International Outsourcing and Individual Job Separations*

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Abstract

This paper studies the effects of international outsourcing on individual transitions out of jobs in the Danish manufacturing sector for the period 1992-2001. A competing risks duration model that distinguishes between job-to-job, job-to-unemployment and job-to-nonparticipation transitions is estimated. It is found that international outsourcing has an overall positive effect on both job-to-job transitions and job-to-unemployment transitions and a negative effect on job-to-nonparticipation transitions. However, only the effect on the job-to-unemployment hazard is significant. Based on the estimation results from a single risk model, where no distinction is made between transitions out of the job, up to 6.5 % of all job separations in the manufacturing sector can be attributed to international outsourcing.

*Selected early results from the analysis are presented in Danish Economic Council (2004); *Danish Economy, Autumn 2004*.

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1 Introduction

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2 Data

The dataset is a 10 % sample of the Danish population for the years 1992-2001. In each year detailed information about the labour market states of all individuals along with information on socio economic characteristics is available. These socio economic variables are extracted from the integrated database for labour market research (IDA) and the income registers in Statistics Denmark. Of particular importance is that a workplace identity is associated with each worker at the end of each year. A firm can have more than one workplace so if a worker changes between two workplaces within the same firm, then this is counted as a job change in the present analysis. Job spells are then straightforwardly constructed from successive years at the same workplace.

Here we are interested in the duration of job spells in manufacturing industries and the different transitions out of the current job. The job spells are flow sampled such that only spells starting in 1993 and later are included in the analysis (thus avoiding problems with left-censoring). The destination state for all spells that end before January 1st 2002 is known and we focus on spells that end with a transitions into a new job, into unemployment and into nonparticipation. If job spells are uncompleted in 2001 then they are treated as right censored observations. Also job spells are treated as right censored observations if they end because of a firm closure. To increase the homogeneity of the sample all part time employed, self employed, students with jobs and persons below the age of 18 have been excluded.

The other important variable is the measure for international outsourcing. I follow most of the literature and measure outsourcing at the industry level in terms of imported intermediates in production. Feenstra & Hanson (1996) and Feenstra & Hanson (1999) suggest two different measures of outsourcing – a broad and a narrow measure. The broad measure is defined here as the value of all imported intermediate inputs of an industry divided by the industry's production value, while the narrow measure restricts attention to intermediate inputs that are purchased from the same industry as the good being produced (again divided by the industry's value of production). The idea behind the narrow measure is that it only includes imported production activity that could have been done within the domestic industry. These two measures are created from input-output tables from Statistics Denmark for the years 1966-2000 and shown in Figure 1 for

all manufacturing industries. For the sample period the broad measure of outsourcing rises from 17.0 percent in 1993 to 19.9 percent in 2000 representing an increase of 17 percent, and the narrow measure rises from 4.3 percent to 5.4 percent representing an increase of 22 percent.

Insert Figure 1 about here

A long list of socio economic characteristics are used as control variables in the analysis. Self explanatory dummies for age, gender, the presence of children, the presence of two adults in the household, citizenship, city size, home-ownership, education and experience are included. There is also a dummy for not being a member of an unemployment insurance fund, trade union membership and dummies for the labour market state prior to the job spell with a distinction between employment, unemployment, self-employment and nonparticipation. There is a dummy for the size of the firm (or more precisely workplace) in terms of the workforce. To capture business cycle effects the GDP growth rate and local unemployment rates based on 51 local labour markets[1] are included. The hourly wage rate is also used as a control variable in the analysis, and the available wage rate variable from the IDA register had to be corrected for pension fund payments. The wage rate in a given year is calculated as total labour income divided by the total number of hours worked. However the measure for total labour income do not include mandatory pension fund payments, but since the variables wage rate, total labour income and pension fund payments are available in the data, it was straightforward to correct the wage rate.[2]

In the final data set there are 151,945 observations where one observation is one year in on job spell. The number of job spells is 61,000 and they come from 43,689 individuals. Descriptive statistics for the data set are presented in Table 1.

Insert Table 1 about here

[1]The local labour markets are socalled commuting areas that are defined such that the internal migration rate is 50 % higher than the external migration rate, cf. Andersen (2000).

[2]Except for the years 1993 and 1994, where the pension fund payment had to be estimated based on collective bargaining agreements for different sections of the labour market. However in 1993 and 1994 pension fund payment were relatively small, so the measurement error arising from this procedure is minimal.

