Job Stability and the Business Cycle

Susanne Steffes[1]
preliminary version!

11th August 2008

[1]Centre for European Economic Research (ZEW); steffes@zew.de; phone: ++49/621/1235-281

1 Introduction

Labour Markets are highly dynamic - this is a stylized fact in the empirical literature. The movements are job and worker flows, more precisely job destruction and creation or separations and hirings . From theory we know that the reasons for these movements are economic shocks and the existence of bad matches where the former concerns job flows and the latter worker flows. Since decades the amount and the determinants of the dynamics are analyzed empirically and still, the challenge is to find appropriate data and good variables that indicate shocks and bad matches. Aggregated shocks can be observed relatively easy but for the analysis of idiosyncratic shocks, industry- or firm-level data is needed. Moreover, the existence of bad matches are hardly observed with usual data thus, proxies have to be found. Since it is known that job and worker flows are not homogenous over firms and workers this heterogeneity should be taken into account in empirical research. Moreover, in the recent theoretical literature the impact of shocks on the behavior of firms and workers is modeled precisely, accounting for the situation in which the firm or worker is. For instance Pissarides (1994) models on-the-job search in a way that it depends on tenure. After a certain employment duration the worker stops searching on-the-job but, if the firm is hit by a shock this point in time will be adjusted. Therefore, analyzing separation rates, tenure of the employee who separates should be taken into account.

In this paper we analyse the impact of the business cycle as well as of firm and worker characteristics on job and worker flow rates. This was even done in other studies but we use a linked employer-employee dataset which contains information on daily employment and additionally various firm and worker characteristics. Furthermore, we analyse whether there are differences in separation rates with regard to tenure. Here, our main question is whether firms primarily fire short-tenure employees after a negative shock with that stabilizing employment of long-tenure employees. Additionally, we differentiate between job-to-job and job-to-unemployment as proxies for voluntary and involuntary

separations. If separations are increasing in a recession, they mainly should lead to unemployment which is expected to be due to involuntary separations. If they are increasing in a boom job-to-job changes should raise due to voluntary separations.

The reason why we expect short-term employment to be more affected from negative shocks is that firing costs are not constant for all workers. They could depend on the type of contract, on former human capital investments paid by the employer and on the length of employment duration. Obviously, all reasons are related to each other. If tenure is short, investments in human capital have probably not been very high and therefore, sunk costs are less for the employer. Moreover, fixed-term contracts are generally not long-term and exhibit generally less firing costs for the employer than other types of contracts (Goux et al. 2001).[1] Additionally, short employment spells exhibit less firing costs due to institutional reasons. In most of the continental European countries firms are not allowed to fire their employees without obeying periods of notice given by law. These periods of notice depend on the length of employment with the same employer and increase with tenure. The amount of severance payments generally depend on tenure. For all these reasons, workforce adjustment is more flexible and less costly for short-tenure jobs. In a recent study Portugal and Varejao (2007)(Portugal and Varejao, 2007) analyze how long establishments remain inactive, i.e. gross or net employment do not change, and take this information in order to make statements about the shape of adjustment costs. They find that a high share of fixed-term contracts, low-skilled employees or shortly employed employees leads to shorter periods of inactiveness. They conclude that adjustment costs are lower for these firms.

In two seminal papers about gross job destruction and creation and employment reallocation based on establishment-level data Davis and Haltiwanger (1990, 1992) found for the US manufacturing industry that employment is highly

[1] In Germany, with the exception of academia the maximum duration a worker is allowed to be employed under a fixed-term contract with the same employer is three years.

dynamic and that there is a lot of heterogeneity of employment changes between establishments and over time. They also found that a large fraction of workforce dynamics occur through worker accessions and separations but not through job creation and destruction[2]. Similar results were found for the US with other data as well as for other countries (see Anderson and Meyer, 1994, for the US, Albaek and Sorensen, 1998, for Denmark, Abowd et al., 1999, for France, Portugal and Varejao, 2007, for Portugal). Burgess et al. (2000) analyze the relationship between job and worker flows and churning and find additional to employer heterogeneity evidence for the so called match heterogeneity which is expressed by different churning flows. Despite high churning rates for most of the employers they find a high share of stable employment relationships indicating that churning flows concern only a part of the whole employment per employer. Since better micro-data - especially linked employer-employee data - was available from the mid-nineties on, firm-level analyses could be done and, thus, between-firm heterogeneity could be controlled for (see for instance Hamermesh et al., 1996). Moreover, employment dynamics of different worker groups, e.g. certain skill or age groups, could be analysed taking within-firm heterogeneity into account. Gürtzgen (2007) uses a dataset similar to ours and investigates the impact of within-firm wage dispersion (as a proxy for wage flexibility) on job and worker reallocation. She finds a negative relationship between wage flexibility and job reallocation. With excess worker flows wage flexibility is positively correlated. Gielen and van Ours (2006) investigate whether workforce adjustments on shocks differ between age-groups. They find that adjustment in the Netherlands occurs for young and prime-age workers through entries and for older workers through exits. The impact of technological and organizational changes on job and worker turnover of different skill-groups is analyzed in Bauer and Bender (2002). They find that organisational changes have negative impacts on the employment growth of low- and medium-skilled but not on high-skilled.

[2]In order to compare total worker reallocation with job reallocation they use information of the Current Population Survey (CPS) which they link to the Longitudinal Research Data (LRD) the data they use in order to calculate job flow rates for the US-manufacturing industry.

In contrast, they find no significant effects of technological changes controlling for firm fixed effects. Abowd et al. (1999) find that lower skill groups exhibit larger turnover rates than higher ones. Furthermore, they investigate the distribution of short-tenure (fixed-term) and long-tenure contracts finding a high short-tenure share of entry and exit rates. They also find that "approximately one third of all short-term hires result in longer-term employment matches".

Caballero et al. (1997) find for the USA that "aggregate shocks account for about 90 percent of fluctuations in average employment growth". "Aggregate shocks are the dominant source of fluctuations in destruction flows but account for less than half of the fluctuations in creation flows." Bachmann (2006) analyzes labour market dynamics over the business cycle for Germany. He uses administrative data which is similar to our employee data but in contrast to our study he cannot control for firm effects. A main advantage of this study is that he distinguishes between flows into unemployment or non-employment and job-to-job transitions. This seems to be important because as results show job-to-job and job-to non-employment transitions are procyclical whereas job-to-unemployment changes are countercyclical leading to an overall a-cyclicality of separations. On the other hand accessions are found to be strongly procyclical. With similar data Fitzenberger and Garloff (2007) descriptively analyze labour market transitions according to the business cycle between 1975 and 1997 for West Germany and their results confirm the findings of Bachmann (2006). Abowd et al. (1999) use the change in registered unemployment rates as their cycle measure and find procyclical employment growth rates. They also find that employment entry rates are weakly countercyclical. In contrast to Germany for France exit rates are found to be strongly countercyclical which can be driven by involuntary exit rates, but even the quit rate is weakly countercyclical. With data for the Netherlands Gielen and van Ours (2006) use the change in national and sectoral employment as a cycle measure and find that job creation is pro- and job destruction is countercyclical referring to the sector-level measure. Accessions and separations are found to be positively related to aggregated

employment growth whereas procyclical quit rates seem to dominate countercyclical layoff rates. For the manufacturing industry in Denmark Albaek and Sorensen (1998) find similar results with the exception that the cyclical reaction of quits is dominated by layoffs leading to countercyclicality of separations. In none of these studies employment is distinguished in short-term and long-term jobs in the way we do. In a model of job finding and separation rates Shimer (2005a) includes short-term unemployment and therefore takes separations that are often not observed in the data into account[3]. The reason is that a higher job finding rate leads to shorter unemployment spells between two employment spells and thus the probability that a separation is not observed leads to a time aggregation bias when analyzing empirically the relation between the two rates. The paper is structured as follows: In the next chapter we give an overview about the theoretical background. The data is described in section 3 including some first descriptive statistics. In section 4 we shortly discuss the econometric model and the specification in section 5 results are discussed. Finally, we end up with a conclusion.

