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Do more high skilled workers occupy simple jobs during bad times?

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1 Introduction

In this paper the time variance of employment is used to test whether more high skilled workers accept simple jobs during recessions. Or more formally, whether the mass of the job complexity distribution at the lower job levels increases after an exogenous shock which reduces the total supply of jobs. If crowding out is a temporary phenomenon, only the new workers will flow in below their skill level. Therefore the analysis will also be done for this group separately.

Some researchers have mistakenly concluded from the fact that some workers with a higher education occupy simple jobs, that crowding out is the main reason for the high unemployment rates of low skilled workers. Schooling is however an imperfect measure of true productivity. An academic degree is no guarantee for higher marginal productivity and little formal schooling does not imply that one lacks skills which are highly valued in the labour market. Moreover, we should realize that job complexity levels change over time, and that schooling can serve as a compensation for a lack of other skills.

A conventional wisdom is that when there is crowding out, there is no need for extra education since well trained workers would occupy simple jobs anyway. This view is also typically based on a static and mechanical view of the labour market. If crowding out is for example the result of search frictions, better schooling will lead to the opening of more complex vacancies and also to more contacts and lower overall unemployment. A final reason to worry about crowding out is that the burden of unemployment is concentrated amongst a particular group of low skilled workers, which can lead to all sorts of social problems. It is therefore important to not only look at changes in the fraction of skilled workers at simple jobs but to also pay attention to the total stock of simple jobs. When the relative amount of skilled workers at simple jobs increases, but at the same time more low skilled workers (in absolute terms) find a job, the position of low skilled workers has still improved. In other words, when there are no victims it does not make much sense to talk about crowding out.

From a welfare point of view, crowding out can never be a first best solution since potential productivity is not used. In the Netherlands it is therefore often argued that the government should follow a "choking chimney policy". The idea behind such a policy is that when the government stimulates the creation of jobs at the top segment, workers with surplus skills on simple jobs will leave those jobs and the unemployed low skilled workers can fill up the vacancies they leave behind. In this paper it is argued that such

a policy is not a good idea. First of all, it is unclear why there would be too few complex jobs in equilibrium and secondly, I find little empirical evidence for crowding out.

The first goal of this paper is to build a framework in which crowding out at the aggregate level is an equilibrium outcome and the result of optimizing behavior of individual firms and workers at the micro level. I will assume that it takes some time before job searchers and firms with vacancies find each other. Crowding out results when unemployed high skilled workers temporary accept simple jobs. As long as the wages on those jobs are higher than the income when unemployed, they will accept those jobs because they can continue searching for complex vacancies anyway. In this respect, crowding out is a temporary phenomenon. The main role of the employers in this model is that they have to decide how many vacancies to open. The equilibrium stock of vacancies will depend on the relevant amount of employed and unemployed job searchers and on the profitability of complex and simple jobs. Thus the model has the long run property that both the supply and composition of jobs adjust to the supply and composition of workers. The model also allows for a different explanation of the relatively high unemployment rate for low skilled workers. This explanation is based on differences in adjustment costs. When the profitability of simple jobs becomes lower than for complex jobs (e.g. because of skill biased technological change), unemployment rates for low skilled workers will be higher than for high skilled workers (because relatively more low skilled workers occupy those simple jobs). This process can take place without crowding out (i.e. more high skilled workers occupying simple jobs).

The second goal of this paper is to test for the empirical relevance of crowding out in the Netherlands in the mid 90's. To avoid most of the pitfalls I discussed before, I will compare differences of the job complexity distributions over the cycle for workers within given education classes. The advantage of this method over simple cross tables at a point in time is that our model is not sensitive for the fact that education is an imperfect measure for true ability (as long as unmeasured ability is constant over time).

The paper is organized as follows. Section 2 starts with an equilibrium search model which allows for crowding out. Section 3 describes our data and in section 4 I will test for the empirical relevance of crowding out in the Netherlands. Finally, section 5 concludes.

2 Theory

One reason for the popularity of crowding out is that the labour market is often treated as a closed system. If this would be true, crowding out becomes a very plausible story. When there is a fixed amount of jobs and an excess supply of labour it is likely that high skilled workers who cannot find a job which matches their capabilities will accept jobs below their level at the cost of workers with intermediate skills, who will on their turn accept low skilled jobs. Finally, at the end of the line there are the low skilled workers who become unemployed.

