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Ruhr-Universität Bochum (RUB), Department of Economics
Universitätsstraße 150, 44801 Bochum, Germany

Technische Universität Dortmund, Department of Economic and Social Sciences
Vogelpothsweg 87, 44227 Dortmund, Germany

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Hohenzollernstrasse 1/3, 45128 Essen, Germany

Ruhr Economic Papers #53

Responsible Editor: Christoph M. Schmidt

ISSN 1864-4872 (online) – ISBN 978-3-86788-056-5

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Bibliografische Information der Deutschen Nationalbibliothek
Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über http://dnb.d-nb.de abrufbar.

ISSN 1864-4872 (online)
ISBN 978-3-86788-056-5

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Abstract
Using an administrative data set containing daily information on individual workers' employment histories, we investigate how workers' labour market transitions are affected by international outsourcing. In order to do so, we estimate hazard rate models for match separations, as well as for worker flows from employment to another job, to unemployment, and to nonparticipation. Outsourcing is found to have no significant impact on overall job stability in the manufacturing sector, but it is associated with increased job stability in the service sector. Furthermore, the effect of outsourcing varies strongly across skill levels and age groups. This is especially the case in the manufacturing sector, where the hazard of transiting to nonemployment rises with international outsourcing for medium-skilled and older workers.

JEL Classification: F16, J63, J23

Keywords: Job stability, labour market transitions; worker flows, outsourcing, duration analysis

July 2008

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* Ronald Bachmann, RWI Essen; Sebastian Braun, Humboldt-Universität zu Berlin, Institute for Economic Theory II, School of Business and Economics. – We are grateful to Joel Stiebale, Arne Uhlendorff, and Andrea Weber, as well as to participants at the ESPE 2008 Annual Conference, and seminars at the Berlin Labour Research Network (BeNa), at IZA, and at RWI Essen for helpful comments. We also thank the staff at the IAB for hospitality and for help with the data. Finally, we gratefully acknowledge the support of the German Science Foundation (DFG), the Collaborative Research Centre SFB 649, and the Leibniz Association. – All correspondence to Ronald Bachmann, Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI Essen), Hohenzollernstr. 1-3, 45128 Essen, Germany, e-mail: bachmann@rwi-essen.de.

1 Introduction

Fears of economic competition from low-wage countries are widespread among workers, trade unionists and politicians in many industrialized countries. The concern is that economies with relatively high labour costs are adversely affected by labour demand shifting towards economies with lower labour costs, thereby reducing job stability and increasing unemployment. One mechanism which is suspected of leading to such an evolution is international outsourcing, which occurs when a domestic firm subcontracts a (production) process to another firm in a foreign country.[1]

While a number of theoretical papers has underlined the importance of international outsourcing for relative labour demand and factor prices (see, for instance, Feenstra and Hanson, 1996a; Arndt, 1997; Deardorff, 2001; Kohler, 2004) no consensus has yet emerged in this regard. Depending on the specific modelling approach, low-skilled workers may lose or benefit from outsourcing. More importantly, there are very few theoretical contributions which depart from the assumptions of full employment and perfect factor mobility, or which analyze the short-run dynamics of the globalization of the production process and the ensuing consequences for the labour market. One noteworthy exception is the article by Mitra and Ranjan (2007), who analyze the impact of outsourcing on unemployment within a two sector model with search frictions in the labour market. In this model, outsourcing can generate an increase in wages and a decrease in sectoral unemployment rates if labour is mobile between sectors. This result stands at odds with the public perception where international outsourcing is mainly associated with employment losses. However, it is in line with the argument stressed by the OECD (2007) that outsourcing may induce employment growth by increasing the competitiveness and the productivity of firms.[2]

In this paper, we analyse the effects of international outsourcing on the dynamics of the German labour market, i.e. on the stability of job matches, as well as on worker flows. The case of Germany is particularly interesting for several reasons. First, Germany is the largest economy in the European Union. Second, it is one of the most open economies in the world, regularly featuring the highest level of exports worldwide. Third, international outsourcing has grown substantially in Germany over recent years. While outsourcing is still more important in manufacturing, during the 1990s

[1] The term is meant to include both intra-firm and arm's length international outsourcing. In the former case the foreign supplier is affiliated with the domestic firm, while in the latter it is independent. The same phenomenon has also been referred to as offshoring, international production sharing, fragmentation of production stages, or slicing up the value chain.

[2] International outsourcing will directly boost productivity if internationally traded inputs are of higher quality than those available domestically. It may also increase productivity by allowing firms to concentrate on their most efficient activities while relocating relatively inefficient production stages to foreign production sites (cf. Görg et al., 2008). Empirical evidence on the link between international outsourcing and productivity is presented by, for instance, Amiti and Wei (2006), Egger and Egger (2006), and Görg et al. (2008).

growth rates have been considerably higher in the service sector (cf. Horgos, 2007). Finally, there is evidence that West Germany experienced a significant increase in economic turbulence, defined as the pace of structural change, during the 1990s (cf. Bachmann and Burda, 2008). The acceleration of international outsourcing is a natural culprit for this development.

We are not the first to analyse the effects of international outsourcing on the German labour market.[3] However, while the existing literature is mostly concerned with job stability, we investigate the effects of international outsourcing on labour market dynamics by looking at worker flows. In particular, we focus on the three flows resulting from the separation of an employer-employee match: direct job-to-job transitions, the flow from employment to unemployment, and the flow from employment to nonparticipation, i.e. out of the labour market. The distinction between these three labour market transitions is important because a match separation can have very different reasons and consequences. For example, a separation may be initiated by the worker, who has found a better job. This will in all likelihood result in a direct job-to-job transition. A separation can also be the consequence of a lay-off, in which case the worker has a relatively high probability of becoming unemployed - this entails a transition from employment to unemployment. The worker may even become discouraged to the extent that he leaves the labour market altogether. These different transitions have very different welfare implications, both for the affected worker and for the economy as a whole. In order to assess the consequences of international outsourcing, the distinction between these three flows is therefore crucial.

Our analysis also takes into account the fact that international outsourcing increasingly affects sectors outside manufacturing, in particular the service sector. While until recently services were considered to be largely impervious to international competition, rapid developments in information and communication technology (ICT) has provided increasing opportunities for international sourcing in the service sector as well. In this context, ICT allows for the coordination of tasks performed at different locations, facilitates the transmission of instructions and permits the electronic transmission of output. For instance, 'knowledge work', such as data entry and information processing (IT services), and research and consultancy services (ICT-enabled business services) can now be carried out remotely via the Internet and tele- and video-conferencing (cf. OECD, 2004).

In order to analyse the effects of outsourcing in manufacturing and services, we use a very large micro data set covering 2% of the dependent-status German employees. As it is derived from administrative records, the data set has the further advantage of featuring very little measurement error, as well as being exact to the day. It is thus possible to follow individual labour market transitions, including direct job-to-job flows, in a very exact way.

[3] See the next section for a discussion of the literature.

The plan of the paper is as follows. In the next section, we give a brief review of the relevant literature. The third section describes the data set used, while the fourth section presents the econometric method. The fifth section contains our estimation results. The last section summarizes the results and concludes.

2 Outsourcing and the Labour Market in the Literature

There now exists a sizeable empirical literature that investigates the labour market effects of international outsourcing. In particular, its impact on relative labour demand and the wage skill premium has been widely discussed (see, for instance, Feenstra and Hanson, 1996b, and Feenstra and Hanson, 1999, for the US; Geishecker and Görg, 2008, for Germany; Hijzen et al., 2005, for the UK). However, the literature is much thinner when it comes to the effects on transitional labour market dynamics. On the micro-level the issue at hand has only been addressed by Munch (2005), Pfaffermayr et al. (2007), and Geishecker (2008).[4]

Pfaffermayr et al. (2007) examine the importance of outsourcing (and trade) for the year-to-year transition probabilities of employment between sectors. Using a random sample of Austrian males, the authors estimate a multinomial logit model with fixed effects. They distinguish between six labour market states: employment in four different sectors, unemployment, and out of the labour force. The individual data is matched with industry-level trade and outsourcing indicators that are, however, only available for the manufacturing sector. The study shows that the probability of staying in or changing into the manufacturing sector falls as the level of international outsourcing rises. This finding is more pronounced in manufacturing industries that have a comparative disadvantage.

