Employment policies at the plant level: Job and worker flows for heterogeneous labour in Norway

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Abstract: Despite the large degree of plant-specific heterogeneity in turnover patterns recently found in the gross job and worker literature, very little is known about the *sources* of the heterogeneity in plant level employment policies. The present paper, studies in detail the employment management policies for *heterogeneous* plants and for *heterogeneous* labour, using a matched worker-employer data set for Norway. Within an econometric framework, I find that the job and worker flows above job changes are different processes since job destruction and reemployment separations have distinct patterns over the business cycle. The two turnover processes also differ over worker types. Further, strong influences of firm and plant size on the patterns are found, as are effects from wage policies, age of plants, market power and union density. Interestingly, the influence of firm size on reemployment separations disappears when the combined effect of market power and high union density is modelled.

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1. Introduction

Labour markets are in constant flux. Plants expand, contract and replace workers who quit or get fired. Many of the recent insights on the massive gross flows in the labour market stem from the recent literature on gross *job* flows (hiring due to expansion of plants by net job creation at the plant level, and firing due to a decline in incumbents and plant exit) and *worker* flows above job changes (*churning* or replacement of workers for a given number of jobs).[1] One of the main observations emerging from this literature is that there is large degree of plant-specific heterogeneity in turnover patterns in that expanding firms fire workers and firms reducing employment hire new workers. However, very little is known about the sources of the heterogeneity in employment practices. Both the job flow and worker flow literature assumes homogenous workers and plants, thus ignoring important aspects of plant-level human resource management and sources of worker mobility dynamics.[2]

In the present paper I go behind the extensive aggregate job and worker flows observed, and study in detail the employment management policies for *heterogeneous* plants and for *heterogeneous* workers at the plant level. I use a panel data set for Norway for the 1986-94 period, matching workers and plants, including plant and worker characteristics. Distinguishing first between three education categories of workers allows analysis of whether high job creation/destruction rates and churning rates are due to job creation for highly educated workers and job destruction for low-educated workers and *vice versa* for replacements, or whether hire and separation are high for all skill levels. Decomposition of labour flows is also done by age and gender.

Then I proceed to test whether job and churning processes are different, which is one of the main questions regarding firm heterogeneity in turnover behaviour, i.e. whether net employment changes at the plant level (job reallocation) are interchangeably the same as worker flows. First, focusing on job destruction and reemployment separations, I test, within an econometric framework, whether the job flow and churning processes show the same pattern over the business cycle, and whether they are distinct for the three types of workers. A business cycle index is specified in order to test the cyclical properties of separations due to replacements and separations due to job destruction, thereby determining whether quits or layoffs are dominant for the two

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[1] For work on job flows see Davis and Haltiwanger, 1992, Dunne, Roberts and Samuelson, 1989, Leonard, 1987; and Wedervang, 1965 for an early contribution. Work focusing on the gross *worker* flows includes Abowd, Corbel and Kramarz, 1996, Albæk and Sørensen, 1998, Hamermesh, Hassink and van Ours, 1996, Burgess, Lane and Stevens, 1995.

[2] A couple of exceptions are Hamermesh, Hassink and van Ours (1996) who distinguish between blue and white collar workers, and Lane, Isaac and Stevens (1998), who distinguish between worker flows over firm size and plant age.

processes. A pro-cyclical pattern would suggest that quits are dominating while a counter-cyclical process would suggest employer-initiated separations (see for instance Burgess and Nickell, 1989). Second, within the econometric model, I condition the two turnover processes on plant-specific variables. The matched worker/plant data used is especially rich in economic data for plants, which comes in addition to all the data on workers common for other data sets. The following testing procedure is used: following the establishment size/wage literature which has established a strong relationship between plant and firm level size and wage policy, I first focus on plant and firm size effects on job destruction and reemployment separations. Then I try to ascertain exactly which attributes of establishment may be behind the size-separation relationships found for the two separation processes and which may explain the firm and plant level heterogeneity.

Following Idson (1996), I first test the two *direct* channels for why large establishments (both plants and firms effects are tested) are able to establish longer employment relationships than small establishments. These are: 1) Large establishments have large internal labour markets which make it possible for workers to substitute intra-firm for inter-firm mobility 2) large employers have higher survival probabilities; thus longer employer-employee relationships are established. Given these two direct channels for why larger employers are able to establish longer employment relationships the following three *indirect* channels have been proposed to explain the size/job duration relationship (Idson, 1996): 1) A longer employment relationship gives higher returns to on-the-job training investments; thus large firms invest more in the worker 2) in order to protect these investments large employers will pay workers higher wages to reduce worker mobility 3) the composition of workers differs by employer size, since large employers may try to select workers with expected low mobility propensities. It is important to note that our data also allows testing for differentials of firm and plant effects over types of workers defined by education level. The questions we ask in addition are whether the size of employers will protect the low skilled or highly skilled workers differently, and will are there differences for voluntary and involuntary separations.

Additional theories may be put forward to explain why there is a *direct* effect from employer size to the personnel policies of employers regarding separations. Capital-skill complementarity, in conjunction with a higher degree of capital intensity in large employers, is one of the most obvious (Griliches, 1970; Hamermesh, 1980). This theory proposes that the employer size difference in mobility arise from not controlling for the capital-labour ratio. Consequently this is the next direct test which will be undertaken here. Then introduce product and labour market imperfections to explain plant specific heterogeneity in turnover patterns. I test the effect of establishments' product market power and the effect of unions. Economic rents may reduce separations via higher wages, and in addition market power may work to reduce separations in a more direct way by providing a «quieter life» or increased X-inefficiency in the form of lower effort also for workers (Nickel, 1998). Unions may work in the same way both through a union wage mark-up and more directly via a «collective voice» channel for workers to air their grievances and improve working conditions (see for instance Freeman, 1980). The combination of the two imperfections is also tested.

The outline of the paper is as follows. The next section provides the theoretical background, including definitions of the worker flow measures used, an overview of relevant theoretical and empirical work to specify hypotheses to test, and finally an overview of data. In Section 3, the descriptive statistics of worker job and worker flows are given by splitting the data set by general education, gender and cohorts. It is important to note is that this analysis is done for both manufacturing and the financial sector. Then regression results are provided and analysed. The last section provides a summary and concluding comments.

2. Theoretical background and descriptive statistics

2.1 Theory and previous empirical findings

Only a few studies have focused on the relationship between employer size and worker mobility. Idson (1996) analyses the relationship of plant and firm size relationship to voluntary and involuntary separations for the US. Brown and Medoff (1989) and Rebitzer (1986) analyse the quit differences over employer size and tenure differences, respectively. Lane, Stevens and Burgess (1996) find employer differences for worker and job flows. The only study not using US data is Dell'Aringa and Lucifora (1996), who analyse quits and layoffs relative to establishment size for Italy, although this is not the main focus of their study. However, all of these studies analyse worker mobility for homogenous workers due to data limitations.

The first part of the test strategy to be followed here is much the same as in Idson (1996). First I test whether plant and firm size can explain differences in quits and layoffs. Then, controlling for the three indirect effects, i.e. on-the-job training, wage differences and worker composition, I test whether direct effects of plant and firm effects remain. Then the two direct effects of the employer size/worker mobility are tested for. It is important to note that our data also allows us to test for differentials of firm and plant effects over types of workers defined by education level. The question is whether the size of employers protects the low skilled or highly skilled workers differently, and whether there are differences over voluntary and involuntary separations.

Additional theories may be put forward to explain why there is a direct link between employer size and personnel policies. Capital-skill complementarity, in conjunction with higher degree of capital intensity in large employers, is one of the most obvious (Griliches, 1970; Hamermesh, 1980). This theory proposes that the employer size difference regarding mobility arise from not controlling for the capital-labour ratio. Thus, this is the next direct test that will be undertaken.

Product and labour market imperfections may also give rise to the employer size/worker mobility relationship. To take product market imperfections first, large employers are more likely to be monopolists or have some market power providing rents. With imperfections in the labour market such as union wage bargaining or asymmetric information, the employer may share some rents with the workers. However, in addition to the wage channel, it is expected that the market power of the firm may also work to reduce separations in a more direct way by providing a «quieter life» from the monopoly rents also for the workers. A quieter life in the form of lower effort and thus lower productivity can be obtained in a union bargaining model with firm rents where workers bargain both over wages and worker effort (for an overview of this argument see Nickel, 1998). Hence, X-inefficiency may increase with less competitive pressure in the product market leading to lower worker mobility.

Labour market imperfections may also lead to connections between employer size and separations if there is a positive relationship between employer size and unionisation. Again, both an indirect effect via higher wages and a direct effect via higher turnover costs or the voice channel are expected to have an impact on quits. The monopoly wage-markup in plants covered by union bargaining is also expected to reduce quits, since the workers get higher wages (Stewart, 1983). In the Norwegian setting this is mainly true for local negotiations. The union density at the plant level is a relevant plant specific variable since union density may be a factor that can increase the workers' bargaining threat in local wage negotiations (Askildsen and Nilsen, 1998). The idea is that local wage negotiations are organised as follows: workers will still work during negotiations (hold-out), but they can use work-to rule practices. The higher the union density the stronger the threat of work-to-rule practices.

A second effect of union or union density is also expected since the unions may also care about aspects other than the wage, such as job satisfaction, job security, or other non-pecuniary aspects of the job. For instance, measures to increase job protection could include stricter rules and more costly rules for firing. Yet another channel found to reduce mobility is the "collective voice" of unions helping the workers to claim better working conditions and to solve problems concerning working conditions (Freeman, 1980). Clearly, the effect of "the collective voice" channel and the possibilities for the unions to obtain better job satisfaction and job security may be improved if there are more rents to be shared. An interaction term between union density and a measure of market concentration is included to capture this effect.

