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Worker turnover at the firm level and crowding out of lower educated workers*

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Abstract

This paper investigates whether employers exploit cyclical downturns to improve the average skill level of their work force. We use a unique dataset that contains information on workers, jobs as well as firm characteristics. Our findings are that at each job level mainly lower educated workers leave during downturns. Furthermore, at each level of job complexity, workers with a higher education are not more productive than lower educated workers. We find no evidence that higher educated workers crowd out lower educated workers during recessions.

Keywords: unemployment, wages, turnover, education, business cycle

JEL codes: J21, J23

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1 Introduction

Most European labor markets are characterized by high and relatively cyclical unemployment rates for lower educated workers. The recent literature has focused on the explanation of the relatively large number of low skilled unemployed, see e.g. Layard et al. (1991), OECD (1996), Nickell and Bell (1996). For the relatively large increase in the unemployment rate of lower educated workers in cyclical downturns (for evidence see e.g. Van Ours and Ridder, 1995), there are two major explanations in the literature. The best known is that firms invest more in job specific capital for higher educated workers. Higher educated workers will therefore be hoarded during recessions and lower educated workers will be laid off (see e.g. Oi (1968), Hamermesh (1993) and Gautier et al. (1999)).

The cyclicity of the unemployment rate of lower educated workers can also be explained by "crowding out", the process by which during recessions lower educated workers are replaced by higher educated workers. This explanation has been rather popular in the Netherlands (see e.g. Asselberghs et al. (1997) and Teulings and Koopmanschap (1989)).

The empirical evidence on cyclical crowding out is mixed. The strongest evidence comes from the relationship between the distribution of employees by education and job level and a measure of labor market tension. Teulings and Koopmanschap (1989) use for example regional differences in unemployment. They find that the relative change in the employment fraction of workers with a higher level of education in occupations for which only lower education is required is higher in regions with high unemployment. From this, they conclude that there is crowding out. Van Ours and Ridder (1995) use vacancy/unemployment (V/U) ratio's of different labor market segments to test for cyclical crowding out. A necessary condition for crowding out in their model is that an unemployed worker is better off searching at lower level jobs. Except for workers with an academic degree they find no evidence that the V/U ratio's are higher in lower labor market segments.

Contrary to those previous studies, we use a combined firm-worker dataset to directly test at the firm level whether the quality of the workforce increases during periods of high unemployment. The dataset that we use is based on administrative records and contains key variables for measuring crowding out like education and job complexity levels. In addition, we observe both new and separating workers.

If cyclical crowding out is important, firms require more schooling at given job complexity levels during bad times. We will therefore test whether the difference in years of schooling between the inflow and outflow of workers for a given job level in a particular firm, is larger during low employment years. Unlike some of the previous studies, which restricted crowding out to be an inflow phenomenon only, we allow crowding out to be the result of a combination of inflow and outflow policies at the firm level. Moreover, we can directly observe whether upgrading at

given job levels is associated with the outflow of relatively low educated workers or the inflow of relatively high educated workers.

An additional advantage of our data is that we have information on gross hourly wage rates that allow us to distinguish between substitution and pure crowding out. We test whether the returns to schooling are still positive when we condition on job complexity levels. Our findings suggest that the wage differential between new workers with relatively many years of schooling and their direct colleagues (in the same firm at the same job level) is close to zero.

The paper is organized as follows. In Section 2 we discuss the data we use and we present some descriptive statistics. Section 3 discusses the theory on crowding out in more detail and presents the formal model which is tested in section 4. Section 5 concludes.

2 Data and descriptive statistics

2.1 Data

For this paper we use the AVO (Arbeidsvoorwaarden Onderzoek) data set of the Department of Social Affairs and Employment which covers the period 1992-96. The data are collected by means of a two stage sampling procedure. In the first stage, a number of firms was drawn from the Ministry of Social Affairs own firm register, using a stratified (by industry and firm size) design¹. In the second stage, a sample of workers was drawn in October of the year of the survey.