Munch (2005) analyses the effects of international outsourcing on individual job separations. The paper concentrates on the Danish manufacturing sector and combines individual yearly spell data with indicators for international outsourcing at the industry-level. Provided that outsourcing is broadly defined, the estimation of a single risk model documents a (small) positive effect of outsourcing on the job separation rate.[5] Distinguishing between job-to-job and job-to-unemployment transition flows, the author also estimates a competing risk model. Outsourcing is found to increase both the unemployment risk and the job change hazard rate.[6] The former effect is stronger for low-skilled, the

[4] In addition, Kletzer (2000) studies the effect of outsourcing on *industry-level* displacement rates. However, studies that analyze outcomes at the industry level may suffer both from an aggregation and an endogeneity bias (see, for instance, Geishecker, 2008, for more details.)

[5] However, the outsourcing term is rendered statistically insignificant when a narrow concept of outsourcing is employed instead. See Section 3.2 for a technical definition of narrow and broad outsourcing.

[6] Narrow outsourcing only has a statistically significant effect on the unemployment hazard of low-skilled workers and the job change hazard of high-skilled workers.

latter for high-skilled workers. Munch (2005) concludes that the quantitative impact of outsourcing on out-of-the-job transitions is relatively small.

In a related contribution, Geishecker (2008) analyses the effect of international outsourcing on work-to-non-employment transitions in the German manufacturing sector. Combining monthly individual-level spell data from the German Socio-Economic Panel (SOEP) with industry-level outsourcing measures, the study estimates a discrete time hazard model. Geishecker (2008) finds outsourcing, when narrowly defined, to markedly increase the probability of leaving employment. In contrast to Munch (2005), the effect does not differ between skill groups but increases with employment duration.

The paper at hand contributes to the existing literature on the effects of international outsourcing on labour dynamics in several respects. First, instead of analysing yearly (Pfaffermayr et al., 2007; Munch, 2005) or monthly (Geishecker, 2008) transitions, our data set contains information on the labour market status of workers on a *daily* basis. This allows us to consider also very short employment spells and permits a more thorough treatment of duration dependence. Second, we consider both the manufacturing and the service sector, and compare the effects outsourcing has in these two sectors.[7] Furthermore, we distinguish between the competing risks of making job-to-job, job-to-unemployment, and job-to-non-employment transitions. While Munch (2005) has implemented a similar framework in his analysis of Danish data, no comparable study exists for Germany.

3 The Data

3.1 The IAB Employment Sample

The data set used is the IAB Employment Sample 1975-2004 (IABS), which is provided by the Institute for Employment Research (IAB) of the German Federal Employment Agency. The data base covers 2% of all the persons who, between the 1st January 1975 (for western German employees) or the 1st January 1992 (for eastern German employees) and the 31st December 2004, worked in an employment covered by social security. The data source consists of notifications made by employers to the social security agencies, which include health insurances, statutory pension schemes, and the unemployment insurance agencies.[8] These notifications are made on the behalf of workers, employees and trainees

[7] While an increasing number of papers consider the labour market effects of service outsourcing (see, for instance, Hijzen et al., 2007, for the UK, and Crinò, 2007, for the U.S.), there exist relatively few studies that examine the impact of outsourcing in the service sector. An exception in this regard is the study by Hijzen and Swaim (2007) that analyses the employment effects of international outsourcing in the service (and the manufacturing) sector. Using industry-level data, they find no negative or even slightly positive effects of international outsourcing on sector-level employment.

[8] For a complete description of the data set, see Bender et al. (2000) and Drews (2007).

who pay contributions to the social insurance system. This means that, for example, civil servants and the self-employed are not included. Overall, the subsample includes over 1.29 million people, of which 1.1 million are from western Germany. For 1995, the employment statistics, from which the IAB Regional File is drawn, cover nearly 79.4% of the employed persons in western Germany, and 86.2% of all employed persons in eastern Germany. As for the unemployed, only those entitled to unemployment benefits are covered.

For the labour market states of employment and unemployment, the following spell information is available: the starting and ending date of the spell, exact to the day; sex, year of birth, degree of education/training, and the region of the workplace (in case of an employment spell) or of the unemployment office paying benefits (in case of an unemployment spell). We use the information on the degree of education/training to define three skill groups: low-skilled workers are individuals with primary or lower secondary education, medium-skilled workers are individuals with secondary education and/or a completed apprenticeship, and high-skilled workers are individuals with tertiary education. For employment spells, there is additional information on the occupation and the gross earnings of the worker, an establishment number, the size of the establishment, and the economic sector. Furthermore, the information for employment spells is updated on an annual basis. A third labour market state, "nonparticipation", is not directly recorded in the data set, but can be inferred. A worker is in this state if she does not work full time and does not receive unemployment benefits. This means that nonparticipation can coincide with the state "out of the labour force". However, it can also mean self-employment, civil service employment[9], retirement, or marginal employment.[10]

The advantages of the data set are thus as follows: first, it does not suffer from the problems inherent in most panel data sets, e.g. there is no sample attrition, and it follows workers over a long period of time because there is no need for rotation as in the CPS. Second, it offers observations at a very high frequency, which means that every actual transition is observed. Again, this is a distinct advantage over survey data like the Current Population Survey (CPS) or the SOEP, which do not record multiple transitions that take place between two interview dates and, in the case of the SOEP, uses retrospective data and does not record all direct job-to-job transitions.

Worker transitions can be inferred from the employment and unemployment histories in the data set. We consider transitions between two labour market states (employment to unemployment or employment to nonparticipation), as well as transitions from one job to the other (direct job-to-job transitions).[11] It has to be taken into account that there might be measurement error in the data

[9]This applies to "Beamte", public sector employees under a special, life-time form of civil service employment. Other workers in the public sector are included in the data set.

[10]Cf. Fitzenberger and Wilke (2004) for an in-depth analysis of this issue.

[11]The notion of a job in the data set is establishment (not firm) based.

because of the way the data are collected. In particular, workers' notifications of becoming unemployed might not always correspond exactly to the actual change of labour market state. For example, this can arise when a worker gets laid off and does not report to the unemployment office immediately. We correct for this latter potential measurement error in the following way: If the time interval between two records (employment or unemployment) is smaller than 45 days, then this is counted as a direct transition between the two states recorded.[12] If the gap between two notifications is larger than 45 days, then this is counted as an intervening spell of nonparticipation.

As the labour market records on workers from West Germany start in 1975, i.e. 16 years before the first year of our analysis, their employment durations are accurately observed. For West Germans, the data therefore do not suffer from a problem of left-censoring. East German workers are only included in the data set from 1992 onwards, and there is no information on their labour market history before that date. We regard this as a minor problem, as the labour market history of East Germans before reunification is in all likelihood not very informative for our analysis. First, officially there was hardly any unemployment in East Germany before 1990. Second, the human capital accumulated by East German workers was difficult to transfer to the new economic environment after reunification.

For our analysis, which is described in Section 4, we consider workers who were employed full-time in the manufacturing or service sector at least once during the time period 1991-2000. We furthermore exclude workers which are younger than 18 years or older than 65 years from the analysis. These sample restrictions leave us with observations on 175,572 workers in the service sector and 84,051 workers in the manufacturing sector.[13]

3.2 Industry-level Data

For the purpose of our study, the most important indicator at the industry level is our measure of international outsourcing. The latter is considered to be a make-or-buy decision. A firm can either produce a given (intermediate) input in-house or buy it from a (foreign) supplier. Outsourcing is then reflected in the foreign content of domestic production and can be measured by the share of imported intermediate inputs in total production. We concentrate on international outsourcing in a narrow sense and define it as the shift of a (two-digit) industry's core activities abroad. For instance, intermediate products that the textile sector in Germany imports from some foreign textile sector will count as international outsourcing. On the contrary, intermediates imported from a foreign food sector by the German textile sector will not be taken into account.[14] Consequently, the outsourcing

[12] We did the calculation for smaller intervals as well. This does not change the results significantly.

[13] For computational reasons, we only use 50% of the workers covered by the IABS in the empirical analysis.