2.2 Definitions

Especially when considering the turnover in heterogeneous workers at the plant level, using the gross flows approach has some advantages over earlier literature on the pattern in quits and fires. From this perspective, the plant worker turnover, or flow, consists of both job flows due to changes in the size of plants, and those due to workers being dismissed, quitting, or being replaced by other workers given the number of jobs. Worker flows ($WF_{e,j,t}$) of skill type *j* for plant *e* equals the sum of total hires of skill type *j* ($H_{e,j,t}$) and total separations of skill type *j* ($S_{e,j,t}$). Job flows ($JF_{e,j,t}$) at the plant level consist of net changes in the size, $L_{e,j,t}$, of the plant; $dL_{e,j,t} = L_{e,j,t} - L_{e,j,t-1}$. Since net change of the plant must equal the difference in hirings and separations, $dL_{e,j,t} = H_{e,j,t} - S_{e,j,t}$, worker flows can be written as consisting of worker flows due to changes in the size of the plant and to replacements in the existing jobs; $WF_{e,j,t} = JF_{e,j,t} + CF_{e,j,t}$.[3] The last part is called churning or replacement flows in the literature, and consists of the sum of hires and separations (equal in equilibrium) due to replacement, $R_{e,j,t} + S^R_{e,j,t}$. The change net change in the employment of worker type *j* for plant *e* from *t-1* to *t* can then be decomposed as[4]:

$$dL_{e,j,t} = H_{e,j,t} - S_{e,j,t} = C_{e,j,t} + R_{e,j,t} - D_{e,j,t} - S^R_{e,j,t} \quad (1)$$

$$= C_{e,j,t} - D_{e,j,t} + R_{e,j,t} - Q_{e,j,t} - F_{e,j,t}$$

From the first line of equation 1, we see that total hires, $H_{e,j,t}$, of worker type *j* for the firm can be decomposed into job creation, $C_{e,j,t}$, and reemployment hires, $R_{e,j,t}$. Total separations, $S_{e,j,t}$, can be decomposed into separations due to job destruction, $D_{e,j,t}$, and replacement separations, $S^R_{e,j,t}$.[5] From the second line of the equation we notice that replacement separations can further be split into quits, $Q_{e,j,t}$, and fires, $F_{e,j,t}$. However, the data set does not allow for a distinction between quits and fires, and thus in the econometric analysis I will use a business cycle

[3] See Burgess, Lane and Stevens (1995) and Hamermesh, Hassink and van Ours (1996) for a discussion of the difference between job and labour turnover for homogeneous workers and the distinction between different labour turnover measures.

[4] I follow the literature here and assume no vacancies, which implies that implying replacement hires, $R_{e,j,t}$, and replacement separations, $S^R_{e,j,t}$, are equal in equilibrium.

[5] Note that we will not observe creation (destruction) of a job of the same skill if a different job is destroyed (created) at the same plant within a year, which is the measurement period.

indicator to distinguish to test whether quits or fires dominates this part of separations.[6] The *aggregate* job and worker flow *rates* (sector, industry etc.) are given in the Appendix.

2.3 Data

The empirical analysis is based on different administrative register files from Statistics Norway. For manufacturing, the data was supplemented with economic information at the plant level from the "Time Series Files" for manufacturing based on the annual censuses (For a description of these data, see Halvorsen, Jensen and Foyn, 1991). The data period covers 1986 to 1994. In these administrative registers, individuals are characterised by their personal identity code and plants with an identification code. This enables us to match persons to plants and to combine information on education, age, tenure etc. with employer characteristics at the individual level. Our database contains yearly information for all employed individuals and all plants in Norway over the age of 16. The employers are defined at the plant level by an identification code dependent on geographical location and independent of ownership conditions. I restrict my attention to plants with an average size of at least five employees, since plant or firm specific information is not available for plants below five employees. When merging in the data from the "Time Series Files" for the econometric analysis, the match by plant numbers is about 90 percent.

In the administrative registers, individuals are characterised by their personal identity code and plants with an identification code. In the second quarter each year every worker is matched to the individual's main employer. The start date of this match is provided by the main employer, as is the stop date it finishes within the year. For each worker, the following information is available for the period 1986 to 1995: working hours per week, union membership, whether the worker holds multiple jobs, annual income, education, and basic demographic background variables. Working time per week is only reported in three discrete categories; 4-19 hours, 20-29 hours and 30 hours or more. Education level is based on the normal duration of the education and includes only completed programs of education (and highest attained) education. All courses of formal education exceeding 300 hours are registered.

The employers are defined at the plant level by an identification code dependent on geographical location, independent of ownership conditions. A number of plant-specific variables are available to our study: plant and firm size, value of production, insurance value of capital, value added, the age of the plant, multi-plant/single plant firms, and investment. Further, the plants

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[6] The voluntary-involuntary distinction in separations requires some type of wage rigidity, for instance because it is too costly to renegotiate an employment contract. Otherwise a separation is only the result of optimising behaviour of workers and plants, as predicted in matching theory or efficient turnover (se for instance McLauglin (1991) for a discussion of this issue.)

are categorised into sectors that are defined as export-oriented, protected, and open to import competition.

Exclusion restrictions were made. Only workers with full-time jobs (30 hours or more per week) were included in the estimation, and workers who held more than one job per year were excluded. For the descriptive statistics all worker were used. See Appendix for precise definitions of how the variables are defined and descriptive statistics of the data.

2.4 Descriptive statistics: An initial look at the data

2.4.1 General results

Table 1 provides the mean values per year for worker and job flows in the period from 1987 to 1994, by level of general education, gender and cohort. In addition to results for manufacturing, which will also be used in the econometric analysis, worker flows for the financial sector in Norway are also presented for the purpose of comparison. The latter sector is quite different from the former in terms of worker composition, foreign competition etc.[7]

In manufacturing, the annual worker turnover rate (*WFR*),i.e., total hires plus total separations, is 44 percent on average over the data period, as can be seen from the upper panel of the table. The hiring (*H*) and separation (*S*) rates constitute on average 21 and 23 percent of the worker turnover, respectively. Notably both hiring and separations are high in all years, and both churning and job flows take place simultaneously. The total churning rate (*CF*) - the rate of workers changing positions in excess of job destruction or job creation - accounts for 21 percent of worker turnover, and job reallocation due to plants expanding by job creation or declining by job destruction (*JRR*) is 23 percent. The ratio between worker turnover due to worker churning and total worker reallocation (*CHR/WFR*) provides a measure of the importance of quits and dismissals in total worker flows. This ratio is 48 percent on average, which means that the fraction of worker turnover explained by churning is 48 percent.[8]

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[7] Manufacturing is by far the largest sector comprising on average 7909 plants (>5 employees) and employing about 280 000 workers (per year) in this period. The financial sector is only about one fifth the size in plants and workers. The relative share of different education groups also differs between the two sectors. The low education share is on average 57 percent in manufacturing, whereas it is only 28 percent in the financial sector. Thus, the latter sector represents a more human capital-intensive sector, with a share of 61 percent for medium educated and 11 percent for highly educated. Over the period there is a decline in both manufacturing and the financial sector in the number of plants and total employment.

[8] Job reallocation for manufacturing in Norway has been analysed in two previous studies using a different data set (Klette and Mathiassen, 1996, and Salvanes 1997). For the 1987-94 period, that data set shows a job reallocation rate of 19.1.

There are several differences between manufacturing and the financial sector. The level of worker turnover is about the same: 42 percent for banking and insurance. However, worker reallocation due to churning is far less important in this sector than in manufacturing; 38 percent is due to churning (*CHR/WFR*) as compared to 48 percent in manufacturing. The share of workers with medium and high education levels is on average 72 percent in banking and insurance, while it is only 42 percent in manufacturing. Hence, the difference in worker turnover rates between a service sector and manufacturing certainly indicates that both the general education and industry differences in the production process may matter in explaining turnover.[9] The results for Norway are very similar regarding job flows, and at the lower end but comparable for churning flows to studies undertaken for the US and Denmark (Burgess, Lane and Stevens, 1995; Albæk and Sørensen, 1995).[10]

The lower panel of Table 1 presents the average annual turnover figures for the two sectors split by educational level. These figures allow us to analyse whether the high job creation/destruction rates and churning rates are due to high job creation for the highly educated workers and job destruction for the low-educated workers and replacing low educated with highly educated, or whether hire and separation are high for all skill levels. It is clear that worker turnover in manufacturing is highest for the higher education group, 56 percent, as compared to 43 percent for the low education group. The corresponding results for banking and insurance are 51 and 42 percent. Most interesting is the finding that hires and fires - both due to job creation and destruction and due to replacement hiring - take place simultaneously for all education levels.

Gross job turnover drives the monotone positive relationship between worker flow and general education level. Calculating the importance of job reallocation of the worker turnover rate, the *JRR* to *WF*, shows that 66 percent of worker flow is due to job turnover for the high-education group and 56 percent for the low-education group. Further, the main component of gross job turnover determining the higher worker turnover in the high-education group, relative to the low educated, is not job destruction for less education workers, but new hires of highly-educated

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[9] For both manufacturing and banking and insurance there has been a steady downward trend in churning flows from 1987 to 1994. This reduction coincides with a steady reduction of net employment at least since 1986 until recently, with an annual reduction rate of 2 percent in our data period for both sectors.

[10] Burgess, Lane, and Stevens (1995) present worker turnover rates for all sectors, including services and the public sector for Maryland, based on quarterly data for the period 1985:3-1993:3. They state that their job reallocation rate or gross job flow rate is comparable to the results given in Davis and Haltiwanger (1992), which is 20.5 percent. The result for Norway is 24 percent (for manufacturing) based on this data set. Given this, we can compare the importance of worker flow given the number of jobs, (*CF/WF*), between the two countries. Churning as a proportion of total worker flow is 46 percent for the US and 48 percent for Norway, which means that we have figures of the same magnitude. Albæk and Sørensen`s (1998) study for Denmark for manufacturing, based on annual data for the 1980-91 period, provides a worker reallocation rate of 56.5 percent with a job flow rate of 23.5 percent and a churning rate of 33 percent. Hence, for Denmark the worker flow due to churning is higher than for Norway and the US, and a *CF/WF*-ratio of 58 percent for Denmark is also somewhat higher.

workers, or gross job creation. This leads to a net job creation rate of 5 (2) percent for the highly education group and -4 (-4) percent for the low education group in manufacturing (the financial sector). Hence, structural changes in the pattern of demand for education levels due to, for instance, skill biased technical change are important in explaining the worker turnover by difference in education and employment policies at the plant level.[11] When the pure churning flows of education are isolated, an interesting pattern evolves, as shown in Figure 1. The figure presents the key results from Table 1. Both means and standard deviations from annual variation are presented. The churning rate for *medium-educated workers* is highest for both sectors, which is reflected in an inverse U-shape for churning in general education. For manufacturing, churning is also lower for highly educated than for less educated, causing an asymmetric curve. Churning in the high-skill financial sector is higher for less educated workers than for highly educated, with a slightly higher churning rate for the medium educated. We will return to possible explanations and tests when analysing the reemployment pattern in the econometric model.