The employee and job characteristics in the AVO-data are: gross wages, overtime payments, hours worked, profit shares, education, age, tenure, gender, occupation, type of contract, and job complexity (see also Venema (1997) for a detailed description). During the period we consider, the job complexity levels refer to the same types of jobs in each year so that we can meaningfully compare them over time. The six job complexity (f1-f6) and seven education (s1-s7) levels are:

f1 Very simple activities which do not change over time. No schooling is necessary and only limited experience. The activities are under direct supervision.

f2 Simple activities which are in general repetitive. Some (lower) administrative or technical knowledge and experience is required. In general the activities take place under direct supervision.

¹Since the 1993 sample contains no information on public sector workers, we excluded firms from this sector from the samples in other years as well. We refer to the appendix for a detailed description of the sampling design.

- f3** Less simple activities which are not repetitive. Administrative or technical knowledge is required and the activities are partly without direct supervision.
- f4** More difficult activities for which an intermediate level of education is required. In general the activities take place without direct supervision.
- f5** Activities within a certain field which require a higher level of knowledge and experience. The activities take place without direct supervision.
- f6** Managers of intermediate and large companies and activities of an analytical, creative or contactual nature, which are undertaken independently and require a university or comparable level.

The seven education levels are (in parentheses: total years required to complete): s1: primary (6), s2: junior general (10), s3: pre-vocational (10), s4: senior general (12), s5: senior vocational (14), s6: vocational colleges (15), s7: university (16).

Table 1 gives estimated population averages for some key variables.

2.2 Descriptive statistics

First, we show that 1993 and 1994 are bad years in terms of employment opportunities. The strong recovery of employment in the Netherlands started in 1995 and continued in the years thereafter. Table 2 shows that in 1993 and 1994 unemployment increased strongly. In 1995 and 1996 unemployment fell and many vacancies were created. Moreover, V/U ratios for almost all education groups, and in particular for those with only elementary school were lower in 1993 than in 1995 and 1996, see Gautier et al. (1998). This cyclical pattern is also present in the AVO data. Table 1 shows that the difference between the inflow and the outflow rates was substantially higher in 1995 and 1996 than in 1993 and 1994. In addition, the fraction of workers employed at shrinking firms was higher while the fraction of workers employed at growing firms was lower in 1993 and 1994 than in 1995 and 1996.

In Tables 3 and 4, we give information on the allocation of workers over jobs and of the education of workers based on four AVO surveys (93, 94, 95 and 96).

To get some idea about the empirical relevance of crowding out in the mid 1990's we first test whether a larger fraction of simple jobs was occupied by higher educated workers in the low employment year 1993. The results of this simple test are shown in Table 5 which indicates that relatively fewer workers with an intermediate and higher education were employed at a simple job (level f1/f2) in the low employment years 1993 and 1994 than in 1995 and 1996.

In the high employment years, the average education level in simple jobs seems to be somewhat higher. Under crowding out, we would expect the opposite.

In the next section we discuss the theory on crowding out in more detail and in addition present a formal test for the presence of crowding out.

3 Theoretical background and a necessary condition for crowding out

3.1 Theoretical background

One of the first models that allows for cyclical crowding out is Okun (1981) who suggests that in bad times it is costly to adjust wages so firms increase their hiring standards instead. A different reason for cyclical crowding out is given by standard job search theory. When it takes time for workers and vacancies to find each other, a possible strategy for higher educated workers is to temporarily accept a simple job and to continue searching for a more complex job that pays a higher wage. Depending on the response of firms this could (but not necessarily so) lead to crowding out, see e.g. Albrecht and Vroman (1999) and Gautier (1999). However, there are also reasons to believe that cyclical crowding out is an unlikely outcome. McCormick (1990) shows for example that skilled workers may be reluctant to accept unskilled jobs even on a temporary basis because of fear of stigmatization. Therefore, unemployed higher educated workers tend to invest in job search, rather than take an interim simple job.

Most studies on crowding out focus on inflows. We believe that it is relevant to also consider outflows. If during a recession more highly educated workers enter simple jobs but at the same time an equal number of them flows out, the position of the lower educated workers does, all else equal, not change. In order to establish a link with the existing literature and to learn more about the in- and outflow policies at the firm level with respect to education, we study inflow and outflow separately and in addition we investigate how average education at given job levels changes over the cycle.