[14] Alternatively, a broader concept would account for the total sum of imported intermediate inputs. However, the narrow indicator should arguably better reflect international outsourcing. When the latter is considered to be the

intensity of an industry is measured by the value of intermediate inputs imported from the same industry abroad relative to the total production value of that industry. Largely following the concept proposed by Feenstra and Hanson (1996b), the outsourcing indicator is calculated as

$$OUT_{jt} = \frac{IMP_{jt}}{Y_{jt}}, \quad (1)$$

where IMP_{jt} indicates the value of imported intermediate inputs from industry j abroad and Y_{jt} gives the production value of industry j in period t. Notice that an increase in the indicator does not necessarily reflect the transfer of *existing* production processes abroad but may also mirror that newly established processes are subcontracted to foreign firms. Hence, an increase in the outsourcing intensity does not necessarily imply a displacement of domestic jobs.

Data on imported intermediates and production values are obtained from Input-Output tables of the German Federal Statistical Office (Statistisches Bundesamt, 2002). Information is provided at the NACE two-digit sector level (WZ93), and on an annual basis. Comparable figures are currently only available for the period 1991 to 2000. Figure A.1 shows the development of international outsourcing for the manufacturing as well as for the service sector.[15] While international outsourcing has increased significantly in both sectors, the service sector has displayed much stronger growth rates in the 1990s.[16] Nevertheless, in absolute terms outsourcing still plays a much larger role in manufacturing. Differences exist not only between manufacturing and services, but also within the two sectors. Table A.1 documents the development of international outsourcing at the two-digit sector level. Most industries have experienced tremendous increases in the intensity of outsourcing. In some sectors, such as 'wearing apparel' or 'post and telecommunication', growth rates reached 100 per cent or more over the ten year period considered. However, some services still remain non-tradable. Accordingly, outsourcing, at least when defined narrowly, does not play any role in, for instance, the hotel and restaurant sector. Likewise, even in manufacturing a few industries, e.g. 'printing and publishing', show no upward trend in their outsourcing intensity during the 1990s.

Unfortunately, the industry classification WZ93 is used in the IABS data only from 1999 onwards. For the previous period, workers are assigned to industries according to the older WZ73 classification. Since no recoding scheme exists at present, the reassignment of workers from WZ73 to WZ93 sectors was done manually. We used the finer three-digit WZ73 classification provided in the IABS dataset and

result of a make-or-buy decision, only those imported intermediate inputs that could be produced within the respective industry should correspond to international outsourcing. Hence, a wider definition is usually considered to be too broad (cf. Feenstra and Hanson, 1999).

[15] The manufacturing sector consists of the NACE sectors 15 to 37 while the service sector comprises NACE sectors 50 to 93.

[16] Notice again that by focusing on international outsourcing in the narrow sense, we concentrate on international outsourcing within a sector. Hence, we do not distinguish between material and service outsourcing, but between outsourcing in the manufacturing sector and outsourcing in the service sector.

assigned each WZ73 sector to one of the sectors distinguished between in the WZ93 classification.[17] The recoding was then tested for the years 1999 and 2000, for which both classification schemes exist in the data. Observations that could not be classified with a certain degree of precision had to be deleted from the dataset.[18] In the two years tested, the misclassification error amounted to approximately 5 per cent.

Further industry-level measures used in the empirical analysis are the production value and the capital-output ratio. The former is again taken from the German Federal Statistical Office (Statistisches Bundesamt, 2002) while the latter is computed from data of the OECD STAN and the EUKLEMS data base (cf. Koszerek et al., 2007). Finally, we include regional unemployment rates as provided by the German Federal Employment Office (Bundesagentur für Arbeit, 2007).

The summary statistics of the sample used in the estimations are displayed in Table A.2.

4 Econometric Framework and Estimation Strategy

In order to analyse the effect of international outsourcing on the hazards of job separation and of experiencing different labour market transitions, we estimate hazard rate models. As our dataset contains *daily* information on individual workers' employment histories, we use a specification in continuous time. Since econometric theory offers little guidance on choosing a functional form for the hazard function, we opt for a semi-parametric approach and estimate a piecewise-constant exponential (PCE) model. In contrast to parametric approaches the PCE model allows for more flexibility in the shape of the hazard function and, unlike the Cox proportional hazards model, it provides explicit estimates of the baseline hazard function. The PCE model is an example of a proportional hazard model. Therefore, the conditional hazard rate of leaving employment $\lambda(t|X)$ satisfies the separability condition:

$$\lambda(t|X(t)) = \lambda_0(t)exp(\beta' X(t)) \tag{2}$$

where X is a vector of individual, potentially time-varying, characteristics, and λ_0 denotes the baseline hazard.[19] The PCE model assumes that the baseline hazard is constant within a specified time interval

[17] As shown in Table A.1 some sectors had to be pooled to avoid ambiguous assignments. A detailed overview of the reassignment can be obtained from the authors upon request.

[18] We deleted any WZ73 observation that could not be assigned to a WZ93 sector with a precision of at least 75 per cent.

[19] In proportional hazard models with time-varying covariates, standard tools of duration analysis can only be applied under certain condition (cf. Van den Berg, 2001). In particular, explanatory variables have to be predictable processes, a concept which basically requires weak exogeneity (cf. Ridder and Tunali, 1999). The condition is clearly fulfilled in the present context. Notice in particular that our main variable of interest is measured at the industry level and beyond the control of an individual employee. Furthermore, episode splitting is required in order to estimate continuous-time PCE models with time-covarying covariates. The survival time (episode) for each individual has to be split into subperiods

but does not impose further functional form assumptions. The baseline hazard is then a step function with k segments

$$\lambda_0(t) = \lambda_j,\ a_{j-1} \leq t < a_j,\ j = 1, ..., k. \tag{3}$$

We specify five such segments: 0 to 182 days of employment duration, 183 to 365 days, 366 to 1095 days, 1096 to 2920 days, and more than 2920 days.

Even though we control for a wide array of observable characteristics, the hazard rates of observationally equivalent individuals may still differ from each other. Ignoring such unobserved heterogeneity in duration models produces incorrect results (cf. Lancaster, 1990). To account for unobserved heterogeneity, the proportional hazard model is extended to allow for a multiplicative unobserved heterogeneity term v, which yields a mixed proportional hazard model.[20] The hazard function then becomes

$$\lambda(t|X(t), v) = \lambda_0(t)exp(\beta' X(t))v, \tag{4}$$

where v follows a Gamma distribution, a choice rationalised by Abbring and Van den Berg (2007), and is assumed to be independent of regressors and censoring time. The heterogeneity term is shared across different spells of a given individual, causing observations within groups to be correlated.

The hazard of job separation involves one single risk. In a first step, we can therefore simply estimate the above model for this hazard. In a second step, we distinguish between the different destination states of a worker leaving a job. We thus estimate the competing hazards of transiting from one job to another, from employment to unemployment, and from employment to nonparticipation. For continuous time models and in the absence of a correlation between the destination specific unobserved heterogeneity terms, the log-likelihood for a model with three destinations can be partitioned into the sum of three sub-contributions, each of which depends only on parameters of a single destination-specific hazard. The overall likelihood can then be maximised by maximising the three component parts separately (cf., for instance, Kalbfleisch and Prentice, 2002). Accordingly, the competing risk model is estimated as a number of single-risk duration models, one for each of the three destinations. Spells ending in any destination other than the one considered are treated as right censored. Thus, the above model is estimated separately for each of the three competing risks.

As described in Section 3.2, we use an outsourcing indicator measured at the industry level as an explanatory variable. Because this indicator is common to several individuals, the standard errors are potentially subject to a downward bias (cf. Moulton, 1990). This is due to the fact that such aggregate explanatory variables do not provide independent information for each individual. Following Geishecker (2008), we argue that the data do not allow us to correct for this problem directly, i.e.

within which each time-varying covariate is constant.

[20] See Van den Berg (2001) for a survey of this model class.

through clustering, because the number of clusters is small relative to the number of observations. Instead, we include industry and region fixed effects, as well as linear time trends for every industry. This corrects for residual correlation within clusters due to time-invariant, and, in the case of the industry trends, time-variant unobserved heterogeneity.

We also want to make sure that the outsourcing indicator does not capture effects which are industry-specific, but unrelated to international outsourcing. Therefore, in addition to fixed effects and industry-specific time trends that capture technological changes at the industry-level (cf. Geishecker and Görg, 2008),[21] we also include the production value and the capital intensity for every industry. Furthermore, monthly dummies are used to take seasonal effects into account. Finally, yearly dummies and regional unemployment rates capture differences in economic conditions over time and across regions.