2 Theoretical background

2.1 Job flows and cyclicality

The empirical evidence that gross job flows vary asymmetrically with the business cycle and the question how to model this theoretically was discussed a lot in the recent decades. The very early models like for instance that developed by Blanchard and Diamond (1989) are simply determining the Beveridge Curve, i.e. the steady state level of vacancies and unemployment by a matching function. The business cycle mechanisms that drive job destruction and cre-

[3]In most studies the minimum time interval employment and unemployment rates are observed is one month, leading to short-term unemployment or employment to be underrepresented.

ation are changes in productivity that follow a Markov process in continuous time. Two kinds of shocks are expected to hit the economy. One is a change in the proportion of potentially productive jobs (macro shocks) and the other is a change in the intensity of reallocation (micro shocks). As an answer to the empirical evidence that job destruction rates are more volatile than job creation Caballero and Hammour (1994) modelled the dependence of job creation costs on the rate of creation to be the reason for variations in job destruction rates over the business cycle. They assume that firms close down costlessly when they reach a certain age because their productivity constantly decreases over the lifecycle. Since job creation is costly with a convex cost function, the adjustment on positive shocks cannot take place instantaneously. Therefore, some of the adjustment takes place by changing endogenously the job destruction age threshold.

In order to make job destruction endogenous Mortensen and Pissarides (1994) developed a matching model of unemployment where the productivity of jobs is determined by a price component that is common to all jobs and a price component that is job-specific. Additionally, there is a common parameter that reflects the dispersion of the idiosyncratic prices. The whole model is determined by the number of vacancies and unemployment which affect job creation through the matching function and a reservation productivity that affects job destruction. The reservation productivity is a threshold value of the idiosyncratic component of the productivity under that a job is immediately destroyed. In a steady state equilibrium positive macro shocks (increase in the aggregated price) are expected to increase job creation and to decrease job destruction. Positive micro shocks caused by an increase in the distribution of the idiosyncratic price component are expected to increase both job creation and job destruction because for some firms the option value of a job increases and for some firms it decreases. On the other hand negative macro shocks are expected to destroy some jobs immediately but to have no impact on job creation. These results are driven by the assumption that shocks once occurred

remain infinitely. Assuming that shocks will end within a finite period of time with a certain probability, i.e. including cyclical shocks into the model, changes the steady state results in the following way: Because a downturn is anticipated in a boom, the option value of a job decreases and therefore the reservation productivity is higher than in the steady state equilibrium. Reversely in a recession the option value is higher than in steady state leading to a lower reservation productivity. Thus, job destruction rates are expected to be less volatile after aggregated shocks[4]. The same holds for job creation in a boom but in a recession job creation rates do not differ from steady state equilibrium. Nevertheless, due to the fact that the unemployment-vacancy ratio and the reservation productivity do not change given the productivity, the adjustment processes lead to an increase in the volatility of job destruction during the first time after a cyclical shock took place.

2.2 Job flows, worker reallocation and cyclicality

In the above section all described models imply the assumption that job reallocation is the only dynamic on the job market and therefore worker reallocation is excluded. However, empirical evidence shows that there is a high amount of excess worker reallocation that is not captured by these models. Therefore, Burda and Wyplosz (1994) included worker flows into a matching model, i.e. separations can take place due to the existence of a bad match without cancelling the job[5]. With this assumption the authors account for heterogeneity in the labor market and additionally differ between vacancies that reflect an unfilled position and vacancies that are planned positions. A negative shock leads to a reduction of the vacancy/unemployment-rate by four alternative possibilities. The elimination of planned positions and the closure of unfilled positions are the first activities in order to adjust. If there are no open vacancies to close

[4]The expectations for idiosyncratic shocks remain the same.

[5]A seminal paper deriving turnover as a consequence of bad match quality that is not known at the beginning of a job is that of Jovanovic (1979).

adjustment takes place by layoffs resulting in new unfilled jobs (number of filled and unfilled jobs exceed employment) or in the more extreme case by job destruction (number of jobs is less than employment). The former occurs after a small shock and is followed by an increase in job creation. The latter occurs after a large shock and is followed by a decrease in job creation. By including on-the-job search Pissarides (1994) developed a search model that also accounts for the mentioned empirical facts by allowing for two different match qualities (good and bad matches) and for wages that are increasing with tenure due to the accumulation of firm-specific human capital[6]. Only workers with bad job matches are searching on-the-job and this only until their current wages equalize possible entry wages of good matches, thus search effort depends on tenure. After a positive shock the number of on-the-job searchers as well as the number of job vacancies increases and the unemployment rate decreases. The author concludes that vacancies are more volatile and unemployment is less volatile in a model with on-the-job search. A further implication of this model is the dependence of tenure on the business cycle. During a boom average tenure decreases because the maximum tenure threshold until a worker in a bad match has the opportunity to receive better outside options increases and therefore more workers are searching on-the-job. For negative shocks the contrary occurs.

Barlevy (2002) elaborated another model including match heterogeneity and states that besides the cleansing effect that arises in recessions (e.g. Caballero and Hammour) there is a sullying effect that leads to a decrease in aggregate productivity due to an inefficient allocation of resources. In his model he introduces on-the-job search and different qualities of job matches. Again, unemployed as well as employed are searching for (better) job matches until they found the best possible match. This implies that jobs are not efficiently allocated. After a negative shock the number of vacancies drops down and thus, it lasts longer for an individual to find the perfect job match[7]. There-

[6]Earlier work on this was done by Burdett (1978) who introduces on-the-job search into a search model that only considers the supply side of the job market.