Fortunately, the labour market is not a closed system. The supply and composition of jobs will of course adjust after some time to the supply and composition of the labour force! That is why there are more jobs in the US than in the Netherlands, why there are more skilled jobs in Korea than in Bangladesh and why most countries with a good education system have more complex jobs in 1997 than in 1957. Still, there are more sophisticated explanations for crowding out to take place. One is that for some reason the supply of jobs does not immediately adjust to the composition of the labour force, because of for example credit or information constraints, and that therefore too little jobs are created. In that case it could happen that some workers find jobs which match their capabilities and others are forced to accept jobs below their skill level. In addition, it is sometimes argued that when employers pay efficiency wages in the complex sector, some high skilled workers will become unemployed and could decide to search for simple jobs. It is however a priori not clear why this would result in higher unemployment rates for low skilled workers. An additional requirement is that the simple job sector should not clear neither. Another reason for crowding out could be that the probability of a bad simple job match is higher for low skilled workers and that employers therefore statistically discriminate this group.[1] An additional requirement would then still be that the simple job segment of the labour market does not clear. In this paper I will focus on search frictions as the reason for crowding out. When it takes time for workers and vacancies to find each other, a possible strategy for high skilled workers is to temporary accept a simple job and continue searching for a complex job which pays a higher wage. The advantage of this approach is that it is relatively easy to allow for on the job search of the skilled workers who occupy simple jobs. Moreover, there are hardly any other models which allow for an analysis which includes labour market flows. The model implies that the process of crowding out is temporary and driven by either variation in the supply of high skilled workers or shocks in the relative

[1] See for example Aigner and Cain (1977) for an exposure on statistical discrimination.

profitability of high skilled jobs.[2] How important temporary crowding out is remains an empirical question, which I will also try to answer in section 3.

2.1 A simple framework to analyze crowding out

One of the first models of job competition and crowding out was developed by Thurow (1975, 1979). In this model, the labour market is not a market of matching demand and supply for various job skills but one of matching trainable individuals with training ladders. Moreover, the marginal product is associated with jobs rather than with workers. Employers prefer skilled workers (who require fewer training costs to reach a certain level of output) in this model. Consequently, the best jobs will go to the best workers and the worst jobs will go to the worst workers. In this respect, the model does not differ from traditional neo-classical models of the labour market. Thurow also assumes that wages are fixed. In bad times workers at the back of job queues who have the highest training costs will therefore not get a job offer. When the supply of skilled workers increases, the skilled workers will accept more simple jobs and the unskilled workers at the back of the queue remain unemployed. Since this is a partial equilibrium model, the composition of vacancies does not adjust to compositional changes in the labour force. This is a severe shortcoming of the model.

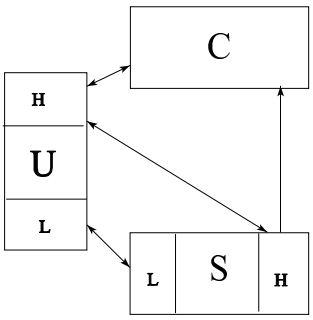
In this section, an alternative model of crowding out will be presented. In this model, search frictions in the labour market prevent the supply of jobs to adjust instantaneously to the supply of workers. Crowding out in this model is an equilibrium phenomenon and occurs when high skilled workers temporary accept simple jobs. In earlier economies, complex tasks could be performed by either a high skilled worker or sufficiently many low skilled workers. Currently, it seems more appropriate to assume that certain complex tasks can only be performed by high skilled workers. In particular if we think about: flying an airplane, teaching students, managing a company, brain surgery, or computer programming. For all those activities there is a minimum amount of skills necessary to perform those tasks and more labour input can simply not compensate for a lack of skills.[3]

[2] For a comparison of the efficiency wage and the search model with and without crowding out, see Gautier and Pomp (1998).

[3] Other models like Pissarides (1994) and the simulation model of den Butter and Gorter (1998)assume that jobs are heterogeneous but workers are not.

Therefore, in our model, complex vacancies can only be filled by high skilled workers while simple job vacancies can be filled by both high and low skilled workers. Since workers will take any position that improves their current state, unemployed high skilled workers also search for simple jobs and high skilled workers employed in the simple sector continue searching for complex jobs. Sometimes it is argued that high skilled workers will not accept simple jobs because of a negative signalling effect, see McCormick (1990). I abstract from that here[4]. Workers and vacancies meet according to a crs matching function which is increasing in the relevant amount of searchers and vacancies. All of this is captured in figure 1. The pools of unemployment (*U*) and simple employment (*S*) consist of two types of workers, high skilled (*H*) and low skilled (*L*). The pool of complex jobs (*C*) contains only high skilled workers. The arrows give the possible flows between the different states.