5 Estimation Results

The hazard rate models described in the previous section are estimated separately for the manufacturing and the service sector. For each sector, we first estimate a basic specification with the outsourcing indicator as one of the explanatory variables. A second specification includes the interaction of the outsourcing indicator with workers' skill levels, and a third specification features the interaction of the outsourcing indicator with different age classes. The two latter specifications are meant to capture skill- or age-specific effects of international outsourcing.

For the first specification, the results for the hazard of match separation, as well as for the hazards of the three transitions (EE, EU, EN) are in Tables A.3 and A.6 for the manufacturing and the service sector, respectively. Generally, the results are in line with the literature on labour market flows (cf. Mortensen and Pissarides, 1999). First, there is negative duration dependence, i.e. the hazard of separating or of making a specific labour market transition falls with match duration. This is generally attributed to the accumulation of human capital and sorting effects (cf. Machin and Manning, 1999). Second, men are considerably less likely to separate from their employer. As an inspection of the individual flows reveals, this is despite the fact that they experience more direct job-to-job transitions than women. This is outweighed by the fact that they are much less likely to become unemployed or non-employed, which is probably to a large extent due to women playing a more important role for child care at home than men. Third, the match separation - age profile displays a U-shape. The jobs

[21] Research and development expenditure is sometimes used as an alternative proxy for technological change. The measure has the advantage of allowing for non-linear technological progress at the industry level. Unfortunately, for many service sectors, data are not available over the time period considered. Moreover, even for the manufacturing sector, research and development data are only collected biannually.

of young and old employees are much less stable than jobs of middle-aged employees. Young employees have a high probability of experiencing a direct job-to-job transition, as they engage in job-shopping at the beginning of their working lives (cf. Neal, 1999). Older workers, on the other hand, have a higher probability of leaving the labour market due to retirement, which implies an EN flow. Fourth, foreigners have a higher probability of separating than German nationals, which is entirely due to the fact that they leave the labour market more often. Fifth, employees with low skills and employees with high skills have less stable jobs than employees with medium skills. For the former, this is mainly due to higher inflows into unemployment and flows out of the social security work force. For the latter, lower inflows into unemployment are outweighed by higher job-to-job transitions and higher flows out of the social security work force. Finally, firm size is generally negatively correlated with the hazard of separating.

The coefficients on the outsourcing indicator yield the result we are most interested in, the impact of international outsourcing on the different hazard rates. For the manufacturing sector, the results for the hazard of job separation indicate that international outsourcing has no statistically significant effect on overall job stability (cf. Table A.3). Indeed, no statistically significant effect can be established for any of the three skill categories, as illustrated in the first column of Table A.4. However, as the first column of Table A.5 makes clear, international outsourcing in the manufacturing sector is correlated with significantly increased separation rates for older workers. This means that, although overall job stability is not reduced by international outsourcing, this seems to be the case for older workers.

Table A.3 also shows that the single risk model masks important effects of outsourcing on the destination-specific hazards. In particular, the estimation results for the different transition hazards show that international outsourcing increases the hazard of transitions from a job in the manufacturing sector to nonparticipation. Not distinguishing between different skill groups, the estimates imply that a one percentage point increase in the international outsourcing intensity increases the hazard of leaving the social security work force by about $exp(0.026) - 1 = 2.6$ per cent. Including interaction terms between skill and outsourcing (cf. Table A.4) shows that the effect is most pronounced for medium-skilled workers, but also applies to workers with low and high skills (however, for these two groups the effect is only significant at the 10% level). In contrast, no effect is found for job-to-job and job-to-unemployment transitions for either skill group. Our results suggest an explanation for the finding of a negative effect of international outsourcing on individual employment security by Geishecker (2008), the only comparable study for Germany. In particular, his finding seems to be driven by the transitions from a job to nonparticipation. Interestingly, we generally confirm

Geishecker's result that in the manufacturing sector the effect of international outsourcing appears to be strongest for medium-skilled workers. This finding is also consistent with a "hollowing-out" of the labour market, which has been found by Autor et al. (2003) for the U.S., and Spitz-Oener (2006) for Germany. This concept describes the increase in low-wage occupations, the decrease in blue collar occupations, and the growth in higher-paid occupations. Given the correlation between skills and occupations, our results can be viewed as evidence that outsourcing is associated with a "hollowing-out of the job stability distribution" in the manufacturing sector, i.e. the fact that medium-skilled workers are most, and adversely, affected by international outsourcing.

Finally for the manufacturing sector, the effect of international outsourcing on the destination-specific hazards differs between age groups. As Table A.5 shows, outsourcing is significantly and negatively correlated with a reduction of the hazard of making a transition from employment to unemployment for middle-aged workers, while the same correlation is positive for older workers. This means that the unemployment risk rises with outsourcing for older workers, while it falls with outsourcing for middle-aged workers. One potential explanation for this result is that the effects of outsourcing are multi-faceted: while the productivity of firms is increased, the skill requirements of the production processes that are still performed in-house also change. Younger workers are able to adapt to the latter, and thus to benefit from productivity gains, which overall reduces their risk of becoming unemployed. Older workers are generally less likely to fulfill the new skill requirements, which makes them more vulnerable to unemployment. This is also consistent with the result that the risk of exiting the labour market rises with international outsourcing for older workers only.

For the service sector, the basic regression result for the hazard of match separation is very different from the result obtained for the manufacturing sector (cf. Table A.6). In particular, outsourcing is significantly, and *positively* correlated with job stability in the service sector. An inspection of the results for the different flows shows that this is due to the fact that outsourcing is strongly, and negatively, correlated with the hazard of experiencing a direct job-to-job transition.[22] A possible explanation for this at first sight surprising finding is that international outsourcing, by increasing the division of labour and thus the specialization of production, is likely to lead to higher levels of competitiveness and productivity of firms. This may translate into higher wages and better job prospects (cf. OECD, 2007). If job-to-job transitions are to a certain degree voluntary, international outsourcing, by allowing firms to offer more attractive jobs, increases job stability as it induces workers to stay with their

[22]The magnitude of the coefficients is high, suggesting that an increase in the outsourcing intensity by one percentage point will decrease the hazard of a job-to-job transition by 23.4 per cent. However, it has to be taken into account that such an increase would be massive in the service sector, since the average outsourcing intensity amounted to just 1.3 per cent in the year 2000.

employers.[23] Empirical evidence on the wage effects of international outsourcing could strengthen or undermine the argument. Unfortunately, at present no such evidence exists for the German service sector.[24] However, this explanation is not at odds with previous empirical evidence. In a cross-country study for 17 OECD countries Hijzen and Swaim (2007) find no negative or even slightly positive effects of international outsourcing on labour demand in the service (and the manufacturing) sector.

Alternatively, and in sharp contrast to the previous explanation, the result may hint at declining employment prospects of industries that increase their outsourcing intensity. This should arguably also lower workers' inclination to leave their job voluntarily, which lowers direct job-to-job transitions. While the argument cannot be conclusively dismissed, the results for the other two hazards do not support this view. In particular, for the service sector, we do not find any evidence for international outsourcing to decrease employment security, i.e. to increase the hazard of job-to-unemployment and job-to-non-employment transitions. On the contrary, including interaction terms between outsourcing and skill levels shows that employment security of high-skilled workers even increases with the outsourcing intensity of an industry: the hazards of making a transition to unemployment and to nonparticipation both fall for high-skilled workers (cf. Table A.7). This may again point to a rise in firms' labour demand due to outsourcing boosting productivity and competitiveness. Neither of these two hazards are affected by international outsourcing for low-skilled and medium-skilled workers. Therefore, for these worker groups, the increase in job security that goes along with international outsourcing is entirely due to a decrease of the hazard of making a direct job-to-job transition.