If we consider the pattern of worker flows for different cohorts of workers from Table 1, there is a strong impression of "job shopping" among young workers. An inverse relationship exists between the age of the worker and the churning rates, both in manufacturing and in the service sector. For instance, in manufacturing, the rate varies from 29 percent for workers aged 25-34 years in 1986, to 6 percent for workers between 55-64 in 1986. The high turnover among young workers and quite low turnover for older workers, who were also eligible for early retirement pensions in this period, shows that the labour market is in persistently high flux and that this situation is not an artefact of workers entering the labour market from school and leaving the labour market through retirement. The implication of the latter would be high separation rates for old workers, which is obviously not confirmed by Table 1.

The female share is 26 percent in manufacturing, while women have a majority share in the financial sector, i.e. they constitute 56 percent of all those employed. Surprisingly, there is no difference in churning rates over gender in either manufacturing or in banking and insurance. A slightly higher total worker flow for females is found, 48 compared to 42 percent in manufacturing and 44 compared to 42 percent in the service sector. Both higher simultaneous gross job creation and higher job destruction for women account for the fact that the difference does not lead to a gender difference in net job creation. An important argument for gender differences in turnover is that young women take extended maternity leaves, which are counted as churning separations in our case, since such leaves are in excess of the standard leave period. This should lead to higher

[11] See Salvanes and Førre (1998) for an analysis of skill-biased technological change and competition from abroad and the pattern in job creation/destruction for different skills.

churning rates for young females relative to males. From results not reported here, analyses of worker flows by gender and cohort show that both in manufacturing and in banking and insurance there are strong differences in churning over cohorts, but no difference over gender. Young women have higher churning rates - possibly due to extended maternity leaves - but young men have equally high churning rates. One possible interpretation here is that extended maternity leaves by young women are compensated for by more job shopping among young males, or by a different career profile, especially for well-educated young men. This would even out the gender difference.

2.4.2 Worker flows by plant size

Table 2 presents a disaggregation of worker and job flows by plant size. The share of plants in each size category and the average firm size are given in the two last rows. Noticeable is the fact that plants up to 15 comprise a share of almost 50 percent of the number of plants. The skewness towards small plants in the Norwegian manufacturing is even stronger since the estimation sample presented here only contains plants above 5 employees. Worker flows in general both including reemployment flows and job turnover, decreases in plant as been found in Burgess, Lane and Stevens (1995). However, the observed monotonic decline is driven by job flows and thus job destruction, and not by reemployment separations, as seen from row 2-4. Actually, we see that reemployment separations are increasing slightly in plant size. Hence, it appears from the descriptive statistics that the two separation processes I focus on, have a different pattern in plant size. And, contrary to the expectation, small plants have lower reemployment or quit rates.

Now, looking at the possible differences in the composition of the workforce by size, we see that the share of workers with more than 10 years of schooling is increasing monotonically by plant size. However, it does not seem like tenure and experience is much higher in larger plants. The annual wage rate is considerable higher for all three education-categories for large plants. Turning to potential direct factors behind an establishment size/turnover relationship, we see that the share of independent plants is much higher for small than for large plants. However, since the reemployment rate does not increase with plant size, the size of the internal market using the multi-plant variable to capture this, does not seem to have any impact on reemployment separations via plants size. Also the age of the plant is higher for large plants as expected, but again this does not go very well with the observed plant size/reemployment separation rate. The other variables I have introduced to explain establishment size/separations by job destruction and churning of workers, from capital intensity to product- and labour market imperfection, are all strongly positively correlated with plants size. The union density, the market share and the concentration in the markets where large plants sell their products are much higher for large plants. However, large plants are more exposed to competition from abroad as seen by the "competition" variable, and thus this is an important variable to control for when measuring market power. I have also provided information on the female share of the workforce since gender differences in separation rates may be explained by establishment size and separation rates. Interestingly, the female workforce share is lower in large plants.

In sum, the degree of worker flow is at the same level in Norway as in other countries, though at the low end for churning flows. I also find differences in job destruction rates, reemployment rates and job destruction rates, over education levels and over cohorts of workers, which of course may partly explain the observed simultaneity of hires and separation of workers at the plant level in many studies. Further, from results not reported in the paper, it is found that these two processes are also found to be interrelated in that when analysing the interrelationship between the churning and net job changes by the three worker groups, there appears to be a relationship, in that plants increasing in size also to a greater extent retain highly educated workers. For contracting plants the opposite is true: they are left with less educated workers. When disaggregating these worker flows by plant and firm characteristics, it was found that establishment differences may well explain some of the observed heterogeneity.

3. Econometric Analysis

3.1 The regression model.

The focus of this study is to analyse the replacement rate - previously defined as separations for a given number of jobs - at the plant level, *e*, and the job destruction rate for three levels of general education for workers, *j* = low (until 10 years), medium (between 10 and 14 years) and high (15 years and above).[12] The following definitions are used for the replacement rate and job destruction rate at the plant level, respectively: $SR^R_{e,j,t,} = (S^R_{e,j,t})/[(L_{e,j,t} + L_{e,j,t})/2$ for the former and $JDR_{e,j,t,} = (D_{e,j,t})/[(L_{e,j,t} + L_{e,j,t})/2$ (job destruction rate for plant *e*).

The same models will be specified both for replacement separations and for job destruction, in order to compare the results. The most general model to be estimated - presented as $SR^R_{e,j,t}$ for convenience - is the following:

$$SR^R{}_{e,j,t} = \gamma_{ejt} + \beta_c I^c_t + \mu_{jc}\left(\gamma_{ejt} \times I^c_t\right) + \beta_h X^s_{et} + \mu_{jh}\left(\gamma_{ejt} \times X^s_{et}\right) + \beta_d Y^d_{et} + \beta_i Z^i_{et} + \varepsilon_{ejt} \qquad (2)$$

[12] Note that the job reallocation rates for each skill group may be higher than the job reallocation rates at the plant level for all skills taken together. The reason is, of course, that it may well be that changes in skill mix within plants take place, e.g. from low to high skills, without changing the size of the plant. Measures of between and within plant job reallocation may be retrieved by deriving the between plant job reallocation measure and the total job reallocation measure (Salvanes and Førre, 1998).

In the specification g_{ejt} is an indicator variable for general education level, (low=up to ten years, medium=between 10 and 14 years, and high=15 years and more) corresponding to the one of the three reemployment rates per plant in each time period I^c_t is a business cycle variable which is specified in order to test the cyclical property of reemployment separations and thereby determine whether quits or layoffs dominate. As is standard in the job flow literature, the manufacturing wide net job creation rate was used as an indicator for the business cycle. X^s_{et} is a 2 dimensional vector for plant and firm size defined by the number of workers. Y^d_{et} is a p-dimensional vector of plant specific variables in addition plant and firm size. I consists of direct effects channels for plant and firm size effects such as plant age, and a proxy for the size of the internal labour market by a dummy for whether the plant is a multi-plant or single plant firm where multi-plant is the reference category. In addition, Y^d_{et} consists of other direct channels to explain the employer size/turnover relationships; the capital labour ratio, the Herfindahl index for product market power plus a variable controlling for whether the product market is exposed to import- or export competition or sheltered (import/export competition is the reference category), union density, and an interaction variable between market power and union density. Z^i_{et} comprises the indirect effects, such as plant wage by each education category, a proxy for on-the-job training defined by accumulated tenure by education group controlled for potential experience by education group. In addition, interaction terms between education categories of workers and the business cycle are included to test whether the turnover patterns for workers of different general education levels differ over the cycle. Interaction terms between the education categories of workers and plant and firm size are also introduced to test whether firm and plant size give different degrees of job protection for different categories of worker. Note also industry fixed effects (3-digit level) and regional dummies are included. Precise definitions are given in Appendix.

3.2 Econometric issues

A couple of econometric issues require attention. First, ranges of the dependent variables $SR^R_{e,j,t}$ and $JDR_{e,j,t}$ are between 0 and 1, and 0 and 2, respectively. This means that it is not obvious that a standard linear regression can be used that allows variation between - ∞ and + ∞. One way to take into account the limited range of variation for $SR^R_{e,j,t}$ and $JDR_{e,j,t}$ is to use the approach of limited dependent models (See for instance Wallis, 1987). Define the following variable (only presented for replacement separations for convenience):

$$\hat{S}R^R{}_{e,j,t} = \ln\left(\frac{c + S_{e,j,t}}{c - S_{e,j,t}}\right) \quad (3)$$

where c is a number larger than 2. Arbitrarily c was chosen to be 2, although different values were experimented with, without giving much different results.

An alternative specification of the truncated dependent variable problem was considered. A tobit model restricted between 0 and 1 for replacements and 0 and 2 for job destruction was specified as an alternative to the specification in equation (2). For the employer specific variables the results are very close for the two specifications. However, the results for replacement and job destruction rates for the three education groups are very different for the two specifications. For the logit transformation of the dependent variable I am able to obtain results very similar to turnover rates as shown in the descriptive statistics. However, for the tobit model these results are very different. As a consequence, I present the results for the logit transformation bearing in mind that the results might be biased for the turnover rates for the three education levels, while the results are almost identical for the firm-specific variables.