Additional years of education at a given job level may serve as a substitute for a lack of other skills. If that is the case, workers with relatively many years of schooling do not earn more than their direct colleagues in the same firms at the same job level. In Section 4.2 we investigate whether this is the case.

As stated in the introduction, we operationalize this by testing the following hypothesis: A necessary condition for cyclical crowding out to take place is that the fraction of higher educated workers at simple jobs increases during bad times. In addition, we would like to know to what extent extra years of education at a given job level may serve as a substitute for a lack of other skills. If that is the case, we expect that workers with relatively many years of schooling do not earn more than their direct colleagues in the same firm at the same job level.

3.2 Testing for crowding out

Let y_{jkt}^{in} be the average number of years of education among the *inflow* at firm j into job complexity level k in year t and let y_{jkt}^{out} be the average number of years

of education at firm j among the *outflow* from job complexity level k in year t .² We assume that the amount of schooling for both inflow and outflow at each job complexity level depends on observable firm characteristics, x_{jt} , fixed firm effects α_j , fixed job effects which are allowed to differ for the in- and outflow, α_k^{in} and α_k^{out} , and macro-economic conditions, which are captured by D_t which equals 1 in the downturn years 1993 and 1994 and 0 in the upswing years 1995 and 1996. Finally, we correct for the fact that the average education of the population increases over time. If we do not correct for this we might underestimate the importance of crowding out, because an upward trend in the average level of education implies that the average level of education for the inflow in 1993 and 1994 (the low employment years) will be lower than in 1995 and 1996. We control for this effect by including average education ($AVED_t$) as an additional explanatory variable.

$$y_{jkt}^{in} = \alpha_j + \alpha_k^{in} + \beta_k^{in} x_{jt} + \gamma_k^{in} D_t + \omega_k^{in} AVED_t + \varepsilon_{jkt}^{in} \quad (1)$$

$$y_{jkt}^{out} = \alpha_j + \alpha_k^{out} + \beta_k^{out} x_{jt} + \gamma_k^{out} D_t + \omega_k^{out} AVED_t + \varepsilon_{jkt}^{out} \quad (2)$$

where β_k^{in} and β_k^{out} are parameters that capture the firm effects, γ_k^{in} and γ_k^{out} are parameters that capture the effect of a downturn, ω_k^{in} and ω_k^{out} are parameters capturing the trend in average education measured over the entire population, and ε_{jkt}^{in} and ε_{jkt}^{out} are i.i.d. error terms which are allowed to be correlated within a given job complexity level and firm.

If firms increase education standards for certain jobs, we expect that during downturns, the difference between the years of education for the inflow and the outflow at given job complexity levels, is higher than in a boom. Thus, if we take the difference between (1) and (2), the effect of the downturn dummy, D_t , on $(y_{jkt}^{in} - y_{jkt}^{out})$ gives us information on potential upgrading behavior of firms.

The key equation that we estimate to test whether the necessary condition that employers increase education standards for given job levels during cyclical downturns is satisfied is:

$$(y_{jkt}^{in} - y_{jkt}^{out}) = \alpha_k + \beta_k x_{jt} + \gamma_k D_t + \omega_k AVED_t + \varepsilon_{jkt} \quad (3)$$

where $\alpha_k = (\alpha_k^{in} - \alpha_k^{out})$, $\beta_k = (\beta_k^{in} - \beta_k^{out})$, $\gamma_k = (\gamma_k^{in} - \gamma_k^{out})$, $\omega_k = (\omega_k^{in} - \omega_k^{out})$ and ε_{jkt} is again an i.i.d. error term. Because we take the difference between the inflow and the outflow, firm-specific effects that are the same for in- and outflow are eliminated. Obviously, γ_k is our parameter of interest. It is likely that the decision which type of worker is fired at a given job level depends for a large extent on firm specific factors. For this reason we allow γ_k to vary across firms, and we interpret γ_k as the average effect of a downturn. If we think of γ_k as a random parameter the disturbance in (3) is heteroskedastic. We take account of this in our estimation procedure.

²We excluded retirements from the outflow. Including retirements does not alter our conclusions.

4 Estimation results

4.1 Flows

The estimation results for γ_k in (3) are shown in Table 6.