Finally, the effect of international outsourcing in the service sector differs much less between age groups than in the manufacturing sector. Table A.8 shows that for all age groups international outsourcing is negatively correlated with the hazards of separating and of transiting directly from one job to another. The only transition hazard where outsourcing seems to have an age-specific effect is the transition from employment to nonparticipation. While this hazard rises with outsourcing for very young workers (aged 18-24) and relatively old workers (55-59), it falls with outsourcing for middle-aged workers. The latter effect can again be attributed to the productivity-enhancing effect of outsourcing. The effect on older workers in the service sector is similar to the one in manufacturing and therefore probably also due to the fact that older workers have difficulties adapting to changed skill requirements. The effect on younger workers could be due to the fact that these workers try to keep up with changing skill requirements by returning to full-time education. Unfortunately, our data

[23] It should be stressed that by no means all job-to-job transitions reflect voluntary job changes. The protection against (instantaneous) dismissal in Germany allows workers to make direct job-to-job transitions even though they were laid off against their will in the first place.

[24] A recent paper by Geishecker and Görg (2008) finds a positive (negative) wage effect for high-skilled (low-skilled) workers but concentrates on manufacturing only.

set does not allow us to investigate these hypotheses further.

The general result obtained is thus that the effects of international outsourcing on labour market dynamics in Germany differ markedly between the manufacturing and the service sector, across skill levels, and between age groups. Furthermore, the destination-specific hazards are affected asymmetrically. In the manufacturing sector, outsourcing appears to increase the risk of job-to-non-employment transitions, especially for medium-skilled and for older workers. For the latter, the hazard of becoming unemployed is also significantly increased. Overall, increased outsourcing in the manufacturing sector goes together with reduced job security for older workers. On the contrary, international outsourcing is correlated with higher job stability in the service sector. In particular, international outsourcing has a sizeable negative effect on the hazard of experiencing a direct job-to-job transition. Differences between skill and age groups are much less pronounced in the service sector than in the manufacturing sector.

A potential explanation for why the effects of international outsourcing on labour market dynamics differ so markedly between sectors may be found in differences in the economic situation of the two sectors. In manufacturing, firms may have predominately relocated *existing* production processes to foreign production sites in an attempt to remain internationally competitive. Clearly then, existing jobs will be displaced by international outsourcing even though the negative effect is partly compensated by the positive pro-competitive and productivity-enhancing effect. On the contrary, over the time period considered, the service sector was constantly expanding. Hence, the rise in international outsourcing in the service sector may be driven by domestic firms subcontracting newly created production processes to foreign firms. Therefore, domestic workers may reap the benefits of international outsourcing while their jobs are not directly put at risk.

6 Conclusion

In this paper, we investigate the impact of international outsourcing on job stability as well as on worker flows from employment to another job, to unemployment, and out of the labour force. Our analysis focuses on the German manufacturing and service sectors during the time period 1991-2000 and uses a very large administrative micro data set covering 2% of German employees. Apart from the large size of the data set, its main advantages are that employment spells are measured on a daily basis, which means that all actual labour market transitions are recorded, and that measurement error is likely to be very low. Using this panel data set, we estimate hazard rate models for the hazards of separating, and of experiencing the three transitions mentioned above. Outsourcing as measured by an indicator derived from input-output tables is included as an explanatory variable in the regressions.

The effect of international outsourcing is found to differ strongly between sectors and transitions, but also to depend on worker characteristics. First, outsourcing has no impact on overall job stability in the manufacturing sector, but is associated with an increase in job stability in the service sector. Second, our results indicate that the different transitions are affected asymmetrically by international outsourcing, which can also explain the differences between sectors. In the manufacturing sector, only the flow from employment to nonparticipation displays a negative correlation with international outsourcing. In the service sector, on the other hand, one important factor for the increase in job stability is the decline in job-to-job transitions for all workers. Third, the effects of international outsourcing differ between skill groups. In the manufacturing sector, we find the positive effect of outsourcing on the hazard of leaving the labour market to be strongest for medium-skilled workers. We argue that this is consistent with a "hollowing-out" of the labour market. In the service sector, on the other hand, high-skilled workers seem to benefit most from international outsourcing as their hazard of transiting from employment to unemployment and from employment to nonparticipation falls. Finally, the effects of international outsourcing are strongly age-specific in the manufacturing sector. Here, while overall job stability remains unaffected, for older workers it is significantly reduced by international outsourcing. This is due to the fact that their hazard of becoming unemployed and of leaving the labour market is significantly raised.

The underlying reasons for the differences between sectors and labour market transitions remain a matter of further investigation. In general, there are two competing forces at work: on the one hand, international outsourcing can directly reduce labour demand by domestic firms, which reduces job stability, at least in the short run. On the other hand, firms that engage in outsourcing may increase their competitiveness and their profitability. This has the potential of increasing employment, and leading to greater job stability and lower labour market turnover. While we provided some first explanations for why these effects may differ between sectors, and skill and age groups, gaining a more thorough understanding of the reasons underlying our empirical findings is clearly warranted.

References

Abbring, J. H., Van den Berg, G. J., 2007. The unobserved heterogeneity distribution in duration analysis. Biometrika 94 (1), 87–99.

Amiti, M., Wei, S.-J., 2006. Service offshoring and productivity: Evidence from the United States. NBER Working Papers 11926, National Bureau of Economic Research, Inc.

Arndt, S. W., 1997. Globalization and the open economy. The North American Journal of Economics and Finance 8 (1), 71–79.

Autor, D. H., Levy, F., Murnane, R. J., 2003. The skill content of recent technological change: An empirical exploration. Quarterly Journal of Economics 118 (4), 1279–1333.

Bachmann, R., Burda, M. C., 2008. Sectoral transformation, turbulence, and labour market dynamics in Germany. IZA Discussion Paper 3324.

Bender, S., Haas, A., Klose, C., Feb. 2000. IAB employment subsample 1975-1995. Opportunities for analysis provided by the anonymised subsample. IZA Discussion Paper 117.

Bundesagentur für Arbeit, 2007. Arbeitsmarkt in Zahlen. Nürnberg: Bundesagentur für Arbeit.

Crinò, R., 2007. Service offshoring and white-collar employment. CESifo Working Paper Series 2040, CESifo.

Deardorff, A. V., 2001. Fragmentation in simple trade models. The North American Journal of Economics and Finance 12 (2), 121–137.

Drews, N., 2007. Variablen der schwach anonymisierten Version der IAB-Beschäftigtenstichprobe 1975-2004. FDZ Datenreport 3/2007, Institut für Arbeitsmarkt- und Berufsforschung (IAB).

Egger, H., Egger, P., 2006. International outsourcing and the productivity of low-skilled labor in the EU. Economic Inquiry 44 (1), 98–108.

Feenstra, R. C., Hanson, G. H., 1996a. Foreign direct investment, outsourcing and relative wages. In: Feenstra, R. C., Grossmann, G. M., Iwin, D. A. (Eds.), The Political Economy of Trade Policy: Papers in Honor of Jagdish Bhagwati. MIT Press, Cambridge, pp. 89–127.

Feenstra, R. C., Hanson, G. H., 1996b. Globalization, outsourcing, and wage inequality. American Economic Review 86, 240–45.

Feenstra, R. C., Hanson, G. H., 1999. The impact of outsourcing and high-technology capital on wages: Estimates for the United States, 1979-1990. The Quarterly Journal of Economics 114, 907–940.

Fitzenberger, B., Wilke, R., 2004. Unemployment durations in West-Germany before and after the reform of the unemployment compensation system during the 1980s. ZEW Discussion Paper 04-24.

Geishecker, I., 2008. The impact of international outsourcing on individual employment security: A micro-level analysis. Labour Economics 15 (3), 291–314.

Geishecker, I., Görg, H., 2008. Winners and losers: A micro-level analysis of international outsourcing and wages. Canadian Journal of Economics 41 (1), 243–270.

Görg, H., Hanley, A., Strobl, E., 2008. Productivity effects of international outsourcing: evidence from plant-level data. Canadian Journal of Economics 41 (2), 670–688.

Hijzen, A., Görg, H., Hine, R. C., 2005. International outsourcing and the skill structure of labour demand in the United Kingdom. Economic Journal 115 (506), 860–878.

Hijzen, A., Pisu, M., Upward, R., Wright, P., 2007. Employment, job turnover and the trade in producer services: Firm-level evidence. Discussion Papers 07/37, University of Nottingham, GEP.

Hijzen, A., Swaim, P., 2007. Does offshoring reduce industry employment? National Institute Economic Review 201 (1), 86–96.