Figure 1 Labour market flows



Assume furthermore that complex jobs produce output y_c while simple jobs occupied by a low skilled worker produce output $y_{sl}=\psi y_c$, where $0<\psi<1$ and simple jobs occupied by a high skilled worker produce output $y_{sh}=\mu y_{sl}$, $0<\mu<1/\psi$ Thus, the output at complex jobs is job specific and always higher than the output at simple jobs while high skilled workers either produce more or less on simple jobs than low skilled workers. A priori

[4] McCormick assumed that unemployed high skilled workers have a higher probability to find a complex job because they have more time to devote to search. Therefore the best workers will decide to remain unemployed rather than accept a simple job. Workers with lesser skills have however also incentives to not accept simple jobs because accepting a simple job gives a bad signal. In my model, I assume that employed workers search exactly as effective as unemployed workers. Therefore there are no incentives for this type of signalling. Of course arguments can be given for more efficient search by either unemployed workers (more time) or employed workers (better network) but the evidence is on this issue is still inconclusive. Moreover, one could also imagine that the temporary acceptance of a job below one's level signals a strong motivation to work.

we have no reasons to set μ either greater or smaller than 1. Arguments can be given for both cases. One can on the one hand imagine that high skilled workers perform not better or even worse than low skilled workers on simple repeating activities. University professors do not have an absolute advantage at hamburger flipping over low skilled workers. On the other hand, there are simple occupations where a higher education can increase one's productivity. Think about a waiter who speaks many languages or a nurse with a lot of medical knowledge. I will return to this issue later. In this version of the model I will not explicitly model the wage process. I will just assume that wages support efficient mobility. With this I mean that the quasi rents of complex jobs are higher than of simple jobs and the quasi rents of a simple job are higher than the quasi rents associated with the state of unemployment.[5] Furthermore assume that unemployed high skilled workers and high skilled workers employed at a simple job search equally efficient.

When workers know on forehand whether a vacancy requires a high or a low skilled worker, the rate at which simple jobs and unemployed workers meet is:

$$x_s = x_s\left[v_s^{+}\left(y_s^{+},\mu^{+},(u_h+u_l)^{+},(u_h/u_l)^{\pm}\right),\left(u_h+u_l\right)^{+}\right] \qquad \textbf{(1)}$$

Where x_s is a crs matching function, increasing in both its arguments and concave, v_s is the simple vacancy rate and u_l represents low skilled unemployment. The equilibrium supply of simple vacancies is on its turn increasing in output, the productivity of high skilled workers on simple jobs, the amount of relevant searchers (which influences the rate at which a vacancy is filled up), and on the ratio of high and low skilled workers, which is less obvious but I will return to that issue later. The intuition behind this is that the asset value of a simple job is likely to differ with the worker type (high and low skilled) who occupies the job because both worker types have different productivities and quit probabilities. At the moment the firm opens the vacancy, it does not know which type of worker will arrive at the vacancy first so it has to form expectations based on the aggregate ratio of unemployed low and high skilled workers.[6]

[5] In Gautier (1998) and Gautier and Pomp (1998) explicit wages are derived by a Nash bargaining over the match surplus.

[6] Remember that there is a CRS production technique and there is free entry of vacancies. This implies that the firm accepts both types of workers as long as there is a positive match surplus. If there is still a surplus, a new vacancy will be opened.

The number of contacts between complex jobs and workers is also an increasing function of vacancies and relevant searchers and is given by:

$$x_c = x_c\left[v_c^{+}\left(y_c^{+},(u_h+e_{sh})^{+}\right),(u_h+e_{sh})^{+}\right] \quad \textbf{(2)}$$

Where v_c are complex vacancies (also increasing in expected productivity and relevant amount of job searchers), u_h is the unemployment rate for high skilled workers and e_{sh} stands for the number of high skilled workers occupying simple jobs but who continue searching for higher paying complex vacancies. All variables are expressed as fraction of the labour force. Note that I implicitly assume that employed and unemployed high skilled workers search equally efficient for complex jobs.

The rates at which low and high skilled unemployed workers find simple jobs is given by: $p_s=x_s/(u_h+u_l)$ and $p_c=x_c/(u_h+e_{sh})$. Given the properties of the matching technology, p_s and p_c are increasing in vacancies and decreasing in the number of job seekers. Furthermore, I will define the firing rates for simple jobs to be equal to $s_{sl}(y_s^{-})$ for low skilled workers and $s_{sh}(\mu y_s^{-})$ for high skilled workers and the firing rate for high skilled workers at complex jobs be equal to $s_c(y_c)$, where both $s_{sl}'(y_s)$ and $s_c'(y_c) < 0$. There are a number of reasons why firing rates for simple and complex jobs could differ. The most uncontroversial one is that complex jobs require more sunk investments in firm specific human capital which gives both the firm and the worker more incentives to continue their relation. But it could also be the case that the evolution of technology structurally leads to net job creation of complex jobs and net job destruction of simple jobs.