Further, and related to the above specification problem, the distributions for SR^R and *JDR* are skewed with a lot of zeros. The no replacement or no job destruction observations are real observations; they represent plants not churning workers and not reducing that particular type of workers. The question is whether the no-replacement observations and observations with positive replacement should be considered as two separate processes. One could argue that due to adjustment costs one decision of the plant is whether to churn workers or not, and given this first step, the next decision is how much to churn. This implies that we have two different but related underlying processes and that they should be modelled as such. On the other hand, although there clearly are adjustment costs for these types of changes, such as search costs, it is hard to argue that these adjustment costs are dependent on how many workers are churned. Whether the employer decides to churn only a little bit (or zero) or to replace 10 workers, should basically be the same. This latter view is also supported by the adjustment cost literature, which stresses the distinction between gross worker adjustment costs, and adjustment costs from changing the size of the plant (Hamermesh and Pfann, 1996). Hence, only one process of replacement will be specified. On the other hand, for job destruction, implying that the employer is downsizing the plant, there might well be differences between reducing by only a few workers and reducing on a larger scale since this implies also implies changes in investment in capital. However, in order to keep identical specifications of replacements and job destruction, these are identically specified. Further, since it is expected that the replacement rate will vary systematically with the stock of the groups of workers of each education level, a robust Huber-White estimator for the variance-covariance matrix was used allowing for plant specific clustering in the variance-covariance matrix.

3.3 Econometric results

3.3.1 Reemployment separations and job destruction are two distinct processes.

The econometric results are reported in Table 3 (reemployment separations) and 4 (job destruction). Two general results are worth noticing before we focus on establishment specific effects. First, it is clear from the pattern over the business cycle for all model specifications that replacements and job destruction are two distinct turnover processes. Job destruction has the expected counter-cyclical pattern, since it basically represents fires or employer-initiated separations. The cyclical pattern of replacement rates is pro-cyclical, which is a strong indication that quits dominates layoffs. The latter is expected on the basis of both institutional characteristics in Norway and the findings of other studies. For one thing, there exists a relatively high degree of labour protection in Norway, which reduces the potential for fires. Mass reduction of employment in a plant, or downsizing, is possible for economic reasons, but will be calculated as a part of job destruction. Dismissals for cause are possible, but expected to take a small share. Hence, it is expected that most of the churning flow is due to workers quitting a job.[13] Secondly, for job destruction it is also apparent that the stability over the cycle increases with education, as seen from the interaction terms between the business cycle and education indicators. For replacement rates no difference exists. Third, the inverse U-shape of replacements in education level is only supported by a few of the estimated models in Table 3 and there is hardly any significant difference. Especially when tenure and experience are conditioned out (from the fourth column in Table 3) the replacement pattern is decreasing in the education level rather than hump shaped. A plausible explanation for the disappearance of the hump shape when on-the-job training is included is a complementarity between general and on-the-job training. Based on the relative strength of two opposite forces, i.e., a lock-in effect of specific training/general education complementarity and the outside option effect possibly higher for high general educated workers, a reasonable prediction for *medium educated workers* is that they will have a higher turnover rate than both higher and lower education workers. Medium-educated workers have higher general education than low educated workers and thus a higher quit rate. They may also have a lower degree of specific-training/general education complementarity than higher education workers, which leads to a higher turnover rate. An alternative theory to explain this pattern is that medium-skilled or educated workers have skills covering parts of low-skill jobs and parts of high-skill jobs. In other words, medium-skilled workers have a wider job search spectrum and thus a high number of

[13] This is also confirmed in Hamermesh, Hassink and van Ours (1996), where the authors found that quits comprised 68 percent of annual separations and only 13 percent fires for the Netherlands.

outside offers, and a high quit rate may be expected for this group.[14] However, no sign of a hump shape at all in job destruction is found in education level before introducing tenure and experience (Table 4). When tenure and experience are introduced in these models the pattern changes, also here introducing a hump shape in job destruction. Hence, from these general results it is quite clear that these two processes should be analysed separately and different effect of firm level personnel policies are expected for the two processes.

3.3.2 Replacement separations

Plant and firm size effects.

In Table 3 the general results of plant and firm size on reemployment separations are presented. In column 1 only the general education level, the business cycle indicator, regional dummies and 3-digit industry dummies are included, while column 2 presents the model with only the log plant and log of firm size. Column 3 is the result consisting of both log of plant and firm size and variables included in column 1 plus effects of plant and firm size estimated for three groups of workers.

The results from column 2 show that when worker characteristics such as education are not controlled for, there exist large effects of plant and firm size on reemployment separations. Interestingly, however, the effect from plant size is positive and from firm size negative. The negative effect from firm size is as expected, both from the indirect effects of large internal markets and lower failure rates, and from indirect effects such as on-the-job training and higher wages. However, the estimated coefficient for plant size is positive indicating that smaller plants have lower quit rates. Hence, the effect of large internal labour markets etc. is only picked up by firm size, and the size of plants within the firm size actually gives higher quit rates. In order to check whether the effect of plant size is non-monotonic and whether the negative effect only represents a portion of the size variable, I split the plant size in quintiles and estimated. The result, not reported here, showed that the negative effect was monotonically increasing in size. One plausible explanation for this result is that the voice channel for “grievance-arbitration” reducing voluntary separations may be quite strong in small firms, since the distance to the manager is expected to be small in small organisations. The size of distribution of Norwegian plants supports this argument, in that the average plant size of the estimation sample is only 44 workers (and only 27 workers in manufacturing for the total census including plants above 5 workers).

[14] It is not clear whether this effect is strong or not. Further, it may be argued that the most highly educated should be the most flexible and thus have the largest set of job options. However, I think there exist clear limits to how low a highly educated employee can go down the job ladder without signalling that he is a bad type/ low effort worker.

Previous studies do not provide results on reemployment separations but on quits which is the natural interpretation of reemployment separations. The literature does not provide consistent results regarding the sign or size of the effects of plant and firm size on quits. Idson (1996) finds that the quit rate is positively (but insignificantly) related to plant size and negatively related to firm size using a cross section of NLS data for the US. Using other data sets, Idson (1996) obtains a negative relationship between quits for both firm and plant size. Brown and Medoff (1989), Dell'Aringa and Lucifora (1996) and Lane, Stevens and Burgess (1996) find that worker and job flows are decreasing in firm size.

The results regarding plant and firm size in column 3 show that the effects on reemployment separations have the same magnitude when controlling for observed labour force characteristics such as general education as when not controlling for it. This result is interesting in that there exists a pure size effect on reemployment rates and that it does not appear to be the case that having more workers with higher education result in lower reemployment or quit rates in large firms. The reverse is true for the effect of higher turnover rates for larger establishments. The included interaction terms between plant and firm size and general education level reported in column 3 show that there is no difference in reemployment rates between low, medium and highly educated persons with respect to *plant* size. However, as compared to low educated workers, medium and highly educated workers have higher reemployment separation rates in large *firms* than in small *firms*.

Indirect effect of size: wage policies and on-the-job training

Since I am primarily interested in ascertaining which properties of large firms and plants lead to establishing the proposed longer employment relationships, I will first try to condition out the indirect effects, such as more on-the-job training and higher wages to protect these investments. To examine the indirect effects of plant and firm size on the size-reemployment relationships, I include the mean log wage at the plant level by education group, proxies for on-the-job training such as plant level mean tenure and experience by education group (experience in general to try to filter out experience *per se* and not experience in the plant the worker is associated with when measured) (column 4). General education and plant and firm size interactions are also kept.

The log wage has a strong negative impact on reemployment separation rates as expected.[15] The coefficients for the proxy for on-the job-training, i,e. average group-wise tenure, both show a

[15] The potential for biased results from plant wage on reemployment is, of course, present here. Although this is a very serious problem, I follow the literature here and use the log wage and do not instrument out the simultaneity effect. I have chosen to do so because no instrument is available which would determine the wage rate and not have any impact on the reemployment rate.

strong negative impact on reemployment separations, as expected. Since experience is potential experience, this variable is linearly related to the age of the worker; thus higher job shopping among younger workers is a reasonable explanation. This model specification confirms the result that only firm size «protects» low educated workers relative to highly educated workers, for voluntary mobility. These results are in line with Idson (1996), who used different proxies for on-the-job training, including the specification used here. Further, both the plant size and firm size effects on reemployment separations are somewhat reduced when introducing these factors. However, even though the difference in wage and on-the-job training policy between large and small plants is important in explaining turnover of workers, strong direct effects from plant- and firm-quit effects are still present.

Direct effects of size: multi-plant firms and plant age, capital intensity, and market imperfections.

The results from testing the direct effects are presented in Table 3, columns 5 to 7. The indirect effects are also included to check whether there exists a direct size effect net of the indirect effects.

The results for the two direct effects behind the size-reemployment separation relationship proposed by Idson (1996) are presented column 5. The potential effect of larger internal labour markets in multi-plant firms is negative, indicating that the reemployment rate is lower in single-plant firms than in multi-plant firms. This result is not expected from the hypotheses proposed by Idson (1996), but it is in accordance with the positive effect of plant size on quits. Idson (1996), using various measures of intra-firm mobility, finds an insignificant effect of internal mobility on quit rates, and the plant and establishment size coefficients are not changed. The age of the plant comes in with a negative sign. This result is as expected, in that, large firms, are also old firms since firm size increases over time due to growth. Idson (1996), using the industry level failure probability rates, finds very mixed results on the effects of quits. The firm and plant effects are reduced somewhat. The same result regarding firm size differences but not plant size differences over education groups of workers holds for the present specification.

The capital-labour complementarity hypothesis is supported as is shown in column 6, since there is a negative coefficient on the K/L ratio. Workers attached to more capital-intensive plants have lower replacement rates. Comparing the results with column 4 in Table 3, which is the identical specification except for the K/L ratio, *there is actually no reduction in the coefficients of plant and firms size when the K/L ratio is introduced*. Also the proxy for on-the-job training, i.e. accumulated average tenure, which is expected to be correlated with the K/L ratio, is unchanged over the two specifications. Hence, the capital-skill ratio does impact the replacemtn rate in the expected direction. It appears to be uncorrelated with the size-replacement relationship, however, this result is also supported by size-wage studies, cf. Troske (1997).

Column 7 reports the results on replacements when market imperfections in the product and labour market are introduced. Market power may generate rents which are shared with workers in order to obtain the optimal amount of worker effort. This is the indirect effect via higher wages. More direct non-wage effects on voluntary separations of market power may also exist such as increased X-inefficiency in the form of lower productivity of workers. The concentration in the market of the firm the plant belongs to is included to capture the effect of market power. Moreover, it is expected that workers organised in unions may be able to capture more of the rents and thus union density is included. Again, both an indirect effect via higher wages and a direct effect via the voice channel are expected to have an impact on quits.