Horgos, D., 2007. Labor market effects of international outsourcing: How measurement matters. SOEP Papers on Multidisciplinary Panel Data Research 58, DIW Berlin.

Kalbfleisch, J. D., Prentice, R. L., 2002. The Statistical Analysis of Failure Time Data. New York: Wiley.

Kletzer, L., 2000. Trade and job loss in U.S. manufacturing. In: Feenstra, R. C. (Ed.), The Impact of International Trade on Wages. University of Chicago Press.

Kohler, W., 2004. International outsourcing and factor prices with multistage production. Economic Journal 114 (494), C166–C185.

Koszerek, D., Havik, K., Morrow, K. M., Röger, W., Schönborn, F., 2007. An overview of the EU KLEMS growth and productivity accounts. European Economy. Economics Papers 290, European Commission.

Lancaster, T., 1990. The Econometric Analysis of Transition Data. Cambridge University Press.

Machin, S., Manning, A., 1999. The causes and consequences of longterm unemployment in Europe. In: Ashenfelter, O., Card, D. (Eds.), Handbook of Labor Economics. Vol. 3C. Amsterdam: Elsevier.

Mitra, D., Ranjan, P., Jun. 2007. Offshoring and unemployment. NBER Working Papers 13149, National Bureau of Economic Research, Inc.

Mortensen, D. T., Pissarides, C. A., 1999. Job reallocation, employment fluctuations and unemployment. In: Taylor, J. B., Woodford, M. (Eds.), Handbook of Macroeconomics. Vol. 1. Amsterdam: Elsevier, Ch. 18, pp. 1171–1228.

Moulton, B. R., 1990. An illustration of the pitfall in estimating the effects of aggregate variables in micro units. The Review of Economics and Statistics 72, 334–338.

Munch, J. R., 2005. International outsourcing and individual job separations. Discussion Papers 05-11, Department of Economics, University of Copenhagen.

Neal, D., April 1999. The complexity of job mobility among young men. Journal of Labor Economics 17 (2), 237–61.

OECD, 2004. OECD Information Technology Outlook 2004. OECD.

OECD, 2007. Offshoring and Employment: Trends and Impacts. OECD.

Pfaffermayr, M., Egger, P., Weber, A., 2007. Sectoral adjustment of employment to shifts in outsourcing and trade: evidence from a dynamic fixed effects multinomial logit model. Journal of Applied Econometrics 22 (3), 559–580.

Ridder, G., Tunali, I., 1999. Stratified partial likelihood estimation. Journal of Econometrics 92 (2), 193–232.

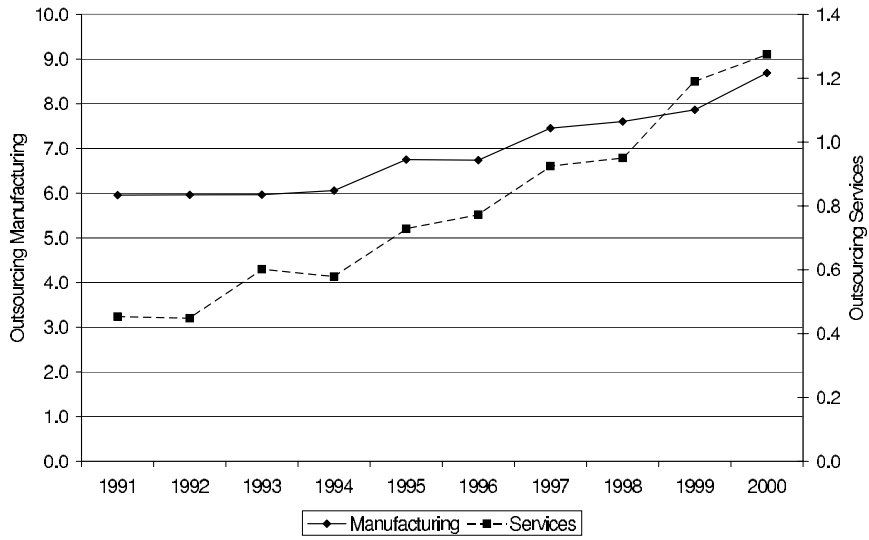
Spitz-Oener, A., 2006. Technical change, job tasks, and rising educational demands: Looking outside the wage structure. Journal of Labour Economics 24 (2), 235–270.

Statistisches Bundesamt, 2002. Volkswirtschaftliche Gesamtrechnungen, Input-Output Tabellen 1991 bis 2000. Wiesbaden: Statistisches Bundesamt.

Van den Berg, G. J., 2001. Duration models: specification, identification and multiple durations. In: Heckman, J., Leamer, E. (Eds.), Handbook of Econometrics. Vol. 5 of Handbook of Econometrics. Elsevier, Ch. 55, pp. 3381–3460.

Appendix A Appendix

Figure A.1: The degree of outsourcing in manufacturing and services in Germany, 1991-2000



Source: Input-output tables provided by the Germany Statistical Office and authors' calculations.
Note: The outsourcing index is defined in equation 1.

Table A.1: Outsourcing by Sector

	ISIC Rev. 3	Mean	Min	Max	Change 1991 - 2000 (percent. points)
Foods Products and Beverages	15	3.779	3.340	4.337	0.226
Tobacco Products	16	0.647	0.140	1.855	0.711
Textiles	17	7.625	5.281	9.534	4.253
Wearing Apparel, Dressing and Dying of Fur	18	14.752	7.551	23.337	13.227
Leather, Leather Products and Footwear	19	18.216	10.747	25.829	14.359
Wood and Products of Wood and Cork	20	4.570	4.169	4.916	0.060
Pulp. Paper and Paper Products	21	14.920	11.068	17.029	2.684
Printing and Publishing	22	1.704	1.523	1.833	-0.003
Coke, Refined Petroleum and Nuclear Fuel	23	5.765	4.096	8.070	-0.702
Chemicals and Chemical Products	24	10.932	8.758	15.155	6.035
Rubber and Plastics Products	25	0.751	0.364	0.982	0.456
Other Non-Metallic Mineral Products	26	2.248	2.095	2.377	0.023
Basic Metals	27	14.846	11.644	17.333	5.048
Fabricated Metals Products	28	1.335	1.075	1.537	0.404
Machinery, and Equipment, NEC.	29	5.141	4.409	5.850	0.944
Office, Accounting and Computing Machinery	30	15.861	8.990	23.352	13.928
Electrical Machinery and Apparatus, NEC	31	4.869	3.802	6.613	2.594
Radio, TV and Communication Equipment	32	16.486	13.850	21.483	7.240
Medical Precision and Optical Instruments	33	3.575	2.941	4.236	0.396
Motor Vehicles, Trailers and Semi-Trailers	34	8.987	7.404	11.559	2.420
Other Transport Equipment	35	27.061	20.519	37.445	16.740
Manufacturing NEC	36	6.035	4.693	8.562	3.392
Recycling	37	0.000	0.000	0.000	0.000
Weighted Average Manufacturing	15-37	6.905	5.955	8.691	2.735
Sale, Maintenance and Repair of Motor Vehicles; Retail Sale of Fuel; Retail Trade	50 / 52	0.000	0.000	0.000	0.000
Wholesale, Trade & Commission	51	2.661	1.068	4.335	3.066
Hotels and Restaurants	55	0.005	0.000	0.014	-0.004
Transport and Storage	60 - 63	0.500	0.184	0.719	-0.129
Post and Telecommunications	64	3.926	2.571	5.278	2.677
Financial Intermediations	65 - 67	0.147	0.083	0.227	-0.053
Real Estate, Renting and Business Activities	70 - 74	0.694	0.361	1.201	0.822
Public Administration and Defence; Compulsory Social Security	75	0.379	0.190	0.552	0.316
Education	80	0.000	0.000	0.000	0.000
Health and Social Work	85	0.000	0.000	0.000	0.000
Sewage and refuse disposal, sanitation and similar activities	90	1.853	1.288	2.571	1.257
Activities of membership organizations n.e.c.	91	0.000	0.000	0.000	0.000
Recreational, cultural and sporting activities	92	4.398	1.992	7.025	4.864
Other service activities	93	0.547	0.061	1.113	1.052
Weighted Average Services	50-93	0.792	0.448	1.275	0.821