We can now write down the 5 differential equations for the different worker states.

$$\frac{du_l}{dt} = s_{sl}e_{sl} - p_s u_l \quad \textbf{(3)}$$

$$\frac{du_h}{dt} = s_c e_c + s_{sh}e_{sh} - (p_s + p_c)u_h \quad \textbf{(4)}$$

$$\frac{de_{sl}}{dt} = p_s u_l - s_{sl}e_{sl} \quad \textbf{(5)}$$

$$\frac{de_{sh}}{dt} = p_s u_h - (p_c + s_{sh}) e_{sh} \quad \textbf{(6)}$$

$$\frac{de_c}{dt} = p_c(u_h + e_{sh}) - s_c e_c \quad \textbf{(7)}$$

In the steady state, all those differential equations will of course be equal to zero and they can be solved for equilibrium low and high skilled employment and unemployment rates. First note that both high and low skilled unemployment rates are decreasing in the hiring probability and increasing in the firing probabilities (both depend on the job specific productivity).

The conventional wisdom is that increased competition of high skilled workers is always bad for low skilled workers. This view is however based on partial equilibrium arguments whereas we should be interested in the general equilibrium effects of high skilled workers looking for simple jobs. In Gautier (1998), I show that the smaller the output ratio of high and low skilled workers at *simple jobs* ,μ, is, the more unemployed low skilled workers will be harmed by competing high skilled workers. The intuition behind this result is the following: Profit maximizing firms will open simple vacancies as long as the quasi rents of a simple vacancy are positive. The quasi rents of a vacancy simply depend on the amount of relevant searchers and the expected output of a filled vacancy. As μ increases, the expected quasi rents of a vacancy will also increase. Consequently, more vacancies will be opened (till the point where the quasi rents of opening an additional vacancy will be zero again). Since employers do not know on forehand whether they will meet a high or a low skilled worker, the low skilled workers will benefit as much from a high μ as the high skilled workers. When μ is equal to one, employers will prefer low skilled workers on simple jobs because the high skilled workers have a probability p_c to quit and leave to the complex sector. But there exists a value for μ (>1) for which employers with simple vacancies are indifferent between a low and a high skilled worker. Call this value μ^*. When $\mu=\mu^*$, the higher productivity of the high skilled worker exactly compensates employers for his positive quit probability. When $\mu<\mu^*$, employers will prefer low skilled workers on simple jobs and simple vacancy supply will therefore be decreasing in u_h/u_l. When $\mu>\mu^*$, the opposite holds.

Some authors have suggested that there is crowding out because low skilled unemployment rates are higher than high skilled unemployment rates. According to this model this is not a very fertile approach because low skilled unemployment rates will always be higher than high skilled unemployment rates, simply because unemployed high skilled workers have the same probability to meet a simple vacancy but also have a positive probability to meet a complex vacancy.

It is also sometimes argued that changes in the unemployment rates of different skill categories can give us information on crowding out. If the fraction of workers with a lower education at simple jobs decreases when unemployment rises, they conclude that there is crowding out. However, there is many evidence of e.g. Pfann and Palm (1993) and Gautier et al. (1998) that firing rates for low skilled workers increase much more in bad times than the firing rates of high skilled workers without the for crowding out necessary requirement that more high skilled workers occupy simple jobs. Oi (1962) gives a number of plausible reasons for this. When the sunk costs required to create simple jobs are lower than for complex jobs. We will expect firing rates for low skilled workers to also be higher. In addition, the earlier mentioned explanation of skill biased technological change can explain the observed differences in unemployment rates.

In our framework, low skilled unemployment can increase for a number of reasons. Besides the above mentioned higher firing rates for low skilled workers, low skilled unemployment will also increase when the productivity of simple jobs falls and less simple vacancies are opened. In both cases there is no crowding out. Thus, changes in unemployment rates over time do also not give us sufficient information to distinguish crowding out from other theories of low skilled unemployment. When low skilled unemployment increases because of crowding out, the origin of the shocks often lies in the complex sector. Crowding out occurs when relatively many high skilled workers occupy simple jobs ($de_{sh}/dt > de_c/dt$). The source behind this process could be a fall in the productivity (or profitability) of complex jobs which on its turn leads to more job destruction (s_c rises) and to a lower stock of complex vacancies (p_c falls). When crowding out takes place, policy makers should therefore focus on distortions in the complex sector.