[7]A similar result is shown by Krause and Lubik (2006) where the endogenous job creation

fore, besides the cleansing effect that raises the overall productivity level there is a reverse effect in recessions. For our purpose this model is interesting because it implies that bad matches have longer tenure during a recession due to a decreasing job offer rate which is a different explanation for the same result compared with Pissarides (1994). However, considering empirical evidence it is important to emphasize that this holds only for voluntary separations followed by wage increases at the new employer. This restriction was repealed by Shimer (2005a) who distinguishes between voluntary and involuntary separations, the former being the result of on-the-job search and the latter of displacement. The focus is here on the job finding and separation rate and the respective effects on job-to-job transitions. In steady state the overall job-to-job transition rate is increasing in the separation rate as well as in the job finding rate for both unemployed and employed workers. After an aggregated shock involuntary job-to-job transitions are positively correlated with the separation rate and the job finding rate of unemployed workers. This means after a rise in the separation rate displacement increases and thus, average tenure decreases. Voluntary job-to-job transitions increase when the job finding rate for employed workers increases. This is the same result as in Pissarides (1994) and Barlevy (2002). In contrast to the first intuition, on-the-job search and thus, voluntary job-to-job transitions increase shortly after a rise in the separation rate. This is due to the fact that displaced workers are expected to be job hopping until they find a good match again. The last result indicates that average tenure decreases in recessions due to involuntary and voluntary separations which leads to the conclusion that business cycle effects on tenure are larger in recessions.

In most of the literature on matching and search models the wage is assumed to be Nash-bargained and therefore the weights are fixed over the cycle leading to constant job finding rates. Because this does not fit to reality, in two recent papers Hall (2005) and Shimer (2005b) develop models with endogenous job finding rates. The mechanism in Hall (2005) is as follows: wages are bar-

rate is higher in booms due to the rising availability of good on-the-job searchers.

gained within a certain bargaining set which lower bound is determined by the reservation wage of the worker and the upper bound is determined by the maximum wage accepted by the employer. If the bargained wage is relatively high, the number of vacancies decreases because the expected surplus for employers decreases resulting in higher unemployment and lower employment rates. Shimer (2005b) takes changes in the separation rate of employed workers as the driving forces that affect the job finding rate and "induce a counterfactually positive correlation between unemployment and vacancies". A main assumption of his model is that wages are renegotioated after each shock. However, since separation shocks are modeled to be exogenous it remains unclear where the volatility of the separation rates comes from. Mortensen and Nagypal (2007) endogenise the separation rate and compare results on the volatility of unemployment and vacancies with a exogenous separation rate model. They find that in a model where worker productivity increases with tenure exogenous shocks have a higher impact on unemployment and vacancies. Their hypothesis is, that endogenous separation rates are more volatile with regard to the business cycle for low-tenure workers because their wages are less volatile and therefore the positive effect of a shock on vacancies is more volatile than in a model with constant productivity-tenure profiles.

3 Data, definitions and descriptive statistics

The database used in this study is the German LIAB, a linked employer-employee dataset provided by the Institute of Employment Research (IAB) of the Federal Employment Agency.[8] The LIAB combines administrative data on employees with employer data from a large-scale representative survey of plants, the IAB Establishment Panel. This annual survey contains data on 16,000 establishments. The LIAB is exhaustive on the number of workers covered within the establishment sample. The employee part of the LIAB is drawn from the

[8]The data source is discussed in greater detail in Alda et al. (2005).

IAB employee history which contains all employees covered by the German social security which are around 80 percent of all employees and the IAB recipient history which contains all unemployment benefit recipients (Bender and Haas, 2002). The establishment part - the IAB-Establishment Panel - is a representative annual survey of establishments (Kölling, 2000).

The longitudinal version of the LIAB currently contains establishments with interviews from 1993 to 2002. We exclude non-profit establishments from our sample. However, information on all current workers in these establishments is available only from 1996 to 2001, we thus calculate job and worker flow rates only for those years. Due to the fact that we are able to observe the daily amount of workers per establishment we use average daily employment for the denominator and not employment at a set date. Furthermore, the data structure allows us to observe individual tenure since 1991 which is long enough to distinguish between employment spells lasting longer than three years (long-tenure), spells lasting less than three but at least one year (medium-tenure) and spells lasting less than one year (short-tenure). Another advantage of the data is the possibility to observe whether the worker moves from job-to-job, changes into unemployment or into non-employment. We define employment spells which are followed by a new employment spell within 60 days to be a job-to-job transition, spells which are followed by an unemployment spell within 60 days to end up in unemployment and spells that are not followed by any observation 60 days after the termination to end up in non-employment.[9] Although, we cannot observe whether a separation is due to a quit or a layoff we assume that transitions into unemployment are involuntary and transitions directly from job-to-job or into non-employment are voluntary from the perspective of the worker.[10]

[9] If we observe an unemployment spell this means that the worker is entitled to unemployment benefits. Workers who are not observed for a certain time could be unemployed but not be entitled to unemployment benefits. But they could also be employed in a foreign country, be self-employed or out-of-labor force.

[10] In Germany a worker who quits a job has to take a waiting period of 6-12 weeks into account before he is entitled to unemployment benefits. Only workers who have not been employed in a job covered by the social security system at least 12 months the last three years

We define the basic firm-level job and worker flows in the following way:

$$JDR_{j^-,t} = \frac{|\emptyset E_{j^-,t} - \emptyset E_{j^-,t-1}|}{(\emptyset E_{j^-,t} + \emptyset E_{j^-,t-1})/2}$$

Job Destruction Rate(JDR)

with $\emptyset E_{j,t}$ the level of employment at firm j in calendar year t, j^- subset of firms with $\emptyset E_{j,t} - \emptyset E_{j,t-1} < 0$

$$JDR_{j^+,t} = \frac{|\emptyset E_{j^+,t} - \emptyset E_{j^+,t-1}|}{(\emptyset E_{j^+,t} + \emptyset E_{j^+,t-1})/2}$$

Job Creation Rate (JCR)

with j^+ subset of firms with $\emptyset E_{j,t} - \emptyset E_{j,t-1} > 0$

$$WAR_{j,t} = \frac{A_{j,t}}{\emptyset E_{j,t}}$$

Worker Accession Rate (WAR)

with $A_{j,t}$ the number of workers that entered the firm

$$WSR_{j,t} = \frac{S_{j,t}}{\emptyset E_{j,t}}$$

Worker Separation Rate (WSR)

with $S_{j,t}$ the number of workers that left the firm

$$EWR_{j,t} = \frac{A_{j,t} + S_{j,t} - |\emptyset E_{j^-,t} - \emptyset E_{j^-,t-1}|}{(\emptyset E_{j,t} + \emptyset E_{j,t-1})/2}$$

Excess Worker Flow Rate (EWR)

$$WSR_{j,t} = \frac{S^S_{j,t}}{\emptyset E^S_{j,t}}$$

Worker Separation Rate, after short tenure (WSR)

with $S^S_{j,t}$ the number of workers that left the firm after short tenure and $\emptyset E^S_{j,t}$ the average number of short-term workers

are not entitled to unemployment benefits

$$WSR_{j,t} = \frac{S^{ue}_{j,t}}{\emptyset E^{5}_{j,t}}$$

Worker Separation Rate, job-to-unemployment (WSR)
with $S^{ue}_{j,t}$ the number of workers that left the firm and moved into unemployment

Due to our definitions we observe job flow rates for the years 1997 to 2001 and worker flow rates for the years 1996 to 2001. We end up with a sample of 8034 firm-years of whom 3119 exhibit job destruction and 3101 exhibit job creation.