The estimated parameter for the effect of union density is negative and shows, as expected, that workers in plants with high union density have lower replacement or quit rates also when the union monopoly effect of higher wages is conditioned out. Remember that industry (three-digit level) dummies are included and the interpretation is within industries. Further, the wage is included, so this is an effect beyond the indirect effect is at work. The coefficient of the Herfindahl index is not significantly different from zero, but the interaction term is significant with the expected negative sign.[16] This gives a strong indication that the combination of working in a highly unionised plant, which also produces for a concentrated market, reduces voluntary separations. What is more interesting in our context is that the effect of firm size on quits disappears for both these two specifications. Thus, the combination of unionisation and market power seems be a strong candidate for explaining the firm-size/quits relationship. This result is in accordance with Dell'Aringa and Lucifora (1996), who find support for a negative relationship between union density and voluntary quits as defined here. However, these authors do not consider the effect of market concentration, the combination of the two, nor the relationship to firm or plant size. Troske (1997) finds an impact of market concentration on *wages* for the US, but no correlation between market power and firm or plant size.

3.3.3 Job destruction rates

Plant and firm size effects

[16] When the Herfindahl index was used separately from the union density/market concentration interaction term, a significant negative sign was obtained. Further, the market share of the firm the plant belongs to was tried in separate regressions both in combination with the Herfindahl index and separately. These two measures are so correlated that nothing was gained by including the market share in addition to the Herfindahl index. Using the market share measure alone created about the same results as using the measure with the Herfindahl index.

I now turn to the results for job destruction or involuntary separations. In Table 4, the effect of plant and firm size on job destruction rates are presented. The results from column 2 show that, without controlling for worker characteristics, such as education, there exists a negative effect of plant size on dismissals. But firm size has no effect. The negative effect from plant size is as expected, both from the indirect effects of large internal markets and lower failure rates, and from indirect effects such as on-the-job training and higher wages. Previous studies do not provide consistent results regarding the sign or size of the effects of plant and firm size on job destruction rates. Dell'Aringa and Lucifora (1996) find that dismissals are decreasing in establishment size, but they do not consider firm size. Idson (1996) finds that the layoff rate is negatively and significantly related to firm size and negatively (but mostly) insignificantly related to plant size. Using other data sets he obtains a negative relationship between quits and both firm and plant size. Important to note in our context in that another distinguishing feature of the two separation processes is found in that plant and firm specific variables have different effects on the two processes.

The results regarding plant and firm size in column 3 of Table 4 show that the effects on job destruction rates of plant size is reduced when controlling for observed labour force characteristic as general education, though a pure plant size effect still exists. Interesting results are revealed by the interaction terms between plant and firm size and general education level as reported in column 3. It is apparent from the results that it is mainly highly educated workers who have relatively higher lay-off rates in large, rather than in small plants, while medium educated show lower rates. Further, when interaction terms between worker type and firm size are included, a firm size effect on job destruction is shown to be present in that mainly medium and highly educated workers that demonstrate increasing layoffs in firm size, and not workers with low education levels. Note also that the indicator variable for highly educated workers disappears in this specification, which means that dismissals for highly educated workers only take place in large establishments.

Indirect effect of size: wage policies and on-the-job training

To examine the indirect effect on job destruction rates of firm and plant size, the log of the wage rate and proxies for on-the-job training are included. Column 4 in Table 4, shows that the log wage does not have any significant effect at all on the job destruction rate. This result is also confirmed in Dell'Aringa and Lucifora (1996). The coefficient for on-the job-training shows no significant impact. This means that investments in on-the-job training do not affect job destruction or layoffs, which is a bit surprising. Nevertheless, this result is also supported in Dell'Aringa and Lucifora

(1996). Idson (1996), using many different data sets, finds the opposite results for layoffs in general. The effect of average experience has a positive sign, meaning that workers with higher general experience in the labour market are less protected from layoffs or job destruction. Since the experience measure is calculated as potential experience, it is linearly correlated with worker age. This means that older workers have a somewhat higher layoff rate, which is reasonable. For reemployment separations or quits, the results are the opposite, in that younger workers showed a higher quit rate. The negative effect of plant size is only reduced a little bit as compared to the results in column 3. Hence, it is mainly via a *direct* effect that plant size works to reduce layoffs or job destruction rates.

Direct effects on layoffs of size: multiplant firms and plant age, capital intensity and

Turning now to the effect of larger internal markets in multi-plant firms on job destruction rates, the coefficient reported in Table 4, column 5, is negative, indicating that the job destruction rate is lower in single plant firms than in multi-plant firms. Again this result is not expected, though it is in accordance with the results on reemployment rates reported in Table 3. Idson (1996), using various measures of intra-firm mobility, finds an insignificant effect of internal mobility on layoffs as well as on quit rates. It is apparent from column 5 that the plant age has a positive effect on layoffs. According to Idson's (1996) argument, this is not predicted, since old plants have lower exit probabilities and, as a consequence, may invest more in on-the-job training etc. However, there exist two effects of plant age here: one is the fact that old plants are beyond the first learning and selection process and thus have lower exit probabilities. On the other hand, there might also be a vintage capital effect, since the age of capital may be correlated with the age of the plant.[17]The plant size/layoff relationship is not changed when plant age and the size of the proxy for the internal market is introduced. Idson (1996), using the industry level failure probability rates and different measures for the size of the internal market, finds very mixed results on the effects of layoffs.

Column 6 reports the result when capital-labour ratio is introduced. The capital-labour complementarity hypothesis is not supported for layoffs or job destruction rates, since a positive coefficient on the K/L ratio is reported. Workers working in more capital-intensive plant have lower layoff rates. Comparing the results with column 4 in Table 4, which is the identical specification except for the K/L ratio, there is quite a strong reduction in the coefficients of plant

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[17] See Salvanes and Tveterås (1999) who disentangle these two effects on the exit rates of plants by constructing an index of the age of machine capital to measure the vintage capital effect.

(and firm) size when the K/L ratio is introduced. Hence, the capital-skill ratio does impact the job destruction rate, though in an unexpected way.

Columns 7 presents the results with the concentration in the market as defined by the Herfindahl index (in addition to the dummy for export/import competition vs. sheltered sectors), union density, and in the interaction term between the two. The coefficient for union density is positive, which suggests that a stronger union lead to more layoffs in the form of job destruction. The latter result is supported by the results for Italy provided in Dell'Aringa and Lucifora (1996). The coefficient of the Herfindahl index is positive but only significant at the 10 percent level. As opposed to the effect on reemployment the interaction term effect is not significant in the case of layoffs. Again, contrary to the results for the reemployment rates, but in line with previous results for layoffs, the plant size effect on layoffs is not reduced nor does it disappear: it is strengthened. This means that there is a correlation between plant size and market concentration; but since market concentration and plant size have opposite effects on layoffs, the effect of plant size is strengthened when market concentration is conditioned out.

4. Concluding Remarks

The focus of the present paper has been on examining the sources of plant-specific heterogeneity in worker and job turnover patterns. The emphasis has been on both plant differences and worker differences for reemployment rates and job destruction rates using a panel of matched worker-employee data set for the Norwegian manufacturing sector.

One of the main questions within the literature on plant heterogeneity is whether net employment changes at the plant level, job reallocation, is a different process than reemployment flows. This is significant because such a difference would mean that declining firms could still hire workers and expanding firms could have positive separations. Using an econometric framework, I find that reemployment separations are pro-cyclical, which suggests that this process consists mainly of quits. I also find that job destruction is counter-cyclical, which imply that this is mainly employer-initiated separations or layoffs, as one would expect. Further, these two processes also demonstrate different patterns over the educational level of workers. Job destruction rates are more stable over the business cycle than for lower educated workers, while no difference occur for reemployment separations. Moreover, in the descriptive statistics the reemployment separation rates are hump-shaped in education level, while job destruction is declining in education level. These results are also found for the financial sector, and hence not particular to the manufacturing sector. In the econometric analysis this inverse U-shape is less pronounced especially when disappears when years of tenure as a proxy for on-the-job training is conditioned out. Complementarity between general and specific education may explain this pattern for reemployment separations or quits. I also find differences in the level of job creation and job destruction rates, as well as for reemployment rates over education levels, cohorts and gender. This, of course, may partly explain the observed simultaneity of hires and separation of workers at the plant level in many studies.

Now, having established that these two processes are different for all workers, and also different over worker categories within each process, I turn to the results from testing for the effects of plant-specific differences on the two turnover processes. Firm size is found to have a negative impact on reemployment rates, and plant size an unexpected positive effect. The latter result may be explained by the strength of the voice channel in small plants, which thus enhances grievance-arbitration, thereby reducing quits. This argument is underlined by the particular size structure in Norwegian manufacturing, where the average plant size in our estimation sample is only 44 workers (and the average is 27 for the population for plants above 5 employees). The estimated coefficient of plant size of job destruction or dismissals is negative as expected, while no effect is found for firm size. The employer size effects still hold with the same magnitude after controlling for observed labour characteristics such as general education level. Turning to two indirect effects behind employer size and reemployment, I find, as expected, that the plants' wage policy and on-the-job training reduce reemployment separations. Furthermore, even when controlling for these effects which may explain plant and firm effects, the direct effects of plant and firm on reemploymnets are important. For job destruction, no effects are found for plants' wage policy, and a bit surprisingly, that none are found for on-the-job training either. The first result is as expected, and is also supported in a study for Italy (Dell'Aringa and Lucifora, 1996). The latter result is also supported in the Italian study. With a slight reduction in magnitude, the plant size effect is still important in explaining job destruction rates.