First, note that the mean of $(y_{jkt}^{in} - y_{jkt}^{out})$ is positive for all job complexity levels, which implies that the average education rose at all levels. It is therefore important to control for the increasing trend in the average level of education. For most job complexity levels, the effect of γ_k on $(y_{jkt}^{in} - y_{jkt}^{out})$ is zero or even negative (relative to the boom years 1995 and 1996). Only for job complexity level 4 it is significantly positive with a coefficient estimate of 0.36.

It is also interesting to see how the inflow and outflow equations behave separately and whether turnover is higher among lower educated workers. This also allows us to get information on potential sample selection effects due to the fact that we only use firms for which both in- and outflow are observed to be positive. Consider the following equations:

$$\begin{aligned} y_{jkt}^{in} &= \alpha_k^{in} + \beta_k^{in} x_{jt} + \phi_k^{in} n_{jkt}^{out} + \gamma_k^{in} D_t + \xi_k^{in} D_t n_{jkt}^{out} + \omega_k AVE D_t + \varepsilon_{jkt}^{in} \quad (4) \\ y_{jkt}^{out} &= \alpha_k^{out} + \beta_k^{out} x_{jt} + \phi_k^{out} n_{jkt}^{in} + \gamma_k^{out} D_t + \xi_k^{out} D_t n_{jkt}^{in} + \omega_k AVE D_t + \varepsilon_{jkt}^{out} \quad (5) \end{aligned}$$

where n_{jkt}^{in} and n_{jkt}^{out} take the value 1 when respectively inflow and outflow are positive and zero otherwise. An F-test on the joint significance of ϕ_k^{in} and ξ_k^{in} and of ϕ_k^{out} and ξ_k^{out} is informative on potential different behavior of the firms for which both in- and outflow are positive. We find that for job complexity levels 1,3 and 4 we cannot reject that ϕ_k^{in} and ξ_k^{in} are zero. Including $\phi_k^{in} D_t n_{jkt}^{out}$ and $\xi_k^{in} D_t n_{jkt}^{out}$ in the inflow equation leads to a somewhat smaller effect of the 1993 dummy. For the outflow equation, we have to reject the null hypothesis that ϕ_k^{out} and ξ_k^{out} are zero for job complexity levels 3 and 6. Finally, we re-estimate equations (1) and (2) with the two-stage Heckman (1979) method.³ We find that the coefficient estimates of the selectivity terms are insignificant for all job levels of the outflow equations and only significantly positive for the inflow equations of job complexity levels 2, 4 and 5. So we cannot completely rule out that some of our estimates of the previous section are biased because of sample selection. However, according to Table 6, the coefficient estimates of the downturn dummy hardly change.

To sum up, the separate estimates for inflow and outflow show that in the low employment years, the average education of the inflow did not increase but

³In the first step a probit was estimated to determine whether the firm actually had respectively positive inflows and outflows. Since we have no variables which do influence the selectivity process but not the main equation, identification is based on the assumption that the error terms are distributed normally. In the accompanying working paper Gautier et al. (1998) we therefore also compare the hiring and firing behavior of firms over a number of sub samples to learn more about selectivity and to check to what extent the firms for which we observe that inflow and outflow are positive at a given job complexity level behave differently from firms for which either the inflow or the outflow is zero.

that the average education level of the outflow level did decrease significantly. This suggests that if any form of upgrading takes place in periods of high unemployment, it is the result of the outflow of workers with a relatively low level of education.

4.2 Do higher educated workers earn more at simple jobs than lower educated workers?

Next, we test whether at a given job complexity level there is a positive relation between wages and years of education. In other words, we test whether, conditioning on job complexity levels, the returns to schooling are still positive. If this is the case, it is likely that workers with more schooling are also more productive on those jobs.⁴ It is then also more appropriate to talk about substitution than about crowding out.

In the literature, workers who have more education than required for a certain occupation are sometimes labeled to be overschooled. We prefer to avoid this term because, although it is possible to measure required schooling, it is very hard to determine whether someone is overschooled or not. This is due to the fact that the productivity of a job depends on worker as well as firm and match characteristics.