In Table 1 we present means and standard deviations of the job and worker flow rates. In the observation period the average job destruction rate in Germany was with 11.34 per cent higher than the job creation rate with 8.63 per cent which also exhibits a lower standard deviation. The worker separation rate was on average higher (28.37 per cent) than the worker accession rate (25.03 per cent). It is now interesting to look at the worker separation rates according to tenure, here we see that differences are very high. The mean of the firm-level separation rates for short-term employed workers is 98.15 per cent which means that on average almost every new employment relationship was separated within the first 12 months. Additionally, the standard deviation is very high, i.e. these rates differ a lot between firms. In contrast, the average separation rate of medium-tenure employees is 24.49 per cent and that of employees with long job duration is 13.88 per cent. This result is not very surprising because hazard rates are known to be decreasing with tenure (see for example Boockmann and Steffes, 2005). The interesting question is whether the separation rates differ according to the business cycle. Next we look whether we can find differences in the average worker separation rate between workers who change into a new job and workers who change into unemployment. With 8.67 per cent for the former and 11.06 per cent for the latter there exists a slight difference. We cannot find differences between these two groups if we look at long-tenure employees.

4 Specification and estimation method

We estimate job and worker flow rates on business cycle concerning three different aggregation levels. In order to analyze the impact of micro shocks we include transaction volume growth rates on the establishment- and the industry-level as well as lagged industry-level values. Macro shocks are represented by national GDP growth rates and their lagged values. Generally, macro shocks are expected to be persistent and micro shocks to be temporary thus, job flows should be more volatile in reaction on the former. However, if separation costs are low job destruction and with this separations should be more likely even after idiosyncratic shocks. Therefore, we expect changes into unemployment after short tenure to be more volatile than after long tenure. Due to higher job finding rates job-to-job transitions are expected to increase in booms. Again this should occur to a higher extent for short-tenure spells because the probability to find a better match is higher for those workers.

Additionally, we include a variety of establishment-level characteristics in order to control for heterogeneity but also to include proxies for the probability of bad matches. One of the main variables is the information whether the establishment has a works council or not. Due to its codetermination rights concerning layoffs (for an overview see Addison et al., 2001) we expect works councils to have a negative impact on job destruction and involuntary separations. Furthermore, if a firm knows about high separation costs it will be reserved with the creation of new jobs and accessions and therefore, a works council should also exhibit a negative impact on these flows. Through its voice function a works council is able to contribute to a better atmosphere in an establishment which could lower on-the-job search and thus job-to-job separations. Whether this is valid for both long- and short-tenure employees is analyzed here.

Firms can adjust on negative shocks by reducing wages or workforce. If wages are rigid from below the necessity to adjust must result in job destruction. In establishments that underlay a collective bargaining contract and therefore

exhibit more rigid wages than other firms we expect higher job destruction rates. Furthermore, for these establishments we expect a moderate hiring policy and therefore less job creation rates.

The possibility to move workers from one job to another could be used in order to improve bad matches but also in order to adjust on shocks. The centralization of the hiring process is also important because hiring costs should be lower the with increasing centralization. Therefore, we expect large or multi-unit establishments to exhibit less volatility than small, individual firms and include the firm size and the organizational level as covariates. The age of a firm should also have a significant impact on job and worker flows. The size of the effect on job flows is unclear. In theory, firms are expected to have a decreasing age-productivity profile (Caballero and Hammour, 1994). If this is true job destruction should be more volatile in old firms. On the other hand one could suspect that old firms are a positive selection because they survived so long and therefore are less likely to be hit by negative micro shocks. However, due to more experience in hiring good workers we expect old firms to have lower separation rates. Furthermore, there is often a positive correlation between the age of a firm and of the workforce which could be a reason for lower separation rates because young workers are more often job shopping.

Beside industry dummies we additionally include the mean age of the workforce, the share of workers with different skill groups and the share of female workers. This is interesting because worker reallocation is generally high for low and high skilled workers but it is unclear whether the heterogeneity within a firm is important and whether there are differences with regard to the duration of employment before separation.[11] In table A1 in the appendix summary statistics of the covariates are shown.

We apply an unobserved effects tobit model[12] with the following equation:

[11] Gürtzgen (2007) find a positive impact of the share of high skilled employees on the separation rates as well as on the excess worker flow rate.

[12] For the job flow rates the limits are at -2 and 2 and for the worker flow ratest he lower limit is at 0.

$$Y_{j,t} = \delta_1 \triangle to_{j,t} + \delta_2 \triangle to_{s,t} + \delta_3 \triangle to_{s,t-1} + \delta_2 \triangle gdp_{t-1} + \beta x_{j,t} + c_j + \varepsilon_{j,t}$$

where $Y_{j,t}$ is the rate of interest of a certain establishment j in period t , δ_x are the parameters of the several business cycle indicators, $\triangle to_{j,t}$ indicates the transaction volume growth rate per establishment and period, $(\triangle to_{s,t})$ indicates the respective rate for industries and $\triangle gdp_t$ indicates the national GDP growth rate per year. $x_{j,t}$ is the vector of firm-level covariates in period t and the respective vector of coefficients. $\varepsilon_{j,t}$ is the idiosyncratic error term being normally distributed and c_j is a establishment-level unobserved effect which is assumed to be strictly uncorrelated with $x_{j,t}$.

In table A1 in the Appendix we show the figures of the business cycle indicators per year. GDP and transaction volume growth rates are the highest in the years 1998 to 2000 when Germany was in a boom. In the years 1996, 1997 and 2001 we can observe lower rates.

5 Results

5.1 Business cycle effects

First we discuss the impact of the business cycle on the various job and worker flow rates which are shown in table 2. In the top panel we can see that a lot of establishment- and industry-level coefficients are not significant which means that establishments hardly adjust their employment after micro shocks. However, if we run separated regressions for small (1-49 employees) and large (at least 50 employees) firms we find that small firms adjust on negative establishment-level shocks via job destruction (see table A2 in the Appendix). Results of the pooled regressions deliver no effects of aggregated shocks on the job destruction rate. But in the separated regressions we find procyclical job destruction rates for large firms. What could be the reason for this result which is contrary to theory? On the one hand it could be due to the restricted obser-

vation period. This problem will be solved in future because a new version of the data with a longer observation period was made available recently. On the other hand, a lot of firms reduced their work force in the last decade in order to become more efficient in future but not to adjust on current shocks. Assuming that the managers of those firms are thinking about the future of their employees they could have decreased employment when the overall job finding rate was high. The effect of the lagged GDP growth on job creation rates is countercyclical and again separated estimations deliver, the result is driven by large firms. However, this result should be verified with a longer observation period. As we have expected, the effects of macro shocks on worker flows are procyclical. These results do hardly differ between small and large firms.

Next, we look how worker separation rates are related to the business cycle if we distinguish between the employment duration of the separated spell (second panel of table 2). We find a positive impact of establishment-level shocks on separations after short employment and a negative impact on separations after long employment. For the latter, results are the same for both exit states for the former we do not find significant effects separating between the exit states.[13] These results are contrary to our expectations that short-term employment is used by German firms to adjust on firm-level shocks and to save long-term relationships from layoffs. One could interpret the positive coefficient of the estimation of short-term separations as an indicator that firms hire workers for a short time when the situation is well and displace them after short time. But then, we should observe the same effects with regard to the hiring rate which is not the case. However, our results point clearly to the fact that separation rates for long-term employed increase in bad times. Thus, first-in first-out is not the way German firms adjust their workforce.