Table A.2: Summary statistics

		Manufacturing		Service Sector	
		Mean	Std. Dev.	Mean	Std. Dev.
Employment duration 0 - 6 months	DD: 0-6	0.080	[0.271]	0.130	[0.337]
Employment duration 7-12 months	DD: 7-12	0.061	[0.239]	0.099	[0.298]
Employment duration 13-36 months	DD: 13-36	0.169	[0.375]	0.237	[0.425]
Employment duration 37-96 months	DD: 37-96	0.260	[0.439]	0.273	[0.446]
Gender	Male: yes	0.765	[0.424]	0.503	[0.500]
Age 18 to 24	Age 18-24	0.078	[0.268]	0.092	[0.289]
Age 25 to 29	Age 25-29	0.131	[0.337]	0.146	[0.353]
Age 30 to 34	Age 30-34	0.154	[0.360]	0.156	[0.363]
Age 35 to 39	Age 35-39	0.144	[0.351]	0.141	[0.348]
Age 40 to 44	Age 40-44	0.131	[0.337]	0.128	[0.334]
Age 45 to 49	Age 45-49	0.117	[0.322]	0.113	[0.317]
Age 50 to 54	Age 50-54	0.122	[0.328]	0.109	[0.312]
Age 55 to 59	Age 55-59	0.096	[0.295]	0.089	[0.284]
Age 60 to 65	Age 60-65	0.026	[0.150]	0.027	[0.161]
Foreign Nationality	Foreign: yes	0.088	[0.284]	0.041	[0.199]
Low-skilled Worker	Low skill	0.203	[0.403]	0.096	[0.294]
Medium-skilled Worker	Medium skill	0.723	[0.448]	0.790	[0.407]
High-skilled Worker	High skill	0.074	[0.262]	0.114	[0.318]
Establishment size 1 - 4 employees	ES: 1-4	0.031	[0.173]	0.121	[0.326]
Est. size 5 - 9 employees	ES: 5-9	0.038	[0.191]	0.086	[0.280]
Est. size 10 - 19 employees	ES: 10-19	0.052	[0.221]	0.091	[0.288]
Est. size 20 - 49 employees	ES: 20-49	0.093	[0.290]	0.147	[0.354]
Est. size 50 - 99 employees	ES: 50-99	0.094	[0.292]	0.117	[0.321]
Est. size 100 - 199 employees	ES: 100-199	0.120	[0.325]	0.113	[0.316]
Est. size 200 - 499 employees	ES: 200-499	0.177	[0.382]	0.133	[0.339]
Est. size 500 - 999 employees	ES: 500-999	0.123	[0.329]	0.079	[0.269]
Est. size 1000 - 4999 employees	ES: 1000-4999	0.156	[0.363]	0.093	[0.291]
Est. size $\geq$ 5000 employees	ES: $\geq$ 5000	0.113	[0.317]	0.016	[0.124]
Capital-output ratio	K/Y	0.449	[0.105]	1.981	[1.686]
Production Value [in 1000]	Prod. value	82.669	[46.818]	187.395	[152.308]
International Outsourcing	OUT	6.594	[5.433]	0.609	[1.059]
Regional unemployment	Unempl	9.420	[3.508]	10.652	[4.115]

Table A.3: Estimation results for the manufacturing sector (I)

	Sep		EE		EU		EN	
DD: 0-6	1.419	[0.015]***	1.011	[0.025]***	1.728	[0.026]***	1.411	[0.023]***
DD: 7-12	1.127	[0.015]***	0.943	[0.025]***	1.738	[0.027]***	0.747	[0.026]***
DD: 13-36	0.576	[0.013]***	0.612	[0.021]***	0.909	[0.026]***	0.312	[0.023]***
DD: 37-96	0.125	[0.012]***	0.252	[0.019]***	0.266	[0.025]***	-0.071	[0.021]***
Male: yes	-0.303	[0.010]***	0.283	[0.018]***	-0.462	[0.021]***	-0.782	[0.019]***
Age 18-24	0.402	[0.014]***	0.181	[0.023]***	0.362	[0.030]***	0.762	[0.025]***
Age 25-29	0.128	[0.013]***	0.071	[0.021]***	0.107	[0.028]***	0.264	[0.024]***
Age 35-39	-0.194	[0.015]***	-0.127	[0.021]***	-0.106	[0.030]***	-0.408	[0.028]***
Age 40-44	-0.294	[0.016]***	-0.198	[0.023]***	-0.123	[0.033]***	-0.660	[0.032]***
Age 45-49	-0.309	[0.017]***	-0.288	[0.025]***	-0.037	[0.034]	-0.636	[0.034]***
Age 50-54	-0.238	[0.016]***	-0.360	[0.025]***	0.177	[0.032]***	-0.456	[0.032]***
Age 55-59	0.531	[0.015]***	-0.597	[0.030]***	1.415	[0.029]***	0.755	[0.027]***
Age 60-65	1.447	[0.019]***	-1.012	[0.062]***	1.806	[0.044]***	2.558	[0.031]***
Foreign: yes	0.115	[0.014]***	-0.091	[0.026]***	0.119	[0.029]***	0.351	[0.024]***
Low skill	0.216	[0.011]***	-0.057	[0.020]***	0.326	[0.022]***	0.357	[0.020]***
High skill	0.103	[0.020]***	0.306	[0.028]***	-0.233	[0.047]***	-0.075	[0.041]*
ES: 5-9	-0.485	[0.021]***	-0.747	[0.033]***	-0.503	[0.039]***	-0.250	[0.040]***
ES: 10-19	-0.533	[0.020]***	-0.800	[0.031]***	-0.594	[0.038]***	-0.283	[0.038]***
ES: 20-49	-0.621	[0.018]***	-0.904	[0.028]***	-0.730	[0.035]***	-0.341	[0.035]***
ES: 50-99	-0.701	[0.018]***	-0.998	[0.029]***	-0.847	[0.035]***	-0.384	[0.035]***
ES: 100-199	-0.754	[0.018]***	-1.087	[0.028]***	-0.911	[0.035]***	-0.404	[0.035]***
ES: 200-499	-0.796	[0.017]***	-1.176	[0.027]***	-0.952	[0.034]***	-0.415	[0.033]***
ES: 500-999	-0.848	[0.019]***	-1.268	[0.030]***	-0.975	[0.037]***	-0.459	[0.036]***
ES: 1000-4999	-0.868	[0.019]***	-1.343	[0.030]***	-1.015	[0.038]***	-0.416	[0.036]***
ES: >5000	-0.989	[0.025]***	-1.789	[0.041]***	-1.340	[0.054]***	-0.203	[0.044]***
K/Y	1.254	[0.211]***	0.917	[0.347]***	1.739	[0.415]***	1.050	[0.367]***
Prod. value	-0.002	[0.001]*	-0.006	[0.002]***	-0.005	[0.002]**	-0.001	[0.002]
OUT	0.002	[0.005]	-0.012	[0.009]	-0.005	[0.010]	0.026	[0.009]***
Unempl	-0.015	[0.007]**	-0.052	[0.010]***	0.056	[0.012]***	-0.006	[0.013]
Failures	80,939		28,762		23,278		28,899	

Further variables: dummies for occupation, economic sector, region, month, year; trend per economic sector.
Base categories: DD: >96 months, Age 30-34, Medium skill, ES: 1-4 employees.
Significance levels: *: 10%, **: 5%, ***: 1%
Data: IABS 1975-2004 and authors' calculations.

Table A.4: Estimation results for the manufacturing sector (II): Skill effects

	Sep	EE	EU	EN	
OUT*					
Low skill	-0.003[0.005]	-0.015[0.009]	-0.004[0.010]	0.017	[0.009]*
Medium skill	-0.003[0.005]	-0.013[0.009]	-0.005[0.010]	0.031	[0.009]***
High skill	0.006 [0.006]	-0.007[0.009]	-0.005[0.012]	0.018	[0.010]*
Failures	80,939	28,762	23,278	28,899	

Further explanatory variables included as in Table A.3. The coefficients for the variables not shown are virtually identical to those in Table A.3.
Base categories: DD: >96 months, Age 30-34, Medium skill, ES: 1-4 employees.
Significance levels: *: 10%, **: 5%, ***: 1%
Data: IABS 1975-2004 and authors' calculations.