3 Econometric model

When the impact of outsourcing on individual job separations is analysed, it is essential to control for state dependence since the job separation rate typically declines with time on the job possibly due to the accumulation of match specific human capital (see eg. Farber (1999) for an overview). To that end this section sets up a duration model, which accommodates for right censored job spells and allows for duration dependency in the transition process out of the current job. Further, to distinguish between transitions from employment to e.g. unemployment, nonparticipation and a new job a competing risks duration model is specified. Even if there is access to a dataset that facilitates control for much individual heterogeneity, there might still be some unobserved heterogeneity left. Thus, unobserved worker characteristics is accounted for, and so a mixed proportional hazard model for the job transitions is specified, ie. the destination specific hazard rates are:

$$\theta_i(t|x_t, \upsilon_i) = \lambda_i(t) \exp(x_t\beta_i + \upsilon_i), \tag{1}$$

where $i = 1, .., m$ indicates the different destination states for transitions out of the job spell, $\lambda_i(t)$ is the baseline hazard capturing the time dependence, and $\exp(x_t\beta_i + \upsilon_i)$ is the systematic part giving the proportional effects of observed and time-varying characteristics, x_t, and unobserved characteristics, υ_i. All job spells that end with a transition to other states than those modelled are treated as right censored.

The annual observations in the data imply that the duration variable T is grouped into $K+1$ intervals $\{[0, t_1), [t_1, t_2), .., [t_k, \infty)\}$ which must be accounted for in the econometric setup. Following Kiefer (1990) the interval specific survival rate is defined as

$$\begin{aligned} \alpha_k &= P(T \geq t_k | T \geq t_{k-1}, x, \upsilon) \\ &= \exp\left[-\sum_{i=1}^{m} \int_{t_{k-1}}^{t_k} \theta_i(t|x_t, \upsilon_i) dt \right] \\ &= \exp\left[-\sum_{i=1}^{m} \exp(x_k\beta_i + \upsilon_i)\Lambda_{i,k} \right] \\ &= \prod_{i=1}^{m} \alpha_{i,k}, \end{aligned} \tag{2}$$

where $\Lambda_{i,k} = \int_{t_{k-1}}^{t_k} \lambda_i(t) dt$ and $\alpha_{i,k} = \exp\left[-\exp(x_k\beta_i + \upsilon_i)\Lambda_{i,k} \right]$.

To find the contribution to the likelihood function from a job spell it is noted that the probability that a spell ends in interval k is given by the conditional probability of failure in that interval times the probability that the spell survives until interval k, or

$(1-\alpha_k)\prod_{j=1}^{k-1}\alpha_j$. Some spells are right censored and they contribute to the likelihood with the survivor function, $\prod_{j=1}^{k}\alpha_j$. Thus the contribution to the likelihood function from a job spell can be written

$$\mathcal{L}_e = \prod_{i=1}^{m}(1-\alpha_{i,k})^{d_i}\alpha_k^{1-\Sigma_i^m d_i}\prod_{j=1}^{k-1}\alpha_j, \tag{3}$$

where $d_1, .., d_m$ are destination state indicators. If the job spell is right censored then $d_1 = .. = d_m = 0$. Instead of imposing a functional form on the baseline hazard we allow for a flexible specification by simply estimating the interval specific baseline parameters $\Lambda_{i,k}$.

The unobserved heterogenity is specified by the stochastic variables $V_1, .., V_m$, so the complete contribution to the likelihood function for each individual is

$$\mathcal{L} = \int_{V_1} .. \int_{V_m} \mathcal{L}_e(t|x_t, V_1, .., V_m)dF(V_1, .., V_m), \tag{4}$$

where F is the joint CDF for the unobserved heterogeneity. We follow Heckman & Singer (1984) by choosing a discrete distribution, and we assume that each stochastic variable can take two values each with an associated probability. Thus, altogether there are 2^m points of support.

4 Results

In the first set of results I have estimated the model without a distinction between the different destination states for the job separations, so this reduces to a single risk duration model. The estimated baseline parameters of this model show that the probability of a job separation declines with job tenure (not shown). The effects of the covariates on the separation rate are presented in Table 2, and it is seen that eg. younger workers and low skilled workers have shorter job spells. Labour market experience reduces the risk of a job separation, but somewhat surprising membership of UI funds and unions.increases the separation rate. A higher wage rate seems to increase the likelihood of a job separation. However, this effect should be interpreted with caution, since it may be endogenous. For the present purposes I include the wage variable mainly to control for heterogeneity. It is also seen that, if workers were unemployed prior to the job spell, then their job spells tend to be shorter when compared to workers who had another job prior to the present job. Also, a higher GDP growth rate lead to a lower job change hazard rate.