Aggregated shocks exhibit very high and significant effects on job-to-job changes after short spells but also after long spells, indicating that on-the-job

[13]This could be due to the way we defined the exit into unemployment and will be checked in future.

search behavior increases with the GDP growth rate. This is very intuitive if we interpret job-to-job transitions as voluntary job moves which raise when the job offer rate increases in a positive shock and decreases in a negative shock. In contrast, job-to-unemployment transitions are not very volatile with regard to aggregated dynamics but as expected coefficients are negative. Comparing the results for the differentiated separation rates with the results of the overall separation rates leads to the conclusion that the procyclicality of job-to-job transitions after short employment duration dominates the business cycle effect of the overall worker separation rate. This leads to the following two conclusions: first, rather the worker separation rate of job-to-unemployment transitions than the overall separation rate should be taken into account in order to observe adjustment behavior of firms; second, adjustments take place for separations after short- and long-term employment but the volatility might be higher for short-term spells.

5.2 Effects of firm characteristics

In table 3 we report the results of firm characteristics on the job and worker flow rates. Some coefficients are not significant but we did not exclude them from the specification in order to control for heterogeneity as good as it is possible. As we have expected, a works council has a negative effect on worker separations and accessions as well as on job creation but no impact on job destruction. With a works council, firms are hiring less in expectation of higher separation costs and for the same reason separation rates are less. Moreover, the impact on excess worker flows is very high, thus churning occurs to a much less extent in firms with a works council. Probably, separation costs are not the only reason for lower job creation rates in firms with works councils but this cannot be treated here. Table 4 contains results for the separation rates differentiated by tenure and exit states. We find a negative impact of a works council on job-to-unemployment transitions but no effect on job-to-job transitions indicating that there is no voice-function which reduces on-the-job search.

Establishments with industry-level collective agreements exhibit a negative correlation with job creation and all worker flow rates. This could be due to the impact of German unions with regard to the layoff policy of firms which increase the separation costs in the same way like works councils. Large firms have the possibility to move employees instead of displacing them if a job has to be destructed or if a match is a bad one. Thus, those firms should exhibit less job destruction and separation rates. We find significantly lower job creation and destruction rates for all firm size groups compared with the establishments with 1-50 employees (reference group) but the effects are not linear. Separation and hiring rates are only found to be significantly higher in establishments with 200-299 employees. However, the excess worker flow rate is higher for larger firms but again the effect is not linear. Thus, the number of jobs is more volatile in small firms compared with larger firms but churning flows are less. The latter is in contrast to our expectation that large firms can use internal labor markets in order to convert bad matches into good ones. For these firms, hiring and separation costs seem to be sufficiently low, leading to higher turnover rates.

Establishments that have been set up 1980 or before are less volatile concerning both, job and worker flows. Worker turnover (including churning) is also significantly lower in establishments that have been set up between 1981 and 1990 compared with younger establishments. The reasons for these findings are diverse. On the one hand, younger firms are probably more susceptible to productivity changes as long as they are acting in the high technology industry. On the other hand, young firms often belong to the service-sector and depend to a high extension on exogenous influences like the location or the income situation of the clients. A reason for higher churning rates could be that younger firms are less experienced in hiring staff so that the proportion of bad matches is high. With regard to different exit states it is interesting that old establishments exhibit less job-to-unemployment and more job-to-job changes, i.e. on-the-job search seems to be higher in old establishments.

We defined 11 industry-dummies of which the private service sector is the reference group. Compared with this group the industries construction; mining, energy, water; finish of raw materials and capital goods exhibit significantly higher job destruction rates. Job creation was also high in the mining, energy, water industry pointing to the fact that a high turnover of jobs occurred in this sector. In Germany the mining industry is dropping down since decades whereas the energy industry - especially from persistent energy resources - increased enormously in the last years. For all industries beside the private service and agriculture industry, we find less worker flows but the magnitudes of the effects differ a lot. All that can be subsumed under the manufacturing, mining and transport/communication industries is found to have the highest churning rates. Observing the results for differentiated separation rates, it should be noticed that in agriculture the amount of workers who move into unemployment after a short employment spell is very high which is due to seasonal work in this sector. The same is valid for the construction industry but here we additionally observe higher separation rates after long tenure compared with all other industries.

5.3 Effects of worker characteristics

The results of the shares of certain worker groups on job and worker flows are interesting because overall, they have an impact on job destruction, churning and hiring but no impact on job creation and separation rates. More precisely, all shares of skill groups are negatively correlated with job destruction and positively correlated with churning and hiring rates. This means that with a more homogenous workforce employment changes are less likely but excess worker flows are more widespread. If we run separate estimations for small and large firms, the coefficients of the shares of white collar workers are not significant in the worker flow estimations. The differentiation of separation rates with regard to tenure and exit states brings very interesting results. In a homogenous workforce the probability of a move into unemployment is significantly less if the worker has tenure of at least three years. In contrast, job-to-job changes are

more likely in homogenous groups if the worker has short tenure.

The share of females in the workforce has no significant impact on job and worker flows with one exception: with a higher share of females the probability to move into unemployment after short employment increases. This is probably due to the sort of occupations and industries in which women select into themselves. The mean age of the workforce has a positive effect on the job destruction rate. This result could point to less productivity growth rates within older workforces. There are two possible reasons for this: first, older workers have more difficulties to learn new technologies and processes; second, there is a correlation between the age of the workforce and the age of the firm, so older firms could be less productive than younger firms. However, we observe older firms to destruct significantly less jobs thus, the second point is not valid here. Furthermore, the mean age of the workforce is negatively correlated with the separation and churning rate. This is mainly driven by significantly less job-to-job transitions (independent of tenure) in establishments with an older workforce. The reasons are the probability of better matches due to workers who are experienced with job search and lower job finding rates for older workers.

5.4 Sensitivity analysis

We run various specifications with different samples as sensitivity analysis.[14]. First, we compared a sample with only small establishments (less than 50 employees) and a sample with only large establishments (more than 50 employees). Where we found differing results we even discussed them above. Second, we included information about closures, outsourcing or integration of parts of the workforce into the estimations. This was done in order to check how much of the job and worker flows are due to these changes and whether it is correlated with micro and/or macro shocks. As one would suspect, closures and outsourcing are highly correlated with job destruction and worker separations (independent

[14]Results can be made accessible on request.

of tenure of the exit state) and workforce integration is highly correlated with job creation and hirings. Interestingly, including this dummies do not change the results with respect to the business cycle. Third, we included dummies for different intervals of the mean age of the workforce. The main results are the same but it can be seen that the effects are not linear.

