regardless of the specification of the growth rates, they always resulted to be insignificant. This emphasises the dominance of plant-specific characteristics.

5 Conclusion

The net employment change hides large gross job gains and job losses both in Eastern and in Western Germany. The labour-market dynamics are mainly due to existing plants, which expand or contract. Entries and exits of plants are of more relevance in the Eastern part of Germany. Although the entry of new plants into the market is still larger in the Eastern part compared to the Western part of Germany, in Eastern Germany the creation of new jobs is not sufficient to compensate the large job losses mainly by exiting plants. The analysis by sector reveals a higher job turnover in all single sectors for Eastern Germany. In spite of these larger dynamics, however, the job flows reveal remarkable similarities in the two parts. Not only is every industry affected, it is also true that industries with high job creation tend to have high job destruction as well. Furthermore, the sectors belonging to manufacturing have a lower job turnover than the service sectors. Differences between Eastern and Western Germany are pronounced when looking at plant size, however. Because of the dominance of small plants in the new federal states that experience high job losses, the positive net employment growth of the larger plants cannot be compensated.

The econometric analysis makes clear that plant size and plant age are the two most important determinants for the magnitude of gross job flows. This finding is emphasised by the results of the interaction effects. The influence of the regional district types becomes visible mainly for young plants in Western Germany. Overall, the analysis clearly shows that is not sufficient to analyse gross job flows only on the national and purely descriptive level, but that plant-level as well as regional characteristics should be taken into account as well.

Appendix

Table A.1: Share of employees in the different size classes (average from 1998 to 2006)

Size class	Germany	
	Eastern	Western
employees in entries and exits	4.17	3.25
$<$ 5 employees	9.20	8.10
5 – 9 employees	8.81	8.31
10 – 19 employees	10.09	9.27
20 – 49 employees	15.28	13.05
50 – 99 employees	12.15	11.01
100 – 249 employees	14.38	14.43
250 – 499 employees	9.21	10.21
500 – 999 employees	6.94	8.22
$>$ 1000 employees	9.78	14.16

Table A.2: Share of employees in the 15 biggest sectors in Germany (average from 1998 to 2006)

NACE-Code	Sector	Eastern			Western		
		Share	jc_{st}	jd_{st}	Share	jc_{st}	jd_{st}
15	Food and beverages	2.38	8.98	11.04	2.61	7.48	8.76
24	Chemical products	0.83	8.23	7.60	1.96	6.32	7.58
28	Metal products	2.33	11.40	12.62	2.97	7.57	8.69
29	Machinery and equipment	1.79	9.13	10.17	4.32	6.20	6.94
34	Motor vehicles	0.70	8.58	5.69	3.04	4.09	3.32
45	Construction	10.43	13.92	25.77	6.45	10.39	14.63
50	Maintenance and repair of motor vehicles	2.50	10.53	11.84	2.41	10.88	9.87
51	Wholesale trade	3.21	11.67	14.60	5.44	9.78	10.55
52	Retail trade	7.45	12.23	14.59	7.74	11.07	11.47
55	Hotels and Restaurants	3.14	18.92	18.59	2.72	17.29	15.87
60	Land transport	3.06	11.80	15.04	1.68	13.00	11.97
63	Auxiliary transport activities	1.69	13.71	13.36	2.43	12.00	10.20
65	Financial intermediation	1.65	6.26	9.54	2.93	6.01	6.71
74	Other business activities	8.18	17.82	16.13	8.16	16.70	12.68
91	Activities of membership organisation	2.26	12.07	13.05	1.62	8.12	7.09
Σ		51.61			53.12		

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