Insert Table 2 about here

Our main variable of interest is the outsourcing measure (in Table 2 the broad measure of outsourcing), and it has a significant positive impact on the job separation rate. The quantitative importance of the estimated coefficient of 0.3243 can be assessed by calculating the relative (percentage) change in this separation rate in response to a 1 percentage point increase in the outsourcing measure as follows: exp(0.3243*0.01)-1=0.003248. That is, the separation rate rises with 0.3 percent if the broad outsourcing measure rises one percentage point. In the same manner it is possible to get an upper bound on the fraction of the separation rate that can be attributed to outsourcing. In 2000 the average level of outsourcing was 0.199, so up to 6.5 percent of the separation rate in the manufacturing sector can be explained by outsourcing, and this amounts to around 4.000 separations in 2000. Compared to a total annual destruction of jobs in the Danish economy of 260.000 (cf. Danish Economic Council (2002)), this number seems rather modest.

The next question is whether the effect of outsourcing differs between transitions into a new job, unemployment or nonparticipation. Outsourcing of production activities to other countries is associated with short run costs if it leads to unemployment or withdrawal from the labour force, but if most workers get a new job immediately this is less of problem. To investigate this issue the competing risks formulation of the empirical model is estimated, the results of which are presented in Table 3. The effects of covariates on the three destination specific hazard rates often have different signs depending on the destination state. Most striking are the effects of labour market experience and the wage rate. Higher wage and more experience increases the job change probability but reduces the unemployment risk, and only experience significantly affects the nonparticipation risk. Education, UI fund membership and union membership also have opposite effect on the job change hazard and the unemployment hazard, thus illustrating the importance to control for individual heterogeneity.

Insert Table 3 about here

With respect to the impact of international outsourcing it is found that there is a positive effect on both job-to-job transitions and job-to-unemployment transitions and a negative effect on job-to-nonparticipation transitions. However, only the effect on the job-to-unemployment hazard is significant. Thus the overall positive effect of outsourcing on job separations in the single risk model can first and foremost be attributed to an even bigger positive effect on the job-to-unemployment transition rate.

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A Appendix: Figures and tables

TABLE 1

DESCRIPTIVE STATISTICS

Variables	Mean	Stdv.
Age 18-24	0.1609	0.3675
Age 25-29	0.1740	0.3791
Age 30-39	0.3273	0.4692
Age 40-49	0.2034	0.4025
Age 50 +	0.1343	0.3410
Female	0.2959	0.4564
Children 0-17 years	0.2488	0.4323
Two adults	0.6723	0.4694
Basic education	0.4124	0.4923
Vocational education	0.4248	0.4943
Further education	0.1628	0.3692
Labour market experience (/100)	0.1312	0.0892
Non insured	0.1058	0.3076
Union member	0.8349	0.3713
Log wage (/10)	0.5092	0.0390
Previous state: employed	0.7207	0.4487
Previous state: unemployed	0.1616	0.3681
Previous state: self employed	0.0226	0.1488
Previous state: nonparticipation	0.0950	0.2933
Firm size 50+	0.6898	0.4626
GDP growth rate (/10)	0.2821	0.1002
Local unemployment rate (/10)	0.6785	0.2399
Outsourcing	0.2028	0.0808
Import	0.6218	0.7022
Export	0.6095	1.0164
# observations	151,945	

TABLE 2

ESTIMATION RESULTS: SINGLE RISK MODEL

	Job separation hazard	
Variables	Coeff.	Std. err.
Age 18-24	**0.2021**	0.0194
Age 25-29	**0.0832**	0.0160
Age 40-49	**-0.0974**	0.0173
Age 50 +	-0.0278	0.0228
Female	0.0064	0.0124
Children 0-17 years	0.0260	0.0145
Two adults	**-0.1078**	0.0129
Basic education	**0.0597**	0.0122
Further education	**-0.0878**	0.0175
Labour market experience (/100)	**-1.1963**	0.1037
Non insured	**-0.2025**	0.0204
Union member	**0.0393**	0.0161
Log wage (/10)	**0.5995**	0.1725
Unemployed	**0.1018**	0.0150
Self employed	**-0.2818**	0.0424
Nonparticipation	0.0204	0.0195
Firm size 50+	**-0.1610**	0.0116
GDP growth rate (/10)	**-0.1386**	0.0459
Local unemployment rate (/10)	0.0203	0.0233
Outsourcing	**0.3243**	0.0795
Import	**-0.0345**	0.0098
Export	**0.0364**	0.0053
υ_2	**1.2816**	0.0139
$P(\upsilon_1)$	**0.2274**	
$P(\upsilon_2)$	**0.7726**	

Note: Bold numbers indicate a significant parameter estimate (5 % level).