Contrary to previous studies, our data allow us to estimate a wage equation including fixed match specific effects. This enables us to check whether higher educated workers are more productive than their direct colleagues with a lower education at the same level of job complexity in the same firm. We estimate the following equation:

$$w_{ijkt} = \alpha_{jkt} + \beta_k s_i + \gamma_k x_{ijkt} + \nu_{ijkt} \quad (6)$$

where w_{ijkt} is the gross hourly wage of worker i who is employed at firm j and job complexity k , α_{jkt} is a fixed job-complexity-firm effect, x_{ijkt} contains both firm and worker characteristics and calendar time, s_i is completed education of worker i (measured in years), and ν_{ijkt} is the error term.⁵ We restrict our analysis to the inflow of new workers in period t because only then we are sure to capture the firm's wage policy during period t . In this way we avoid potential biases because of the endogeneity of tenure.⁶ Also note that we now use the individual as unit

⁴Here, we interpret productivity in a broad sense, i.e. net of training costs etcetera.

⁵We include: industry, occupation, size, growing/shrinking firm, type of wage contract (collective, sector binded, bilateral) full/part time, sex and calendar time dummies, and age². Note that those firm characteristics are orthogonal with respect to the transformed regressors. Hence, including them in the fixed effects instead of estimating them separately does not change the education coefficient (which is the only coefficient we are interested in here).

⁶This is also the reason why for each job complexity level the mean of z_{ijk} is negative.

of observation and that we have to weigh accordingly.⁷

From Table 7 we see that new workers with relatively many years of schooling earned almost the same as the other workers at simple jobs, although the coefficient for job complexity level 2 is significantly negative and for job complexity level 3 significantly positive. This result is in contrast with the literature on "overschooling". Duncan and Hoffman (1981), Rumberger (1987), Hersch (1991), Hartog and Oosterbeek (1985) and other studies surveyed in Hartog (1998) all find that the rewards to surplus schooling are positive. None of these studies corrected however for fixed match effects.

To get a better idea of the differences between our results and those found in the literature on overschooling, we estimated the education effect without correcting for fixed firm effects but still including fixed job complexity effects. The coefficient estimates with s.e.'s of the schooling variable are presented in the last two rows of Table 7. Except for job level 1, the estimates for the effects of schooling on gross hourly wages turn out to be highly significant and positive in this case. This suggests that workers with relatively many years of schooling tend to select themselves into high wage firms and that the results of the "overschooling" literature are mainly driven by selectivity effects.⁸ A possible interpretation of our results is that for workers with relatively many years of schooling, their education compensates for a lack of other skills.

5 Conclusion

Crowding out is the process where in recessions lower educated workers at simple jobs are replaced by higher educated workers. Crowding out as explanation for the high and cyclical unemployment rate of lower educated workers has become increasingly popular in the Netherlands and recently also in Belgium, France, Spain and the U.K.. We show that the idea of crowding out is not supported by the facts. Only for one of the intermediate job complexity levels we find that firms upgraded their work force in low employment years. For the other five job complexity levels we find no evidence for upgrading during recession years. We also find no evidence that the average education of the inflow increased during recession years but we do find that, in particular during low employment periods, workers with relatively few years of education leave at a higher rate than workers with more years of education.

New workers with a relatively high education earn about the same as their colleagues at the same job level at the same firm in the same year. For job complexity level 3 (which contains by far the most workers), we find that workers

⁷WLS was necessary because more than 300 strata were used in the sample and we therefore could not include all cross products of firm and size classes on the right hand side of the equations. Weighted and unweighted regressions gave similar results.

⁸See Hartog (1998) for a discussion of other measurement problems related to overschooling.

with relatively many years of schooling earn slightly (but statistically significant) more than their direct colleagues at the same job level in the same firm while at job complexity level 2, workers with relatively many years of schooling earn slightly less (but statistically significant) than their direct colleagues. The general evidence is thus that at a given level of job complexity workers with relatively many years of schooling are not more productive than their direct colleagues. The difference between our results and the results in the literature on "surplus schooling" is driven by the fact that we take account of match specific effects. It turns out that workers with relatively many years of schooling (compared to other workers at the same job level) select themselves into high wage firms.