6 Conclusion

In this study we analyzed the effects of business cycles and firm characteristics on job and worker flows. The differentiation between workers with short and long job durations and between the exit states new job and unemployment is the main contribution to the existing job and worker flow literature. We used a representative dataset that allows to calculate average daily employment per establishment and that is linked with establishment data containing a wide range of specific information. As business cycle indicators we included the establishment-level transaction volume growth as well as the industry-level transaction volume growth and its lagged values. These indicators are proxies for micro-level shocks, as a proxy for macro-level shocks we included national GDP-growth and its lagged values.

Results show that German establishments mainly react on macro shocks by adjusting their workforce but that there is a huge difference between small and large firms. Whereas large firms are affected by aggregated shocks, small firms adjust their workforce on idiosyncratic shocks by job destruction. Job-to-job transitions are procyclical and dominate the volatilty of churning and separation flows. The effects are higher for short-tenure workers. Against our expectation, not short-term but long-term employees are separated and move into unemployment when an establishment was hit by a idiosyncratic shock. Thus, we do not observe first-in, first-out behaviour of establishments. Furthermore, the inclusion of firm and worker characteristics is important and delivers interesting insights in the job and worker dynamics on the German labour mar-

ket.

References

Abowd, J. M., Corbel, P. and F. Kramarz (1999), The Entry and Exit of Workers and the Growth of Employment: An Analysis of French Establishments, *The Review of Economics and Statistics* 81 (2), 170-187.

Albaek, K. and B. E. Sorensen (1998), Worker Flows and Job Flows in Danish Manufacturing, 1980-1991, *The Economic Journal* 108 (451), 1750-1771.

Alda, H., Bender, S. and H. Gartner (2005), The linked employer-employee dataset of IAB (LIAB), IAB Discussion Paper No. 6/2005.

Anderson and Meyer (1994), *The Extent and Consequences of Job Turnover*, Brookings Papers: Microeconomics, 177-248.

Bachmann, R. (2005), Hirings, Separations and Job-to-Job Transitions over the business cycle, SFB 649 Discussion Paper 2005-045, Berlin.

Barlevy, G. (2002), The Sullying Effect of Recessions, *The Review of Economic Studies* 69, 65-96.

Bauer, T. K. and S. Bender (2002), Technological change, organizational change and job turnover, IZA Discussion Paper No. 570, Bonn.

Bender, S. and A. Haas (2002), Die IAB-Beschäftigtenstichprobe, in: G. Kleinhenz (Hrsg.), Beiträge zur Arbeitsmarkt- und Berufsforschung Nr. 250, 3-12.

Boockmann, B. and S. Steffes (2005), Individual and Plant-level Determinants of Job Durations in Germany, ZEW Discussion Paper No. 05-89, Mannheim.

Burda, M. and C. Wyplosz (1994), Gross worker and job flows in Europe, *European Economic Review* 38, 1287-1315.

Burdett, K. (1978), A Theory of Employee Job Search and Quit Rates, *The American Economic Review* 68 (1), 212-220.

Burgess, S., J. Lane and D. Stevens (2000), Job Flows, Worker Flows, and Churning, *Journal of Labour Economics* 18(3), 473-502.

Caballero, R. J., Engel, E. M. R. A. and Halitwanger, J. (1997), Aggregate Employment Dynamics: Building from Micrtoeconomic Evidence, *The American Economic Review* 87 (1), 115-137.

Caballero, R. J. and M. L. Hammour (1994), The Cleansing Effect of Recessions, *The American Economic Review* 84 (5), 1350-1368.

Davis, S. J. and J. Halitwanger (1990), Gross job creation and destruction: microeconomic evidence and macroeconomic implications, *NBER Macroeconomics Annual* 5, 123-168.

Davis, S. J. and J. Halitwanger (1992), Gross job creation, gross job destruction and employment reallocation, *The Quarterly Journal of Economics* 107 (3), 819-863.

Fitzenberger, B. and A. Garloff (2005), *Descriptive Evidence on Labor Market Transitions and the Wage Structure in Germany*, ZEW Discussion Paper No. 05-95, Mannheim.

Gielen, van Ours (2006), Age-specific cyclical effects in job reallocation and labor mobility, *Labour Economics* 13, 439-504.

Goux, D., Maurin, E. and M.Pauchet (2001), Fixed-term contracts and the dynamics of labour demand, *The European Economic Review* 45, 533-552.

Gürtzgen, N. (2007), *Job and Worker Reallocation in German Establishments: The Role of Employer's Wage Policies and Labour Market Institutions*, ZEW Discussion Paper No. 07-084, Mannheim.

Hall, R. E. (2005), Employment Fluctuations with Equilibrium Wage Stickiness, The American Economic Review 95 (1), 50-65.

Hamermesh, D. S., Hassink, W. H. J. and J. C. van Ours (1996), Job Turnover and Labor Turnover: A Taxonomy of Employment Dynamics, *Annales D'Économie et de Statistique* N° 41/42.

Jovanovic, B. (1979), Job Matching and the Theory of Turnover, *Journal of Political Economy* 87 (5), 972-990.

Kölling, A. (2000), The IAB-Establishement Panel, Schmollers Jahrbuch 120 (2), 291-300.

Krause, M. U. and T. A. Lubik (2006), The cyclical upgrading of labor and on the job search, *Labour Economics* 13, 459-477.

Mortensen, D. T. and É. Nagypál (2007), Labor-market Volatility in Matching Models with Endogenous Seperations, *The Scandinavian Journal of Economics* 109 (4), 645-665.

Mortensen, D. T. and C. A. Pissarides (1994), Job Creation and Job Destruction in the Theory of Unemployment, *The Review of Economic Studies* 61 (2), 397-415.

Nagypál, E. (2006), Learning-by-Doing Versus Learning About Match Quality: Can We Tell Them apart?, Review of Economic Studies, forthcoming.

Pissarides, C. A. (1994), Search Unemployment with On-the-job Search, *The Review of Economic Studies* 61, 457-475.

Portugal, P. and J.Varejao (2007), Employment Dynamics and the Structure of Labor Adjustment Costs, *Journal of Labor Economics* 25 (1), 137-165.

Shimer, R. (2005a), The Cyclicality of Hires, Separations, and Job-to-Job Transitions, *Federal Reserve Bank of St. Louis Review* 87 (4), 493-507.

Shimer (2005b), The Cyclical Behavior of Equilibrium Unemployment and Vacancies, The American Economic Review 95 (1), 25-49.