Turning now to direct effects behind the employer size effects, I find that the age of plants is reducing the reemployment rate, indicating that older plants are also able to establish longer employer-employee relationships. The impact of firm size is only mildly reduced when this variable is included. The plant age has a positive effect on the job destruction rate, which is counter to the argument that old plants with low exit probabilities are expected to invest more in on-the-job training etc., leading to less destruction of jobs. However, two possible effects of plant age exist; first old plants beyond the first learning and selection process have lower exit rates. Second, however, there may also exist a vintage capital effect by which the age of capital, and thus the embodied technology, is correlated with the plant age. For the proxy used for the size of the internal labour market, whether the plant is a part of a multi-plant firm or not, I find that independent plants, i.e. those with smaller internal markets, have lower reemployment rates and job destruction rates. Including the capital labour ratio in the reemployment regression has a negative effect, as expected, which supports the capital-skill complementarity hypothesis. However, the effect of plant and firm size is not reduced. The plant and firm effects are reduced for the job destruction regression, but the sign of the variable is positive, thus not supporting the capital labour complementarity hypothesis for this process.

What has been found so far is that plant and firm size are important in explaining reemployment separations and separations from job destruction, and, importantly, that the two processes operate differently. Also, the firm and plant variables have different effects on the three types of workers for the two processes. Including both direct and indirect effects of explanations of what may be behind the employer size provide plausible signs, but none of these appear to be able to explain the impact of plant and firm effect to any degree. Interestingly, and more novel, is the finding that when imperfections in the product and labour market, especially the combination of strong union bargaining power and high concentration in the product market are included, the direct plant effect on reemploymnet disappears. The firm effect remains at the same magnitude, though the significance level is reduced. For job destruction the plant effect is not reduced when market imperfection variables are introduced.

The effects on the two separation rates from market imperfections are quite interesting. The Union density has the expected negative signs on reemployment separations. On the other hand, for job destruction, the union density has a positive coefficient, implying that an imperfection in labour market leads to higher job destruction rates. The union density results are also supported by the results obtained by Dell'Aringa and Lucifora (1996). Hence, also market imperfections have different effects on the two turnover processes.

To conclude the paper, let me contrast the obtained effects of labour and product market imperfections on worker and job flows with the perspective of ongoing research on the degree to which product and labour market imperfections lead to less flexibility of labour markets, as measured by worker and job flows, cf. Bertola and Rogerson (1997), Garibaldi, Konings and Pissarides (1996), Leonard (1987), Salvanes (1997). The results from this paper indicate that worker churning or reemployment separations, which is mainly voluntary quits, is reduced by union density, as would be expected. But note that it is reduced also via a direct "collective voice channel" and not only via the wage channel. However, flexibility, as measured by job flows is *increased* as a consequence higher union density. This appears to be counterintuitive at first glance since more imperfections are expected to give less flexibility. There are many questions that arise regarding labour market flexibility and efficiency. First of all, it is not clear what the first-best optimal level of job and worker flows should be. Secondly, in a second-best world with market imperfections, such as an incomplete set of markets, market power and asymmetric information, it is even not clear that more rigidity and imperfection will reduce the efficient allocation of resources or the flexibility of the labour market. Let us consider two examples that also may rationalise the results obtained here. One example is the one due to Freeman (1980), mentioned throughout the present paper of unions enhancing efficiency by providing workers with a collective voice channel of communicating better with firm managers. Because of the classical public good properties of many services or goods provided to workers in the firm, such as grievance procedures, safety regulations etc., individual worker negotiations with the management may lead to a suboptimal provision of these goods which the collective bargaining channel provided via a union could alleviate. And since better communication channels may provide this good to the workers, less quits are expected. Indeed, this effect is quite clear in our data, and this represents a constraint on the firms' behaviour leading to a more efficient allocation of resources. Another example illustrating the result of more job destruction for higher union density is the following: A solidaric wage policy advocating «equal pay for equal work», independent of the firms productivity, may indeed lead to productivity enhancement by speeding up the reallocation of workers from a low-productivity sector to a high productivity sector. The idea is that a high wage common for all sectors for a particular type of work leads to reduced jobs - job destruction - in the low-productivity sector, because the firms cannot pay that much. The same policy leads to expansion via positive job creation in the high-productivity sector, which is also able to expand since their productivity is above the going wage. The mechanism necessary for this to be an efficiency enhancing policy is that there is a second-best situation at the outset. A reasonable externality in this case could be one of the mechanisms suggested in the new endogenous growth theory where there are increasing returns to scale and positive externalities from producing in some sectors, which could, in this case, be the high productivity sectors (See Agell and Lommerud, 1993; and Agell, 1998). Empirical research on the connections between market imperfections and labour market policies in terms of hires and separations at the plant level, is required to obtain a better understanding of the economic mechanisms involved.

References

Agell, J. (1998). "On the benefits from rigid labour markets: Norms, market failure, and social insurance", memo, Uppsala University.

Agell, J. and K.E. Lommerud (1992). "Egalitarism and growth", *Scandinavian Journal of Economics*, 96:559-579.

Askildsen, Jan Erik and Oyvind Anti Nilsen (1998). "Union Membership and Wage Formation", Discussion paper, Department of Economics, University of Bergen.

Abowd, J. M., P. Corbel and F. Kramarz (1996). «The entry and exit of workers and the growth of employment: An analysis of French establishments», NBER working paper No. 5551.

Albæk, S. and B.E. Sørensen (1998). «Worker flows and job flows in Danish manufacturing, 1980-91», *Economic Journal*, 108(November): 1750-1771.

Bertola, G. and R. Rogerson (1997). "Institutions and labor reallocations", *European Economic Review*, 41(6): 1147-1171.

Brown, C. and J. Medoff (1989). "The Employer Size-Wage Effect", *Journal of Political Economy* 97: 1027-1059.

Burgess, S. J. and S. Nickell (1989). "Labour turnover in UK manufacturing." *Economica*, 57: 295-317.

Burgess, S., J. Lane and D. Stevens (1995). "Job flows, worker flows and churning", CEPR working paper No. 1125.

Davis, S. and J. Haltiwanger. (1992) «Gross job creation, Gross job destruction, and employment reallocation.» *Quarterly Journal of Economics* Vol. 107: 819-63.

Dell'Arringa, C. and C. Lucifora. (1996)"Labour turnover and unionism in Italy", *Annale d`Economie et de Statistique* No. 41/42: 127-154..

Dunne, T., M. J. Roberts and L. Samuelson (1989). «Plant turnover and gross employment flows in the US manufacturing sector» *Journal of Labor Economics* 7: 48-71.

Freeman, R. B. (1980). "The exit-voice tradeoff in the labor market: unionism, job tenure, quits, and separations", *Quarterly Journal of Economics,* 94:643-673.

Garibaldi, P., J. Konings, and C. Pissarides (1996). "Gross job reallocation and labour market policy", in Snower and de la Mesa (eds.). *Unemployment policies: How should governments respond to unemployment?* Cambridge: Cambridge University Press.

Griliches, Z. (1970). "Notes on the Role of Education in Production Functions and Growth Accounting," In *Education, Income, and Human Capital,* edited by W. Lee Hansen, New York: NBER.

Hamermesh, D. S. (1980). "Commentary," In *The Economics of Firm Size, Market Structure and Social Performance,* edited by John J. Siegfried, Washington D.C.: Federal Trade Commission.

Hamermesh D. S., W. H.J. Hassink and J. C. van Ours (1996). «New facts about factor demand dynamics: Employment, jobs and workers» *Annale d`Economie et de Statistique* No. 41/42: 21-40.

Hamermesh, D.S. and Pfann (1996). "Adjustment costs in factor demand", *Journal of Economic Literature*, 34: 1264-1292.

Halvorsen, R., R. Jenssen and F. Foyn (1991). "Dokumentasjon av industristatistikkens tidsseriebase", Oslo: Statisitics Norway.

Idson, T.L. (1996), "Employer size and labor turnover" *Research in Labor Economics*, Vol. 15: 273-304.

Klette, T.J. and Mathiassen, A. (1995). «Job creation, job destruction and plant turnover in Norwegian manufacturing.» *Annale d`Economie et de Statistique* No. 41/42: 97-125.

Lane J., A. G. Isaac and D. W. Stevens (1998). «Firm heterogeneity and worker turnover» *Review of Industrial Organisation* Vol. 13: 113-125.

Leonard, J. (1987). «In the wrong place at the wrong time: The extent of frictional and structural unemployment». In Lang, K. and Leonard, J. (eds.), *Unemployment and the Structure of Labor Markets*. Blackwell, London.

McLaughlin, K. J. (1991). «A theory of quits and layoff with efficient turnover.» *Journal of Political Economy*, Vol. 99(1): 1-29.

Nickell, S. (1998). "Product markets and labour markets", paper presented at EALE, September 1998.

Rebitzer, J. (1986). "Establishment size and job tenure", *Industrial Relations*, 25:292-302.

Salvanes, K. G. (1997). «Market rigidities and labour market flexibility: An international comparison.» *Scandinavian Journal of Economics* Vol. (2.): 315-333.

Salvanes, K. G. and S. E. Førre (1998). «Job creation, heterogeneous workers and technical change: Evidence from matched worker/plant data from Norway», memo, Norwegian School of Economics and Business Administration.

Salvanes, K. G. and R. Tveterås (1998). "Firm exit, vintage effect and the business cycle in Norway", Discussion paper no. 2/99, Norwegian School of Economics and Business Administration.

Stewart, M. B. (1983). "Relative earnings and individual union membership in the United Kingdom", *Economica*, 50: 111-125.

Troske, K. R. (1998). "Evidence on the Employer Size-Wage Premium from Worker-Establishment Matched Data", Forthcoming in *Review of Economics and Statistics.*

Wallis, K. F. (1987). "Time series of bounded economic variables", *Journal of Time Series Analysis*, 8(1): 115-123.

Wedervang, F. (1965). *Development of a Population of Industrial Firms*, Bergen: Universitetsforlaget.

APPENDIX

Variable definitions.