Table A.5: Estimation results for the manufacturing sector (III): Age effects

	Sep		EE		EU		EN	
OUT*								
Age 18-24	-0.007	[0.006]	-0.023	[0.010]**	-0.014	[0.011]	0.014	[0.009]
Age 25-29	-0.007	[0.006]	-0.021	[0.009]**	-0.021	[0.011]*	0.018	[0.010]*
Age 30-34	-0.008	[0.006]	-0.017	[0.009]*	-0.031	[0.011]***	0.012	[0.010]
Age 35-39	-0.008	[0.006]	-0.013	[0.009]	-0.030	[0.011]***	-0.003	[0.010]
Age 40-44	-0.007	[0.006]	-0.007	[0.009]	-0.041	[0.011]***	-0.006	[0.011]
Age 45-49	-0.010	[0.006]*	-0.008	[0.010]	-0.037	[0.011]***	-0.010	[0.011]
Age 50-54	0.003	[0.006]	-0.005	[0.010]	-0.011	[0.011]	0.018	[0.010]*
Age 55-59	0.032	[0.005]***	-0.002	[0.010]	0.037	[0.010]***	0.068	[0.009]***
Age 60-65	0.020	[0.006]***	0.021	[0.013]*	0.035	[0.012]***	0.047	[0.010]***
Failures	80,939		28,762		23,278		28,899	

Further explanatory variables included as in Table A.3. The coefficients for the variables not shown are virtually identical to those in Table A.3.
Significance levels: *: 10%, **: 5%, ***: 1%

Data: IABS-R01 and authors' calculations.

Table A.6: Estimation results for the service sector (I)

	Sep		EE		EU		EN	
DD: 0-6	1.184	[0.010]***	0.989	[0.015]***	1.975	[0.024]***	0.942	[0.015]***
DD: 7-12	1.135	[0.010]***	1.123	[0.015]***	2.295	[0.024]***	0.562	[0.015]***
DD: 13-36	0.620	[0.009]***	0.752	[0.014]***	1.414	[0.024]***	0.236	[0.014]***
DD: 37-96	0.249	[0.008]***	0.395	[0.013]***	0.658	[0.025]***	0.056	[0.013]***
Male: yes	-0.149	[0.006]***	0.228	[0.009]***	-0.230	[0.014]***	-0.522	[0.010]***
Age 18-24	0.176	[0.008]***	0.263	[0.013]***	0.140	[0.020]***	0.158	[0.014]***
Age 25-29	0.069	[0.007]***	0.142	[0.011]***	-0.004	[0.018]	0.031	[0.012]**
Age 35-39	-0.166	[0.008]***	-0.091	[0.012]***	-0.015	[0.019]	-0.327	[0.014]***
Age 40-44	-0.328	[0.009]***	-0.175	[0.013]***	-0.071	[0.021]***	-0.687	[0.017]***
Age 45-49	-0.397	[0.010]***	-0.255	[0.015]***	-0.027	[0.022]	-0.814	[0.018]***
Age 50-54	-0.399	[0.010]***	-0.341	[0.015]***	0.065	[0.022]***	-0.768	[0.019]***
Age 55-59	-0.056	[0.010]***	-0.525	[0.018]***	0.738	[0.022]***	-0.163	[0.017]***
Age 60-65	0.983	[0.012]***	-0.868	[0.037]***	0.888	[0.036]***	1.840	[0.019]***
Foreign: yes	0.251	[0.010]***	-0.074	[0.018]***	-0.026	[0.027]	0.693	[0.017]***
Low skill	0.287	[0.008]***	0.058	[0.014]***	0.317	[0.017]***	0.523	[0.014]***
High skill	0.009	[0.010]	0.117	[0.014]***	-0.249	[0.025]***	0.004	[0.018]
ES: 5-9	-0.257	[0.009]***	-0.255	[0.015]***	-0.351	[0.019]***	-0.221	[0.016]***
ES: 10-19	-0.280	[0.009]***	-0.249	[0.015]***	-0.450	[0.020]***	-0.233	[0.017]***
ES: 20-49	-0.305	[0.008]***	-0.246	[0.013]***	-0.535	[0.018]***	-0.248	[0.015]***
ES: 50-99	-0.296	[0.009]***	-0.227	[0.014]***	-0.637	[0.020]***	-0.198	[0.016]***
ES: 100-199	-0.331	[0.009]***	-0.260	[0.015]***	-0.734	[0.021]***	-0.224	[0.016]***
ES: 200-499	-0.384	[0.009]***	-0.302	[0.014]***	-0.848	[0.022]***	-0.285	[0.016]***
ES: 500-999	-0.436	[0.011]***	-0.331	[0.017]***	-1.013	[0.028]***	-0.316	[0.019]***
ES: 1000-4999	-0.470	[0.011]***	-0.365	[0.017]***	-1.125	[0.029]***	-0.300	[0.019]***
ES: >5000	-0.455	[0.022]***	-0.360	[0.033]***	-1.216	[0.064]***	-0.283	[0.037]***
K/Y	0.250	[0.059]***	0.717	[0.086]***	-0.017	[0.148]	-0.005	[0.103]
Prod. value	-0.003	[0.001]***	-0.005	[0.001]***	-0.002	[0.002]	-0.001	[0.001]
OUT	-0.113	[0.015]***	-0.266	[0.022]***	-0.002	[0.032]	0.003	[0.026]
Unempl.	-0.019	[0.003]***	-0.049	[0.005]***	0.043	[0.007]***	-0.020	[0.006]***
Failures	226,152		88,295		48,496		89,361	

Further variables: dummies for occupation, economic sector, region, month, year; trend per economic sector.
Base categories: DD: >96 months, Age 30-34, Medium skill, ES: 1-4 employees.
Significance levels: *: 10%, **: 5%, ***: 1%

Data: IABS 1975-2004 and authors' calculations.

Table A.7: Estimation results for the service sector (II): Skill effects

	Sep		EE		EU		EN	
OUT*								
Low skill	-0.129	[0.016]***	-0.257	[0.025]***	-0.052	[0.035]	0.013	[0.028]
Medium skill	-0.107	[0.022]***	-0.271	[0.023]***	0.013	[0.032]	0.011	[0.026]
High skill	-0.141	[0.017]***	-0.238	[0.025]***	-0.117	[0.039]***	-0.129	[0.030]***
Failures	226,152		88,295		48,496		89,361	

Further explanatory variables included as in Table A.6. The coefficients for the variables not shown are virtually identical to those in Table A.6.
Base categories: DD: >96 months, Age 30-34, Medium skill, ES: 1-4 employees.
Significance levels: *: 10%, **: 5%, ***: 1%
Data: IABS 1975-2004 and authors' calculations.

Table A.8: Estimation results for the service sector (III): Age effects

	Sep		EE		EU		EN	
OUT*								
Age 18-24	-0.061	[0.016]***	-0.328	[0.024]***	0.054	[0.034]	0.146	[0.027]***
Age 25-29	-0.130	[0.015]***	-0.286	[0.023]***	-0.014	[0.034]	-0.026	[0.027]
Age 30-34	-0.153	[0.016]***	-0.274	[0.023]***	-0.028	[0.034]	-0.094	[0.027]***
Age 35-39	-0.116	[0.016]***	-0.224	[0.023]***	-0.030	[0.034]	-0.095	[0.028]***
Age 40-44	-0.109	[0.016]***	-0.252	[0.024]***	-0.015	[0.035]	-0.050	[0.029]*
Age 45-49	-0.114	[0.016]***	-0.242	[0.024]***	-0.045	[0.036]	-0.065	[0.030]**
Age 50-54	-0.101	[0.016]***	-0.247	[0.025]***	-0.009	[0.035]	0.003	[0.030]
Age 55-59	-0.084	[0.017]***	-0.261	[0.027]***	0.020	[0.035]	0.104	[0.028]***
Age 60-65	-0.138	[0.018]***	-0.226	[0.037]***	0.101	[0.041]**	0.011	[0.029]
Failures	226,152		88,295		48,496		89,361	

Further explanatory variables included as in Table A.6. The coefficients for the variables not shown are virtually identical to those in Table A.6.
Significance levels: *: 10%, **: 5%, ***: 1%
Data: IABS-R01 and authors' calculations.