Our main conclusion is that the evidence for crowding out is very thin. As far as it takes place, it is more outflow driven than inflow driven. If crowding out were an important cause of the high unemployment rate of lower educated workers, policy makers should stimulate job creation at the top segments of the labor market to encourage higher educated workers to leave simple jobs. Our results suggest however that it is more likely that lower educated workers became unemployed because their jobs have become less productive. Policies to reduce unemployment of lower educated workers should therefore focus directly on the lower segment of the labor market. One can think of decreasing the costs of creating lower educated jobs by means of tax incentives, stimulate the training of lower educated workers, or lowering the replacement rate for low skilled workers.

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Appendices

A AVO data

A.1 Sampling design

The AVO data are collected by the Dutch "Labor inspection" which is part of the Ministry of Social Affairs and Employment and contains administrative data from workers employed in both the private and the public sector. The data were collected by means of a two stage sampling procedure. In the first stage, a number of firms was drawn from the Ministry of Social Affairs and Employment own firm register which is roughly similar to the firm register of the CBS (Statistics Netherlands), using a stratified (by industry and firm size) design.⁹ The number of strata changed between surveys. In 1993, the sample consisted of 1682 firms which were drawn from 80 strata, in 1994 of 1563 firms from 280 strata, in 1995 of 1375 firms from 312 strata, and in 1996 of 1548 firms from 328 strata.

At the second stage, a sample of workers was drawn in October of the year of the survey. In the sequel, the year in which the sample is drawn is denoted by t . For the workers in the sample, information was collected from the wage administration of the firm, both for years t and $t-1$ (if they were employed at the firm in both years; the information for year $t-1$ is also for October). In addition, the number of workers who left the firm between October of year $t-1$ and October of year t was registered. To obtain information on workers who left the firm, a random sample was drawn from these employees. In addition to the information that was collected for all sampled employees, the new labor market position was registered for the employees who left the firm. The sample size was increased if certain conditions were not met.¹⁰ For our analysis we only used workers who were employed in the private sector.

⁹Firms from the service sector and semi-public sectors were included in all samples. Since the 1993 sample contained no information on public sector workers, we excluded this sector from the other samples as well.

¹⁰At least 10 employees had to be covered by a collective bargaining agreement and 10 not; the minimal number of employees present in October of year t and $t-1$, the number of workers hired in this period and the number of workers who separated in this period had to be at least 8. If one of these conditions was not satisfied the sample size was increased.

The two-stage sampling design is rather complex. At the firm level it results in random samples from the employees present in October of year t and the workers hired¹¹ since October of the previous year.¹² If needed, sampling weights that are obtained by multiplying the inverse of the probability that the firm of the employee is in the sample and the inverse of the probability that the employee is selected from all the employees of this firm, are used to obtain sample statistics that refer to either the population of employees present in years t and $t-1$, the inflow, or the outflow. For firm variables, the sampling weight is equal to the inverse probability that the firm is in the sample.

Some wage related variables and *hours worked* are available for October of year t and year $t-1$. Job characteristics, as the complexity of the job, were only registered in year $t-1$ for separating workers and in t for the other workers. This precludes the study of promotion within the firm. The data also contain information on various separation routes like lay-offs, transitions into other jobs, disability inflow, and early and normal retirement. This information comes from administrative records of firms, and that it is therefore limited by the scope of the firm's administration.

The complex sample design results in a large variation in the sampling probabilities and, as a consequence, in the corresponding sampling weights. This may magnify (small) biases in the firm register from which the sample was drawn. Indeed, a comparison of estimated population averages for some worker and firm variables obtained using these weights and the estimated population averages for the same variables obtained from the Dutch labor force survey (EBB) reveals substantial differences (Gautier (1998)). Almost all differences are eliminated if we remove employees with sampling weights that are larger than 500 (about 5% of the sample in each year). These workers are employed in small firms in industries with relatively few firms.¹³ We do want to stress however that our estimations in section 4 are conditional on the job complexity level so that our results are not biased by oversampling of certain job complexity levels. Another disadvantage of this data set is that it does not contain any information on value added, output, profits, capital and investment. The main reason for this is that the data were designed to study wage growth and therefore only information from the wage administration of firms was obtained.