In order to aggregate worker flows to a sector level, the following formulas are used. The rates for job creation (entry, increment for established plants), and job destruction (exit, declining) for skill type *j*, can be defined as:

$$ENTRY_{j,t} = \frac{2}{L_{j,t-1} + L_{j,t}} \sum_{\substack{e \notin E_{e,t-1} \\ e \in E_{e,t}}} L_{e,j,t} \qquad INCR_{j,t} = \frac{2}{L_{j,t-1} + L_{j,t}} \sum_{\substack{e \in E_{e,j,t-1}, E_{e,j,t} \\ dL_{e,j,t} \geq 0}} \left| L_{e,j,t} - L_{e,j,t-1} \right|$$

$$DECR_{j,t} = \frac{2}{L_{j,t-1} + L_{j,t}} \sum_{\substack{e \in E_{e,j,t-1}, E_{e,j,t} \\ dL_{e,j,t} \leq 0}} \left| L_{e,j,t} - L_{e,j,t-1} \right| \quad EXIT_{j,t} = \frac{2}{L_{j,t-1} + L_{j,t}} \sum_{\substack{e \in E_{e,t-1} \\ e \notin E_{e,t}}} L_{e,j,t-1}$$

respectively, where $E_{e,j,t}$ is the set of establishments with employment of skill type j in year *t*, and $L_{j,t}$ is the total employment of type j, defined by: $L_{j,t} = \sum_{e \in E_{e,j,t}} L_{e,j,t}$.

The *gross job creation* and *gross job destruction* rates of industry *i* in year *t* are given by:

$$JCR_{j,t} = INCR_{j,t} + ENTRY_{j,t}, \quad JDR_{j,t} = DECR_{j,t} + EXIT_{j,t}$$

The *net employment change* (or *job flow rate*) and *gross job reallocation rate* (or *job reallocation rate*) are given by:

$$JRR_{j.t} = JCR_{j,t} + JDR_{j,t} \quad JFR_{j,t} = JCR_{j,t} - JDR_{j,t} ,$$

Similar definitions are used for churning flow and worker flow rates:

$$CFR_{j,t} = \frac{2}{L_{j,t-1} + L_{j,t}} \sum_{\substack{e \in E_{e,j,t-1}, E_{e,j,t} \\ dL_{e,j,t} \geq 0}} \left| R_{e,j,t} + S^{R}{}_{e,j,t-1} \right|$$

$$WFR_{j,t} = JRR_{j.t} + CFR_{j,t}$$

where $R_{e,j,t}$ are hires in excess of job creation at the plant level for each type of workers, and S^R are separations in excess of job destruction.

Worker categories by general education level.

Education level is based on the normal duration of the education and includes only completed (and highest attained) education, and all formal education courses exceeding 300 hours are registered. We also use a three category discrete measure of skill, based on the level of education. These levels of education are calculated according to the «Nordic Key for Classification of Education» comparable to the «International Standard of Classification of Education» (ISCED). The grouping of individual educational courses by educational level is based on observation of the normal duration of the educational activities. The standard is organised with 9 educational levels. Following this standard we have defined «low educated» as up to the third level, which is equivalent to 10 years of education. «Medium educated» is defined as education from the third up to the fifth level, which is equivalent to normal education duration of 14 years, not leading to an academic degree. «High educated» is three years of college/university leading to an academic degree. Low educated includes primary education plus one year of secondary education (or in the old education system primary education which was changed in 1970; seven years plus three years («realskole»), medium education includes high school, both vocational and general high school preparing for college/university, plus two years of college/university.

Plant characteristics.

Plant size (*logplant size*) is defined as the logarithm of the total number of workers at the plant level including also part time workers. Firm size (*logfirm size*) is defined as the logarithm of the total number of workers at the firm level, including also part time workers. Experience (*experience*), strictly potential experience, is defined as age minus years of education minus seven. Tenure (*tenure*) is defined as the number of years worked for each employer. Both are calculated as plant level averages by the three education levels. Market concentration (*Herfindahl index*) of the plant is defined as Herfindahl index of the gross share per year production in total sector gross production at the 5 digit ISIC level of the firm the plant belongs to. Note that this therefore measures shares of *production* not *sales*. So, for example, in a very open sector, a plant producing a high share of domestic production may still only have a low share of domestic or international sales. The plants are also categorised according to the degree of competition (*competition*) from abroad by using information on whether the plant is a part of a sector (at the 3-digit ISIC level) which is primarily export-oriented or open to import competition, or a protected sector, which is the base category). The share of union members at the plant level (*union*) is calculated as the number of union members to the number of workers. The real (1990) wage (*variable name = wage*) was derived using the annual plant wage payment to the worker (including salaries and wages in cash and kind. The average wage at plant level for the three educations was calculated based on the individual wages. The consumer price index was used to derive the wage variable in 1990 values. As an exclusion criterion, we used an hourly wage rate, and excluded an hourly wage rate below 30 kroner per hour and above 500 kroner per hour, since these are obviously either below or above possible wage rates. The capital labour ratio (*K/L*) is calculated as the value of capital relative to the number of workers. The capital value is based on the fire insurance value of the buildings and machinery. Following Griliches and Ringstad (1971) and Klette (1998) we estimate the capital services as follows:

$$K_{i,t} = R_{i,t} + (r + d^{m})\overline{V}^{m}_{i,t-1} + (r + d^{b})\overline{V}^{b}_{i,t-1}$$

where *Ri,t* is rental costs of machinery and buildings for equipment rented by the plant. r is the real return to capital, where we used the standard returns used in public investment projects.i.e., 7 %. d^{m} and d^{b} are depreciation rates for machinery (0.06) and buildings (0.02) taken from the Norwegian National Accounts. $\overline{V}^{m}_{i,t-1}$ and $\overline{V}^{b}_{i,t-1}$ are the values of the plants' machinery and buildings based on insurance values, calculated as the avarage for the present year, the year before and the year after, using the "perpetual inventory" method. Investments are assumed to take place at the end of each year. As noted by Klette (1998), one problem with the fire insurance values reported separately for buildings and machinery by the plants is that there are missing variables. The procedure of taking the average over three years is an attempt to reduce this problem.

Table 1A. Summary statistics for variables used.

Variables	Mean	St. dev.
Wage (low ed.) (1000 NOK)	176	45
Wage (med ed.)	203	53
Wage (high ed.)	300	100
Low educ. (share)	0.60	0.21
Medium educ.	0.35	0.20
Highly educ.	0.05	0.08
Tenure (low ed.)	9.81	2.04
Tenure (med ed.)	9.61	2.11
Tenure (high ed.)	9.62	2.76
Experienc (low ed.)	25.28	7.29
Experience (med. ed.)	17.78	7.39
Experience (high ed.)	16.33	8.25
Share independent plants	0.68	0.46
Plant age	18.76	9.64
K/L	488	641
Herfindahl index	0.158	0.30
Competition	0.014	0.117
Market share	0.05	0.021
Union density	0.59	0.039
Female share	0.278	0.237
Firm size	19.10	66.42

Note: All means of plant specific variables are calculated at plant level. All values in 1990 NOK.

Table 1. Worker flows by general education level, cohort and gender for manufacturing and banking and insurance, mean 1987-94.

	Manufacturing							**Banking and insurance**						
	H	S	WF	JRR	CF	JFR	ES	H	S	WF	JRR	CF	JFR	ES
Mean	0.21	0.23	0.44	0.24	0.21	-0.02		0.21	0.22	0.43	0.27	0.16	-0.02	
Educat.														
Low	0.19	0.23	0.43	0.25	0.18	-0.04	0.58	0.19	0.23	0.42	0.31	0.11	-0.04	0.29
Medium	0.24	0.23	0.047	0.27	0.20	0.01	0.38	0.22	0.22	0.44	0.28	0.16	-0.01	0.61
High	0.31	0.25	0.56	0.40	0.16	0.05	0.04	0.27	0.25	0.51	0.36	0.15	0.02	0.10
Cohort														
1961-70	0.33	0.32	0.65	0.36	0.29	0.02		0.31	0.31	0.62	0.39	0.24	0.01	
1951-60	0.19	0.21	0.41	0.26	0.14	-0.02		0.21	0.22	0.43	0.29	0.14	-0.01	
1941-50	0.16	0.18	0.33	0.24	0.10	-0.02		0.17	0.18	0.36	0.28	0.08	-0.01	
1931-40	0.12	0.17	0.29	0.23	0.06	-0.04		0.15	0.17	0.33	0.28	0.04	-0.02	
Gender														
Female	0,23	0,25	0,48	0,28	0,20	-0,02	**0,26**	0,21	0,23	0,44	0,28	0,16	-0,02	**0,56**
Male	0,20	0,22	0,42	0,23	0,19	-0,02	**0,74**	0,20	0,22	0,42	0,28	0,14	-0,02	**0,44**

*These calculations are based on the total samples.

Table 2. Worker flow rates and plant characteristics by plant size (mean 1987-94).

Characteristics	**Plant size**				
	5-15	**16-25**	**26-50**	**51-200**	**200+**
Worker flows	0.46	0.45	0.44	0.40	0.38
Job reallocation rate	0.27	0.23	0.22	0.20	0.18
Job destruction rate	0.073	0.071	0.069	0.060	0.062
Reemployment separations	0.095	0.107	0.111	0.105	0.101
Indirect effects					
Wage (1000 NOK) (low ed.)	176	177	176	181	199
Wage (med ed.)	200	203	203	208	224
Wage (high ed.)	264	283	302	314	334
Share of low educated workers	0.59	0.62	0.62	0.60	0.53
Share of medium educated workers	0.37	0.34	0.33	0.34	0.38
Share of highly educated workers	0.04	0.05	0.05	0.06	0.09
Tenure (years) (low ed.)	9.8	9.9	9.8	9.9	9.9
Tenure (med. ed.)	9.6	9.5	9.6	9.7	9.6
Tenure (high ed.)	9.4	9.7	9.9	9.6	9.5
Experience (years) (low ed.)	24.7	25.3	25.7	26.1	26.9
Experience (med. ed.)	17.7	17.7	17.7	18.0	18.6
Experience (high ed.)	16.0	15.5	16.0	19.9	16.8
Direct effects					
Share independent plants	0.82	0.68	0.60	0.41	0.24
Plant age	18.8	20.8	21.7	23.2	24.2
K/L	488	485	484	494	623
Herfindahl index	0.137	0.156	0.182	0.273	0.53
Competition	0.01	0.02	0.03	0.09	0.25
Market share	0.006	0.012	0.025	0.063	0.20
Union density	0.21	0.38	0.53	0.67	0.77
Female share	0.28	0.29	0.29	0.28	0.23
Firm size	19.1	47.8	65.3	157	659
Share of plants	0.49	0.16	0.16	0.15	0.04

Table 3. Estimates of reemployment equations for three education categories for Norwegian manufacturing, 1987-94 using a matched employer-employee data set.