Tables

Table 1: Job and worker flow rates

Rate	Mean	Standard Deviation	Observations
Job destruction rate	0.113	0.181	3119
Job creation rate	0.086	0.125	3101
Worker accession rate	0.250	0.259	8034
Worker separation rate	0.284	0.287	8034
Separation rate after short tenure	0.982	0.687	8034
Separation rate after medium tenure	0.245	0.265	8034
Separation rate after long tenure	0.139	0.191	8034
Job-to-job changes	0.087	0.131	8034
Job-to-unemployment changes	0.111	0.209	8034
Job-to-job changes after short tenure	0.294	0.317	8034
Job-to-unemployment after short tenure	0.365	0.498	8034
Job-to-job changes after long	0.044	0.120	8034
Job-to-unemployment after long tenure	0.043	0.119	8034

Table 2: Business cycle effects on job and worker flows

Variable	Job destruction		Job creation		Churning		Hirings		Separations	
Δ transaction volume	-0.0002	-1.49	0.0000	0.27	0.0000	-0.39	-0.0002	-1.52	-0.0002	-0.97
Δ industry-lev. transact. vol.	0.0008	0.55	-0.0013	-1.17	-0.0003	-0.31	-0.0011	-0.91	-0.0017	-1.06
Δ industry-lev. transact. vol. lagged	0.0013	0.89	0.0022	1.91	-0.0020	-2.12	-0.0007	-0.54	-0.0033	-2.04
Δ aggregated GDP	-0.0045	-0.66	0.0002	0.04	0.0238	5.87	0.0327	6.00	0.0614	8.60
Δ aggregated GDP lagged	0.0023	0.27	-0.0207	-3.48	0.0322	6.16	0.0397	5.67	0.0694	7.52

Variable	Short tenure		Long tenure		Short, j-t-j		Short, j-t-ue		Long, j-t-j		Long, j-t-ue	
Δ transaction volume	0.0009	2.35	-0.0007	-6.16	-0.0001	-0.32	0.0003	0.85	-0.0006	-5.86	-0.0003	-3.61
Δ industry-lev. transact. vol.	-0.0023	-0.65	-0.0014	-1.16	-0.0015	-0.71	0.0002	0.08	-0.0018	-1.69	-0.0007	-0.81
Δ industry-lev. transact. vol. lagged	0.0021	0.58	0.0003	0.25	0.0005	0.25	0.0021	0.77	0.0005	0.50	-0.0005	-0.54
Δ aggregated GDP	0.1357	8.61	0.0035	0.68	0.1676	17.87	0.0053	0.44	0.0137	2.93	-0.0014	-0.39
Δ aggregated GDP lagged	0.0837	4.15	-0.0005	-0.07	0.1586	13.16	-0.0283	-1.84	0.0069	1.16	-0.0084	-1.79

Table 3: Firm-specific effects on job and worker flows

Variable	Job destruction		Job creation		Churning		Hirings		Separations	
Council	-0.0180	-1.40	-0.0308	-3.90	-0.1515	-11.53	-0.1459	-9.42	-0.2718	-11.31
Industry-level collective agreement	-0.0118	-0.97	-0.0238	-3.23	-0.0246	-2.52	-0.0387	-3.15	-0.0607	-3.47
Firm-level collective agreement	-0.0078	-0.50	-0.0131	-1.33	-0.0205	-1.72	-0.0170	-1.11	-0.0375	-1.77
Independent	-0.0126	-1.08	-0.0066	-0.94	0.0189	1.73	0.0118	0.90	0.0373	1.89
Medium sized branch	-0.0005	-0.03	-0.0017	-0.18	0.0139	1.02	0.0022	0.13	0.0265	1.08
Headquarters	0.0258	0.89	-0.0168	-0.80	0.0001	0.00	-0.0039	-0.13	-0.0175	-0.43
Mean age	0.0040	2.89	-0.0003	-0.33	-0.0022	-1.54	-0.0033	-2.02	-0.0050	-1.97
Unskilled blue collar	-0.0023	-4.36	0.0000	0.14	0.0026	4.66	0.0011	1.65	0.0056	5.54
Skilled blue collar	-0.0027	-4.92	-0.0006	-1.69	0.0015	2.74	-0.0002	-0.38	0.0035	3.54
Unskilled white collar	-0.0022	-3.45	-0.0004	-0.96	0.0015	2.60	0.0002	0.34	0.0032	3.06
Skilled white collars	-0.0022	-3.96	-0.0005	-1.38	0.0011	1.92	-0.0006	-0.97	0.0024	2.40
Females	-0.0001	-0.34	-0.0001	-1.05	-0.0001	-0.49	-0.0004	-1.40	-0.0006	-1.42
50-100	-0.0858	-6.30	-0.0235	-2.66	0.0135	1.00	-0.0132	-0.82	0.0560	2.28
100-199	-0.0745	-4.96	-0.0375	-3.85	0.0170	1.09	0.0070	0.38	0.0650	2.28
200-299	-0.0774	-4.34	-0.0226	-2.04	0.0525	2.95	0.0474	2.24	0.1435	4.41
300-499	-0.0769	-4.31	-0.0298	-2.67	0.0308	1.66	0.0194	0.89	0.0961	2.84
500-999	-0.0887	-4.66	-0.0283	-2.46	0.0185	0.93	0.0103	0.44	0.1007	2.74
1000	-0.0983	-5.19	-0.0330	-2.84	0.0061	0.29	0.0111	0.46	0.1105	2.84
Year of setting up before 1981	-0.0496	-4.48	-0.0325	-4.88	-0.0426	-3.23	-0.0483	-3.30	-0.0587	-2.39
Year of setting up 1981-1990	-0.0099	-0.82	-0.0126	-1.51	-0.0596	-3.71	-0.0453	-2.57	-0.0965	-3.21
Insurance, credit	-0.0214	-0.79	-0.0064	-0.42	-0.1044	-3.49	-0.1150	-3.46	-0.2144	-3.85
Transport, communication	0.0104	0.36	-0.0138	-0.62	-0.1360	-4.06	-0.1102	-2.90	-0.2842	-4.56
Trade, repair	0.0052	0.29	-0.0140	-1.23	-0.1146	-5.09	-0.1038	-4.18	-0.2077	-4.94
Construction	0.0790	3.36	0.0258	1.57	-0.0920	-3.30	-0.0259	-0.82	-0.2084	-4.02
Mining, energy, water	0.1033	3.85	0.0990	4.57	-0.1763	-4.99	-0.1037	-2.65	-0.3795	-5.75
Agriculture	-0.0122	-0.47	-0.0436	-2.19	-0.0309	-0.90	0.0023	0.06	-0.0315	-0.49
Finish of raw materials	0.0586	2.78	-0.0216	-1.80	-0.1683	-6.95	-0.1502	-5.58	-0.3564	-7.90
Capital goods	0.0361	1.95	-0.0147	-1.33	-0.1620	-7.46	-0.1563	-6.45	-0.3631	-8.98
Consumer goods	0.0297	1.41	-0.0190	-1.50	-0.1349	-5.44	-0.1127	-4.09	-0.2613	-5.65
Services for firms	-0.0171	-0.73	0.0028	0.19	-0.0631	-2.26	-0.0693	-2.24	-0.1260	-2.41
Sigma u	0.0819	15.90	0.0380	5.53	0.3399	41.24	0.1798	40.44	0.1883	37.52
Sigma e	0.1459	47.69	0.1107	43.22	0.2406	78.57	0.1369	79.43	0.1850	80.35
Rho	0.2396	0.0270	0.1053	0.0373	0.6662	0.0128	0.6331	0.0135	0.5087	0.0155
Left censored observations	0	0	0	0	114	114	63	63	35	35