In section 4 we will test with a matched firm-worker data set to what extent the relatively high unemployment rates for low skilled workers in the beginning of the nineties were the result of crowding out. But first we will describe our data in the next section.

3 Data

For this paper we have used the AVO (arbeidsvoorwaarden ontwikkeling) data over the period 1992-95 from the department of Social Affairs. This is a firm worker data set. The data were collected from administrative records of a sample of firms by means of a stratified 2 steps sample procedure. In the first step a sample of firms was drawn from the ministry's own database (which is roughly similar to the firm-statistics collected by Statistics Netherlands) while in the second step a sample of workers was drawn from each of the firms. The number of workers drawn from a particular firm depended on the size of the firm.

Each year (October), in the first step a sample of firms (about 2000 per year) is drawn from the population of firms with 1 or more employees.[7] In the second step, a sample of workers (around 25,000 a year) is drawn from the records of firms selected in the first step. The population of firms was allocated over a number of strata (80 in 1993, 280 in 1994, and 312 in 1995). The strata were based on combinations of sectors and size classes. In particular the amount of firms with less than 10 employees was underrepresented. This was corrected by reweighing.

The amount of workers drawn depends on firm size (from firms with less than 10 employees, all workers were drawn, from the larger firms, the sampling probability decreases with firm size) and whether the employee had a collective wage agreement or not. Finally, a distinction was made between employees who were present at both sample moments (stayers), workers who were only present at the first sample moment (outflow) and workers who were only present at the second sample moment (inflow). More than 75% of the workers were present at both sample moments. When workers were only present at t-1 and not at t (leavers), information was obtained on the new labour market state of the worker. The fractions of entering and leaving workers which were sampled in a particular period are consistent with the macro figures. We have information on 7 job complexity levels (which vary by the required experience, the complexity of the activities and the amount of supervision required for the job) and 7 types of education. In general, the first three education levels are considered to be low. For a description of the job complexity and education levels I refer to the appendix.

[7] The sample was drawn from the firm register of the Department of Social Affairs which contains roughly the same information on companies as "Statistiek van het ondernemingsbestand" of Statistics Netherlands.

In the reweighing process, every firm gets a weight equal to the inverse of the probability to be sampled. All firms within each of the strata have the same probability to be drawn and consequently receive the same weight. The "Statistiek van het ondernemersbestand 1994" of Statistics Netherlands was used for this procedure. For the determination of the weights of the employees, the Statistics Netherlands statistic: "Banen van werknemers" (jobs of workers) was used. Since different worker types are distinguished within a firm (with or without collective wage agreement, and new staying and separating workers), individual workers have different probabilities to be selected in the sample. As a result it is possible that within a stratum workers can have different weights.

The data were collected by civil servants (inspectiedienst) of the Department of Social Affairs. Information on wages, hours worked, days worked and a number of other variables were collected from the wage administration. Finally, it is useful to mention that the response rates are very high. Job complexity levels were for example reported for more than 99% of the workers.

Disadvantages of the data are that the sampling strategy is quite complex and that the number of strata from which firms were drawn change over time. In addition, the data contain no information on output, investment and profits. For more information on the data see Van den Berg et al. (1998).

4 Measuring the importance of crowding out

4.1 Testing crowding out with micro data

I will test for crowding out by measuring changes over time in the fraction of high skilled workers at simple jobs and used education as a proxy for worker skills. The "true" skills of a worker depend however on education plus some observed and unobserved characteristics. The identifying assumption is that these unobserved characteristics are constant over time but that crowding out is not. In order to clarify this, it will be useful to introduce a shorthand notation for the distribution of new workers with a given level of education over the various job levels. We label this distribution f(i), where i stands for the level of education. Crowding out implies that in a bad year more workers accept jobs below the level which corresponds to their skills,

i.e. f(*i*) in a bad year lies to the left of f(*i*) in a good year.[8] On the other hand, if the seemingly imperfect match between job level and educational level is due to unobserved differences between workers, then f(*i*) should *not* depend on the state of the labor market. Thus, the fraction of workers with a higher education who occupy simple jobs and who have unobserved characteristics which do not make them more productive than low skilled workers (e.g. because they choose the wrong field) is assumed to be constant over the cycle. This could be a restrictive assumption when people anticipate bad labour market conditions and therefore choose studies with higher job probabilities. However, the time lags between the beginning of an education and the time one enters employment are so large that we can reasonably rule this option out. Also note that what we observe are equilibrium outcomes. Crowding out could be either caused by employers who require more skills for given jobs when employment is low or because more high skilled workers arrive at low skilled jobs. In this paper I will define the following operational condition for crowding out to take place.