A.2 Description of variables

¹¹However, we do not know the number nor the characteristics of employees who were hired after October of year $t-1$, but left the firm before October of year t .

¹²To be precise: because of the additional requirements, the design results in random samples from subgroups of workers distinguished by presence in October of year t or $t-1$, or both and covered by collective bargaining (or not).

¹³An alternative would be to include a full set of industry and firm size dummies in the regression equations. Because of the small number of firms (and workers) in the omitted strata, this gives the same result as omitting the observations in these strata.

outflow

Workers not older than 60 years who left a firm because of disability, their temporary contract ended, layoff, displacement, they reported to have found a new job or they were initially hired from a temporary employment office. We do not observe movements between jobs within firms.

inflow

Workers who enter a new firm. Again, we do not observe within firm labour flows.

tenure:

Measured in years (difference between starting and sampling date).

wage

Monthly wages (including extra time payments, profits shares etc.) and hours worked are measured very accurately. We calculated nominal gross hourly wages for each worker and deflated the wage by the consumer price index to obtain real wages.

wage agreement

We distinguish 3 types of wage contracts. Most workers have a collective wage agreement (CAO) which is bargained over at the sectoral level. The minister of social affairs has the right to force all firms within a sector to pay the same collectively bargained wage (AVV) and finally there are workers who have a bilateral bargained wage contract. Those workers are in general employed at higher positions..

part-time /full-time

Part-time refers to working less than 100% of the regular number of hours

occupation

We have information on the following occupations : (1) simple technical activities, (2) administrative, (3) computer, (4) commercial, (5) service orientated, (6) creative. (7) management.

sector

Although the AVO data contain information on the public sector we restricted our analysis to the private sector. We distinguish 12 sectors. (1) agriculture and fishing, (2) food, (3) chemical, (4) metal, (5) other industry, (6) construction, (7) trade, (8) hotels, restaurants catering, (9) transport, communication, (10) banking and insurance, (11) other services, (12) health care

firm size

We have used the following size classes. (1) 1-9 , (2) 10-19, (3) 20-49 (4), 50-99, (5)100-199, (6) 200-499, (7) ≥ 500 employees.

B Tables

Table 1: AVO data: means 1993–96

variable	93	94	95	96
workers employed at shrinking firm (%)	30.6	30.4	24.6	26.5
workers employed at growing firm (%)	33.2	39.0	44.8	41.6
male (%)	62.9	64.4	62.3	64.0
inflow (% of total employment)	11.8	10.8	13.4	13.8
outflow (% of total employment)	11.0	8.7	9.6	10.0
collective wage agreement (CAO, AVV) (%)	74.1	78.7	77.0	76.4
age (years)	35.8	35.9	36.0	36.0
completed education (years)	11.2	11.1	11.3	11.5
real gross hourly wage (Dutch guilders)	25.9	24.1	26.7	27.2
tenure (years)	7.5	8.0	7.5	7.8
firm size (1-19 employees)	87.8	79.7	80.8	81.0
firm size (20-49 employees)	7.1	12.5	11.4	11.1
firm size (50-99 employees)	2.2	4.3	4.4	3.3
firm size (100-199 employees)	1.1	1.9	1.7	1.6
firm size (200-499 employees)	0.8	1.1	1.0	1.1
firms (>500 employees)	0.3	0.4	0.5	0.7
# workers	24053	31250	26059	36380
# firms	1682	1563	1375	1548

Note: Individual records are weighted by individual*firm weights, firm records are weighted by firm weights

Table 2: Labor market conditions: 1993-96

Indicator	93	94	95	96
unemployment change (%)	22.7	15.4	-6.7	-6.6
employment change (man year, %)	-0.5	-0.3	2.1	1.7
new registered vacancies (x1000)	383	438	526	571
filled registered vacancies (x1000)	396	428	508	561
employment (x1000)	5754	5778	5897	6016

Note: Source Statistics Netherlands.