Table 4: Firm-specific effects on separation rates

Variable	Short tenure		Long tenure		Short, j-t-j		Short, j-t-ue		Long, j-t-j		Long, j-t-ue	
Council	-0.0671	-1.76	-0.0309	-3.38	-0.0190	-0.95	-0.1075	-3.48	-0.0088	-1.05	-0.0213	-3.03
Industry-level collective agreement	-0.0537	-1.65	-0.0116	-1.37	0.0045	0.25	-0.0562	-2.19	-0.0021	-0.27	-0.0109	-1.72
Firm-level collective agreement	-0.0463	-1.12	-0.0136	-1.19	0.0254	1.10	-0.0722	-2.24	-0.0083	-0.79	-0.0117	-1.39
Independent	-0.0462	-1.38	-0.0049	-0.59	-0.0231	-1.32	0.0086	0.32	-0.0093	-1.27	0.0117	1.84
Medium sized branch	-0.0773	-1.76	0.0069	0.61	-0.0221	-0.94	-0.0001	0.00	0.0032	0.32	0.0120	1.42
Headquarters	-0.0954	-1.19	0.0109	0.49	-0.0170	-0.39	-0.0344	-0.55	-0.0304	-1.53	0.0278	1.71
Meanage	-0.0077	-1.85	0.0005	0.53	-0.0117	-5.40	0.0036	1.06	-0.0028	-3.08	0.0011	1.44
Unskilled blue collar	0.0067	4.07	-0.0023	-5.68	0.0036	4.22	0.0028	2.10	0.0000	-0.08	-0.0026	-8.65
Skilled blue collar	0.0028	1.66	-0.0027	-6.60	0.0012	1.36	0.0013	0.95	-0.0002	-0.46	-0.0027	-8.77
Unskilled white collar	0.0028	1.54	-0.0020	-4.24	0.0031	3.16	0.0009	0.63	0.0002	0.49	-0.0028	-8.05
Skilled white collars	0.0012	0.69	-0.0023	-5.70	0.0019	2.13	-0.0009	-0.65	0.0003	0.69	-0.0028	-9.10
Females	0.0009	1.29	-0.0001	-0.49	-0.0007	-1.87	0.0015	2.67	-0.0001	-1.00	0.0001	0.79
50-100	0.0913	2.25	-0.0311	-3.14	0.0807	3.74	0.0923	2.79	0.0072	0.78	0.0021	0.27
100-199	0.1559	3.40	-0.0250	-2.27	0.0823	3.43	0.1614	4.33	0.0240	2.37	0.0353	4.14
200-299	0.1304	2.47	-0.0187	-1.45	0.0777	2.81	0.2089	4.91	0.0298	2.54	0.0554	5.64
300-499	0.1275	2.37	-0.0218	-1.69	0.0963	3.45	0.1800	4.15	0.0398	3.41	0.0569	5.74
500-999	0.0561	0.98	-0.0112	-0.83	0.0710	2.41	0.1633	3.54	0.0531	4.37	0.0688	6.66
1000	0.1192	2.05	-0.0161	-1.20	0.0817	2.76	0.1921	4.05	0.0399	3.29	0.0861	8.26
Year of setting up before 1981	-0.0615	-1.78	-0.0188	-2.42	0.1130	6.54	-0.2344	-8.34	0.0191	2.74	-0.0493	-8.24
Year of setting up 1981-1990	-0.0207	-0.51	0.0014	0.16	0.0118	0.57	-0.0364	-1.08	0.0060	0.73	-0.0036	-0.52
Insurance, credit	-0.1522	-1.93	-0.0214	-1.17	-0.1501	-3.76	-0.1444	-2.22	0.0011	0.07	-0.0187	-1.31
Transport, communication	-0.0629	-0.68	0.0292	1.29	0.0176	0.37	-0.0893	-1.20	0.0435	2.14	0.0044	0.26
Trade, repair	0.0375	0.65	-0.0086	-0.67	-0.0463	-1.60	0.0484	1.02	0.0170	1.46	0.0024	0.24
Construction	0.1001	1.33	0.0528	2.97	-0.1340	-3.46	0.3173	5.21	-0.0313	-1.92	0.0993	7.44
Mining, energy, water	-0.0234	-0.25	0.0598	2.82	0.0131	0.28	-0.1018	-1.34	0.0436	2.31	-0.0047	-0.29
Agriculture	0.3426	3.87	0.0098	0.50	-0.1380	-3.06	0.4669	6.48	-0.0103	-0.55	0.0290	1.91
Finish of raw materials	-0.1710	-2.70	0.0100	0.70	-0.0571	-1.80	-0.0618	-1.20	0.0238	1.86	0.0093	0.85
Capital goods	-0.1257	-2.19	-0.0007	-0.05	-0.0290	-1.01	-0.0400	-0.86	0.0286	2.45	-0.0006	-0.06
Consumer goods	0.0842	1.30	0.0041	0.27	0.0152	0.47	0.1127	2.14	0.0047	0.35	0.0208	1.85
Services for firms	-0.0899	-1.23	-0.0249	-1.48	-0.0550	-1.48	-0.1336	-2.20	0.0055	0.36	-0.0244	-1.85
Sigma u	0.4022	32.10	0.0557	11.86	0.1758	23.88	0.3386	33.49	0.0500	11.57	0.0499	16.35
Sigma e	0.5352	78.65	0.1776	78.05	0.3119	71.70	0.3933	71.44	0.1513	68.67	0.1164	64.14
Rho	0.3610	0.0165	0.0895	0.0147	0.2411	0.0171	0.4257	0.0167	0.0983	0.0164	0.1550	0.0176
Left censored observations	240	240	270	270	898	898	924	924	1283	1283	1619	1619

Table A1: Summary Statistics of Covariates

Variable	Mean	Standard Deviation
Council	0.689	0.463
Industry-level collective agreemen	0.688	0.463
Firm-level collective agreement	0.123	0.329
Independent	0.631	0.483
Small branch	0.230	0.421
Medium sized branch	0.116	0.320
Headquarters	0.023	0.151
Mean age	40.029	4.071
Unskilled blue collar	16.573	22.762
Skilled blue collar	32.926	28.836
Unskilled white collar	4.988	12.005
Skilled white collars	38.057	30.622
Females	37.957	28.513
1-49	0.032	0.177
50-99	0.211	0.408
50-100	0.183	0.387
100-199	0.157	0.364
200-299	0.099	0.298
300-499	0.106	0.308
500-999	0.090	0.286
1000	0.123	0.328
Year of setting up before 1981	0.437	0.496
Year of setting up 1981-1990	0.189	0.391
Year of setting up 1991-1995	0.368	0.482
Year of setting up after 1995	0.006	0.080
Insurance, credit	0.046	0.210
Transport, communication	0.046	0.209
Trade, repair	0.102	0.303
Construction	0.087	0.282
Mining, energy, water	0.033	0.178
Agriculture	0.035	0.184
Finish of raw materials	0.104	0.305
Capital goods	0.165	0.371
Consumer goods	0.090	0.287
Services for firms	0.055	0.227
Private Services	0.237	0.425
Closed	0.030	0.171
Outourcing I	0.040	0.197
Outsourcing II	0.017	0.129
Incorporation	0.041	0.197