Condition 1
Crowding out occurs when in periods of low employment, more high skilled workers occupy simple jobs.

The next issue is to find two years in our sample period in which employment opportunities differed. Table 2 shows that in 1993 unemployment rose strongly and also few vacancies were opened while in 1995 unemployment fell and many vacancies were opened. Moreover, the *v*/*u* ratio for almost all education groups, and in particular for those with only elementary school was lower in 1993 than in 1995. In what follows, we will therefore consider 1993 to be a bad year and 1995 to be a good year in terms of employment opportunities.

4.2 Stylized Facts

In this section we will start with some key statistics on the magnitude and composition of employment. The analysis will be on both detailed job complexity levels (f1-f7) and less detailed job complexity levels: *low* (f1,f2), *intermediate* (f3-f5) and *high* (f6,f7). An additional advantage of the last method is that the results are less vulnerable for

[8] This can be viewed as a supply approach. Van den Berg et al. followed a more demand orientated approach to test whether firms upgraded their work force during recessions. Their results are consistent with the ones in this paper.

measurement errors due to the always subjective definition of job complexity levels and the fact that I used different samples. A disadvantage is however that some detail is lost.

We will now turn to some simple tests. Remember that if an increase in low skilled unemployment is the result of crowding out, we expect that in the shrinking employment year 1993, given the job level, a smaller fraction of the workers has a lower education.

We see in table 3 that both the workers with an intermediate and a higher education occupied relatively more simple jobs in the high employment year. Moreover, the fraction of high skilled workers at intermediate jobs was 10% points higher in 1995 than in 1993. If the reduction of employment opportunities for low skilled workers was the result of crowding out, we would expect the opposite.

We repeated this exercise for the stocks of one sample to make sure that our results are not driven by sample differences or the fact that the economy behaved fundamentally different in 1993 than in 1995. Table 4 gives the results for 1992-93 (employment was lower in 1992 than in 1993) and table 5 gives the results for 1994-95 (employment was lower in 1994). We have to be careful with interpreting those results since job complexity levels were only measured once (in October *t*-1 for all the workers who were present in period *t* and in October *t* for the new workers). Hence the shifts are partly driven by changes in job complexity levels between inflow and outflow. In general, we would expect that job-leavers who are included in period *t*-1 occupied more complex jobs than new workers who were present in period *t*. If we compare 1994 with 1995 (in 1994 employment was 3% lower than in 1995), we see that only 0.5 % point more workers with an intermediate or higher education occupy simple jobs. This is an upperbound on the crowding out effect because the stocks of 1994 and 1995 only differed by outflow_{95} (included in 1994) and inflow_{95} (included in 1995). The tests for 1992 and 1993 give similar results. Again, we do not find evidence for a crowding out effect.

4.3 Ordered logit estimates

4.3.1 Estimates for low, intermediate and high complex jobs

Still, we can not rule out that a labour market in a boom behaves fundamentally different from a labour market in a recession. Female participation could differ, the age distribution of the labour force could differ, and some sectors (like the chemical sector) are more vulnerable for cyclical movements than others. Moreover, unions and

employers organizations could behave differently in tight labour markets. In this section I try to correct for this by estimating the probabilities from an ordered logit for workers with a certain education type and other characteristics to be employed at different job complexity levels.

Let f^* be an index of job complexity, which depends on a vector $\boldsymbol{x}$ of characteristics, such as occupation, education, sector, age, sex and tenure.

$$f^* = \beta' \boldsymbol{x} + \epsilon$$

Where ϵ has a logistic distribution and the mean and variance of ϵ are normalized to zero and one. We do not observe f^* but we do observe that

$$\begin{aligned} f=1 \quad & \text{if } 0 \le f^* < \mu_1 \\ f=2 \quad & \text{if } \mu_1 \le f^* < \mu_2 \\ f=3 \quad & \text{if } \mu_2 \le f^* < \mu_3 \\ & \vdots \\ f=7 \quad & \text{if } \mu_6 \le f^* \end{aligned}$$