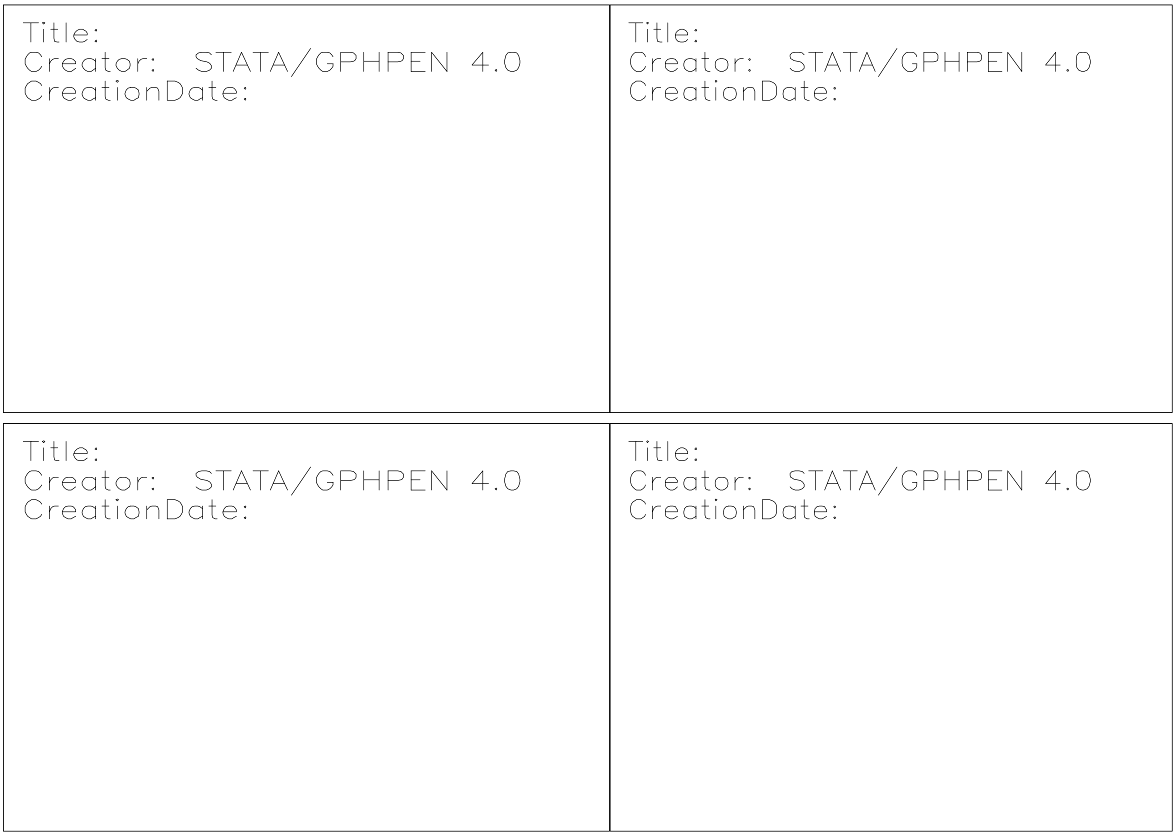
	General results						**Indirect effects**				**Indirect effects**			
Variables	**C1**		**C2**		**C3**		**C4**		**C5**		**C6**		**C7**	
Ed. Low	10,4	*34,9*			9,08	*23,0*	14,1	*25,4*	15,4	*11,5*	14,2	*24,8*	12,4	*19,4*
Ed. Med	10,9	*34,7*			7,47	*17,4*	11,5	*21,3*	12,9	*21,7*	11,6	*21,1*	10,5	*17,4*
Ed. High	8,01	*20,9*			2,86	*4,15*	6,91	*9,24*	8,46	*10,3*	7,04	*9,29*	6,54	*7,91*
Bus. cycle	0,15	*4,92*	0,14	*5,10*	0,14	*4,85*	0,20	*6,93*	0,21	*7,03*	0,20	*6,85*	0,14	*4,22*
Ed.Med×Busc	-0,03	*0,78*			-0,03	*0,38*	-0,04	*1,10*	-0,04	*1,11*	-0,04	*1,12*	0,01	*0,36*
Ed.High×Busc	0,07	*0,92*			0,08	*0,99*	-0,02	*0,31*	0,03	*0,33*	0,03	*0,31*	0,15	*1,67*
Logplant size			2,15	*17,9*	2,33	*16,1*	2,04	*14,7*	2,21	*15,5*	2,03	*14,5*	1,99	*5,40*
Logfirm size			-1,24	*13,2*	-1,54	*15,7*	-1,04	*10,8*	-1,21	*11,2*	-1,02	*10,7*	-0,48	*1,39*
Ed.med×psize					0,11	*0,65*	0,16	*1,02*	0,16	*0,87*			0,59	*1,79*
Ed.high×psize					-0,15	*0,52*	0,32	*1,15*	0,24	*1,11*			0,16	*0,23*
Ed.med×fsize					0,54	*4,24*	0,42	*3,43*	0,44	*3,58*			-0,13	*0,44*
Ed.high×fsize					0,98	*4,02*	0,72	3,06	0,73	3.01			0,66	*1,04*
Logwage							-5,39	18,1	-5,40	18,2	-5,25	*18.6*	-5,00	*15,4*
Tenure							-0,10	3,09	-0,09	2,83	-0,10	*3,08*	-0,10	*2,69*
Experience							-0,24	25,5	-0,23	24,1	-0,25	*25,3*	-0,23	*21,7*
Multiplant									-0,66	3,28				
Plantage									-0,06	6,17				
K/L×10^{-4}											-2,12	*1,74*		
Herfindahl													0,26	*0,66*
Competition													-2,27	*2,47*
Union density													-1,51	*4,57*
Herfin×Union													1,32	*2,26*
Root MSE	0,236		0,154		0,154		0,152		0,152		0.152		0,150	
R^2-adj	0,15		0,02		0,24		0,25		0,26		0,26		0,26	

Note: The dependent variable is the reemployment separation rate (i.e. separations above jobdestructions) for each plant for three education levels of workers (low-(>10 years), medium-(10-14 years), and high-(15+ years)). All parameter estimates are multiplied by 100The variance-covariance matrix is estimated by a robust estimator. Three digit ISIC indicators and regional dummies are included. T-values are given in provided next to parameter estimates for each column.

Table 4. Estimates of job destruction equations for three education categories for Norwegian manufacturing, 1987-94 using a matched employer-employee data set.

	Indirect effects													
Variables	**C1**		**C2**		**C3**		**C4**		**C5**		**C6**		**C7**	
Ed. Low	7,51	*22,4*			9,52	*19,3*	7,16	*8,93*	7,77	*10,2*	6,94	*7,52*	8.76	*11,9*
Ed. Med	7,01	*20,6*			9,40	*19,4*	7,89	*12,8*	8,41	*11,9*	6,69	*6,94*	8,82	*12,7*
Ed. High	5,53	*12,5*			0,61	*0,88*	-0,48	*0,51*	-0,16	*0,17*	4,86	*6,50*	6,10	*0,67*
Bus. cycle	-0,41	*8,71*	-0,30	*8,13*	-0,40	*8,67*	-0,40	*8,74*	-0,41	*8,70*	-0,40	*8,63*	-0,43	*8,63*
Ed.Med×Busc	0,16	*2,95*			0,16	*2,91*	0,16	*2,97*	0,16	*2,88*	0,16	*2,94*	0,14	*2,47*
Ed.High×Busc	0,33	*3,68*			0,33	*3,46*	0,35	*3,28*	0,34	*3,73*	0,34	*3,70*	0,31	*3,00*
Logplant size			-0,78	*4,47*	-0,57	*3,02*	-0,46	*2,41*	-0,43	*2,16*	-0,29	*2,01*	-1,70	*4,08*
Logfirm size			0,12	*0,82*	0,14	*0,81*	-0,59	*1,77*	-0,57	*3,19*	-0,10	*0,61*	0,60	*1,52*
Ed.med×psize					-0,75	*3,58*	-0,69	*3,48*	-0,72	*3,65*	-0,73	*3,75*	-0,18	*0,41*
Ed.high×psize					1,37	*4,36*	1,27	*4,15*	1,32	*4,04*	1,31	*4,08*	2,59	*3,50*
Ed.med×fsize					0,60	*3,52*	0,66	*3,78*	0,62	*3,56*	0,63	*3,63*	0,19	*0,45*
Ed.high×fsize					0,54	*2,01*	0,52	*2,12*	0,67	*2,36*	0,62	*2,21*	-0,59	*0,84*
Logwage							-0,60	*1,57*	-0,56	*1,44*	-0,57	*1,46*	-0,19	*0,49*
Tenure							-0,05	*1,38*	-0,06	*1,51*	-0,06	*1,40*	-0,07	*1,47*
Experience							0,12	*1,61*	0,11	*8,83*	0,11	*8,72*	0,09	*7,41*
Multiplant									-1,01	*4,66*				
Plantage									0,06	5,90				
K/L×10^{-4}											0,22	*5,24*		
Herfindahl													0,69	*1,63*
Competition													-2,34	*3,73*
Union density													1,44	*3,89*
Herfin×Union													-0,18	*0,22*
Root MSE	0,20		0,20		0,20		0,20		0,20		0,20		0,19	
R^2-adj	0,16		0,004		0,16		0,16		0,16		0,16		0,16	

Note: The dependent variable is the job destruction rates for each plant for three education levels of workers (low-(>10 years), medium-(10-14 years), and high-(15+ years)). All parameter estimates are multiplied by 100.The variance-covariance matrix is estimated by a robust estimator. Three digitISIC indicators and regional dummies are included. T-values are provided next to parameter estimates for each column.



a) Manufacturing. b) Banking and insurance.

Figure 1. Churning rates for low, medium and high educated in Norway, 1987-94.