TABLE 3

ESTIMATION RESULTS: COMPETING RISKS MODEL

	Job change hazard		Unemployment hazard		Nonparticipation hazard	
Variables	Coeff.	Std. err.	Coeff.	Std. err.	Coeff.	Std. err.
Age 18-24	**0.4494**	0.0308	0.0654	0.0419	**0.3209**	0.1193
Age 25-29	**0.1847**	0.0240	-0.0207	0.0397	**0.3606**	0.0697
Age 40-49	**-0.3018**	0.0258	**0.1663**	0.0369	**-0.7261**	0.0824
Age 50 +	**-0.5848**	0.0364	**0.3889**	0.0446	**0.4451**	0.0886
Female	**-0.1831**	0.0197	0.0374	0.0226	**0.6407**	0.0604
Children 0-17 years	-0.0087	0.0218	0.0598	0.0348	-0.0411	0.0713
Two adults	0.0094	0.0240	**-0.2858**	0.0237	-0.0531	0.0679
Basic education	**-0.0830**	0.0208	**0.0761**	0.0227	**0.1872**	0.0480
Further education	**0.1755**	0.0223	**-0.4218**	0.0377	**-0.3732**	0.0755
Experience (/100)	**0.9515**	0.1697	**-3.4324**	0.1951	**1.3844**	0.5850
Non insured	**0.1320**	0.0296	**-1.6102**	0.0607	**0.3346**	0.0986
Union member	**-0.0495**	0.0242	**0.5748**	0.0401	0.0667	0.1161
Log wage (/10)	**3.7498**	0.2407	**-6.5581**	0.5420	-1.0562	1.5494
Unemployed	**-0.5613**	0.0285	**0.4351**	0.0238	**0.3842**	0.0596
Self employed	**-0.3933**	0.0636	**-0.2613**	0.0843	-0.1302	0.1915
Nonparticipation	**-0.3387**	0.0311	**0.1945**	0.0333	**0.5301**	0.0671
Firm size 50+	**-0.0989**	0.0175	**-0.2953**	0.0210	-0.0128	0.0908
GDP growth (/10)	**-0.3812**	0.0857	**-0.3766**	0.1250	**0.7666**	0.3312
Local unempl. (/10)	**-0.1892**	0.0359	**0.3630**	0.0413	0.0622	0.2249
Outsourcing	0.0850	0.3545	**0.9032**	0.1483	-0.7386	0.3787
Import	-0.0049	0.0646	**-0.0696**	0.0182	-0.0399	0.0583
Export	**0.0369**	0.0154	0.0238	0.0136	**0.0534**	0.0197
$\upsilon_{j,2}$	5.7805	15.4797				
$\upsilon_{u,2}$	7.8131	208.4488				
$\upsilon_{n,2}$	**7.9370**	2.5370				
$P(\upsilon_{j,1}, \upsilon_{u,1}, \upsilon_{n,1})$	**0.8674**					
$P(\upsilon_{j,2}, \upsilon_{u,2}, \upsilon_{n,2})$	**0.1326**					

Note: Bold numbers indicate a significant parameter estimate (5 % level).

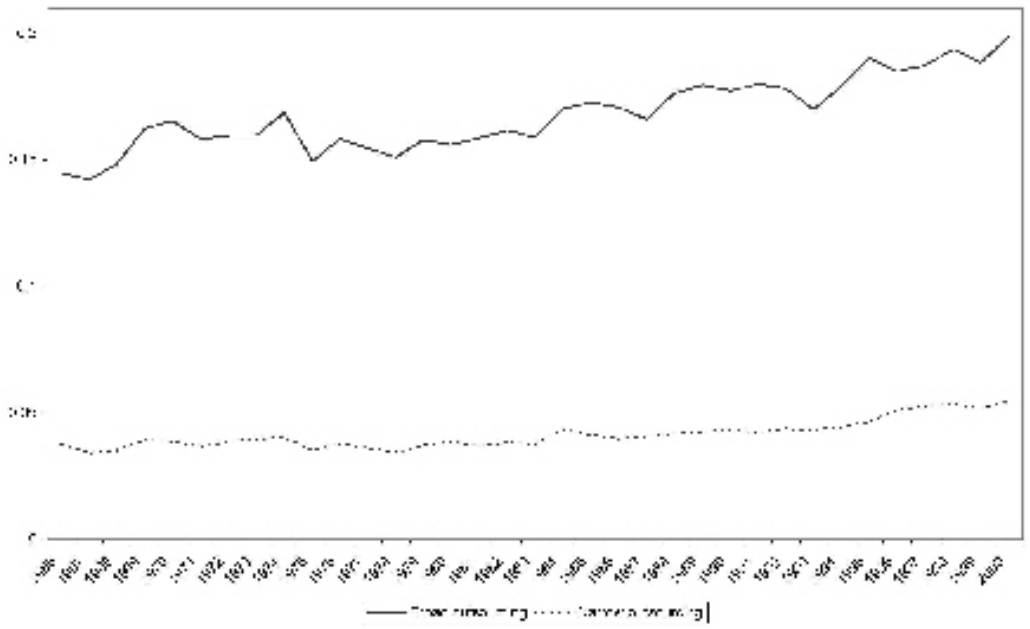

Figure 1: Outsourcing in Danish manufacturing industries