The probabilities for f=1...7, can be calculated in the standard way. I will calculate those probabilities both for a high and a low employment year separately. If the probabilities for "the average worker" with a certain education type to be employed at a low complexity job are higher in the low employment year, this would be evidence in favour of crowding out. I will estimate our model for detailed (f1-f7) and rough (1-3) job complexity levels and with and without wage. On the one hand, the gross hourly wage (including overtime payments, profit shares etc.) is a good measure of a worker's true productivity but on the other hand we have to worry about endogeneity issues. It is possible that wages are linked institutionally to different job complexity levels. Table 10 shows however that there is quite some wage dispersion within each of the first 5 job complexity levels. The issue of including or excluding wages is also related to the degree in which crowding out is a matter of substitution or not. When skilled workers

earn higher wages at simple jobs, it partly reflects substitution. In the estimates which include the wage effect we thus measure the pure crowding out effect.[9]

In table 6 the estimation results are printed for "rough" job complexity levels. All variables are highly significant. The probability to be employed at a complex job increases with education, age, tenure, productivity (measured as hourly wage), and is also higher for workers at growing firms, males, creative and managerial occupations, and for full time workers. Our results appear to be qualitatively invariant with respect to in- or excluding hourly wages.

From a statistical point of view we have to reject the hypotheses that low skilled workers were crowded out in 1993. The 1995 dummy is negative and highly significant which means that in the high employment year, workers performed on average less complex tasks. If we transform the coefficients into probabilities, we also see in table 7 that differences in job complexity levels for a given education are much larger between males and females and part-time and fulltime workers than between different years.

In the previous specification I implicitly assumed that the effects of the different variables was the same for all job complexity levels. In table 8, probabilities based on 2x3 separate ordered logit estimates for 1993 and 1995, and for each of the different education groups to reach optimal flexibility, are presented. The transformation of coefficients into probabilities is done over the average characteristics of the 1993-worker (for both 1993 and 1995). In this table I also included information for new workers only since it is likely that crowding out would be concentrated in this group. Under crowding out we would expect a positive sign in the differences between 1993 and 1995 at low job complexity levels and a negative sign at high job complexity levels. There is some evidence that more workers with an intermediate education flew in at low job complexity levels in 1993 and more high skilled workers flew in at intermediate jobs. If we consider the whole sample however, we see no evidence for crowding out. To the contrary, a larger fraction of the high skilled workers occupied complex jobs in the low employment year 1993.

[9] Van den Berg et al. (1998) show that workers with more schooling than their direct colleagues at the same job level in the same firm do not earn higher wages. They do tend to select themselves into high wage firms.

4.3.2 Estimates for detailed job complexity levels

We now turn to a more detailed description of job complexity levels. Instead of considering only 3 job levels we will now distinguish 7 levels. For matters of clearness I decided to present the results in a graphical form. Figures 2-8 show how for given education classes, the distribution of job complexity levels changed between 1993 and 1995. The probabilities are again based on ordered logit estimates (different ones for 1993-95, where the 1995 probabilities are obtained from the 1995 coefficient estimates and the average 1993 population averages) with the same variables (excluding wages) as in the previous section. Recall that we would expect for all different education classes to find more mass at low complexity jobs in 1993 than in 1995. First of all we see from all graphs that only workers with an elementary education occupy simple jobs at f1, both in 1993 and 1995, which suggests that in this segment there is no crowding out.

Figures 2 and 3 show that in the low employment year there is a shift in mass from job complexity level 3 to job complexity 2, which is consistent with crowding out. For workers with a higher secondary education and a university degree, the shift is in the opposite direction, which is inconsistent with crowding out. For the other groups, the distributions overlap.

If we look at the distributions of the inflow of workers (figures 9-15), we see some evidence that crowding out took place. Three out of 7 education groups exhibit a small leftward shift in the low employment year. Only the workers with a university degree occupied on average more complex jobs in 1995 than in 1993. We can conclude thus that only for the inflow of new workers there is weak evidence for crowding out. In 1993, relatively many workers with a higher secondary education occupied job complexity levels 2 and 3 and relatively few workers from this education class occupied job complexity level 4. For the workers with a lower secondary education and the workers with elementary school only we see a shift from job complexity level 3 to job complexity level 2.

4.4 Inflow and outflow

In the previous sections we established that in a year of low employment, the fraction of skilled workers occupying simple jobs did not increase. We did however find some evidence that during bad times, new skilled workers were hired more frequently at low skilled jobs. The differences are small however and cannot explain the disproportionally large share of low skilled workers who are unemployed in recessions. The previous section also suggested that the firms who use bad times to improve the quality of their

workforce mainly do this by firing relatively underqualified workers. In this section we will collect more stylized facts on the firing and hiring behaviour of firms over different segments of the labour market.