Table 3: Allocation of workers over job complexity levels (in %)

sample	f1	f2	f3	f4	f5	f6
93	2.8	15.7	46.3	20.8	10.0	4.3
94	5.0	16.3	46.9	20.7	8.4	2.7
95	5.2	14.1	47.3	21.2	9.0	3.1
96	3.5	10.9	47.1	23.9	11.7	2.9

Note: date refers to calendar time. The figures represent (fractions of) stocks of workers. Differences between samples are partly due to the fact that we do not observe promotions within firms.

Table 4: Allocation of workers over education classes (in %)

sample	s1	s2	s3	s4	s5	s6	s7
93	7.4	13.3	39.9	8.7	18.6	9.5	2.7
94	6.8	12.8	42.2	7.4	19.3	9.1	2.5
95	7.9	13.6	36.9	8.0	19.9	10.5	3.3
96	6.0	14.5	34.4	8.9	20.4	12.4	3.4

Note: The figures represent (fractions of) stocks of workers.

Table 5: Allocation of workers over jobs 1993-96 (in %)

job level	f1,f2				f3,f4				f5,f6			
education	93	94	95	96	93	94	95	96	93	94	95	96
s1-s3	93.1	92.7	91.8	90.1	63.0	61.5	58.7	58.4	6.5	4.8	3.4	3.5
s4, s5	6.5	6.9	7.2	8.9	32.8	33.1	34.9	34.8	28.4	25.7	21.3	22.9
s6, s7	0.4	0.4	1.0	1.0	4.2	5.5	6.4	6.8	65.1	69.5	75.3	73.7

Table 6: Coefficient estimates of the "downturn" dummy for different job complexity levels .

job complexity level	f1	f2	f3	f4	f5	f6
N (in- and outflow)	218	928	1931	810	349	113
$y_{jk}^{in} - y_{jk}^{out}$ mean	0.18	0.25	0.32	0.52	0.31	0.24
equation (3), γ_k	0.55	0.02	0.10	0.36	0.03	-0.19
s.e.	0.37	0.03	0.09	0.18	0.23	0.26
N (inflow)	478	1765	2935	1448	757	297
y_{jk}^{in} mean	9.05	9.83	10.97	13.41	14.84	15.60
equation (4), γ_k	-0.29	-0.15	0.12	-0.25	-0.12	-0.31
s.e.	0.64	0.15	0.08	0.15	0.11	0.16
2 step selection (in), γ_k	-0.33	-0.12	0.10	-0.29	-0.10	-0.31
s.e.	0.32	0.14	0.10	0.15	0.11	0.17
N (outflow)	357	1432	2705	1405	721	299
y_{jk}^{out} mean	8.44	9.46	10.47	12.96	14.38	15.22
equation (5), γ_k	-1.21	0.00	-0.28	-0.63	-0.39	-0.66
s.e.	0.38	0.20	0.09	0.16	0.19	0.20
2 step selection (out), γ_k	-1.20	-0.00	-0.28	-0.64	-0.36	-0.66
s.e.	0.38	0.10	0.09	0.16	0.19	0.21

Note: estimates for the inflow are WLS while for outflow weighted ML is used. In the outflow equations, the downturn dummy is estimated as a random coefficient whereas in the inflow equation it is estimated as a fixed coefficient (see the discussion in the text). Coefficients which are significant at the 95 % level are printed in bold. Average schooling, sector and firm size dummies are included.

Table 7: Effects of education on wages from a fixed effect WLS regression

job complexity level	f1	f2	f3	f4	f5	f6	all
N	1061	3663	7283	2734	1243	375	16359
R²	0.33	0.33	0.34	0.20	0.26	0.24	0.19
Education (years)	-0.00	-0.006	0.005	0.00	0.00	-0.09	0.00
s.e.	0.005	0.002	0.002	0.004	0.01	0.06	0.001
Education (years, no firm effects)	0.004	0.007	0.014	0.011	0.012	0.09	0.05
s.e.	0.004	0.002	0.002	0.003	0.009	0.032	0.001

Note: Estimates are based on inflow only. The last row refers to estimates without fixed firm effects. Coefficient estimates which are significant on the 95 % level are printed in bold. The F statistic for the hypothesis that $\beta_1 = \beta_2 = \dots = \beta_6 = 0$, is equal to 3.25.