For an unemployed job searcher at least 3 issues are relevant, the probability to get a job, the expected duration of the job and the net increase in wealth of the job. The probability to get a job is determined by the relevant stock of competing job searchers and total hirings. Table 11 shows that both hiring and firing rates are always higher at simple jobs. The cyclical behaviour of firing and hiring rates for simple and complex jobs is different however. In bad times, relatively many workers are fired at simple jobs and relatively little workers are hired at complex jobs. This is consistent with Pfann and Palm's (1993) finding based on aggregate data. We also see for all job types that there are less job to job movements in bad times, which is of course already a well known fact.

Thus the fact that the stock of low skilled unemployed workers is relatively high in recessions seems to be mainly caused by increased outflow and to a much lesser extent to a reduction of inflow. Note that both processes can take place with and without crowding out. Under the crowding out hypothesis more high skilled workers occupy simple jobs resulting in either increased outflow of low skilled workers, decreased inflow or a combination of both. On the other hand, less low skilled workers can get hired and more low skilled workers can get fired without an increase of the fraction of high skilled workers at simple jobs.

Conclusion

In this paper I presented a bare bone matching model in which low skilled unemployment could rise relatively strongly due to either crowding out, or a decrease in the profitability of simple jobs. For policy makers it is important to know how important crowding out actually is because it has implications for which labour market segment economic policy should focus on. In general, crowding out results when either the supply of high skilled workers rises or the supply of complex jobs falls and some high skilled workers compete with low skilled workers for simple jobs.

The main empirical question was whether more high skilled workers occupied simple jobs in the beginning of the nineties in the Netherlands. This was tested with a combined firm/worker data set. It turns out that there is weak evidence that new workers (with elementary, secondary and with vocational education) flow in at less complex jobs in bad times than in good times (for new workers with a higher secondary education there

is no such evidence). When we consider the entire stock of workers we do not find more mass at low job complexity levels. Those two results imply that recessions are periods of increased outflow for workers (both skilled and unskilled) at simple jobs. Unemployment increases disproportionately for low skilled workers because they are concentrated in those simple jobs. This hypotheses was confirmed by direct testing. From a theoretical point of view it is not surprising that complex jobs remain open longer since complex jobs typically require more sunk investments in firm specific human capital and therefore both the employer and the employee at a complex job have more incentives (than those at simple jobs) to continue their relation in bad times.

The message for policy makers is that labour market policies which stimulate job creation at the top segment of the labor market will be less effective in reducing low skilled unemployment than policies which focus directly at the bottom segment.

Abstract[10]

In this paper I show what the consequences for both low and high skilled employment rates are when unemployed high skilled workers search for both simple and complex jobs and continue searching for complex jobs when they happen to meet a simple vacancy first. Moreover, I use a matched firm-worker data set to investigate whether more high skilled workers occupy simple jobs during bad times as crowding out theories predict. The results of the analysis suggest that there is only weak evidence for crowding out of intermediate skilled workers by high skilled workers in the beginning of the nineties but no evidence for the crowding out of low skilled workers. Some evidence is given for the hypothesis that the high unemployment rates among low skilled workers are caused by the fact that firing costs for simple jobs (where relatively many low skilled workers are employed) are lower than for complex jobs.

Keywords: crowding out, low skilled unemployment, matching, business cycle JEL codes: J21, J23.

[10] The author would like to thank The Department of Social Affairs for kindly letting me use the AVO data, L. Borghans, G.J. van den Berg, A. de Grip, J.C. Van Ours, M. Pomp, and G. Ridder for useful comments and discussions. Remaining errors are mine.

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Appendix A Job complexity and education levels

We have used the following classification of job complexity levels.

Low

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 repeating. Some (lower) administrative or technical knowledge and experience is required. In general the activities take place under direct supervision.

Intermediate

f3 Less simple activities which do not repeat themselves continuously. Administrative or technical knowledge is required and the activities are partly without direct supervision.

f4 More difficult (non-repeating) 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.

High

f6 Managing activities of an analytical, creative or contactual nature, which are undertaken independently and require an academic or comparable level.

f7 Managers of intermediate companies or comparable plants, departments etc who also participate in decision making and managers of large companies or comparable plants or departments.

In this paper I merged f7 and f8 because of the few observations in f8.

We have used the following education scheme:

el/basis	primary/elementary	**Low**
v.a/ mavo	lower secondary	
lbo	lower vocational	
mao/havo,vwo	higher secondary	**Intermediate**
mbo	intermediate vocational	
hbo	higher vocational	**High**
wo	academic	

Tables

Table 1 Unemployment rates for different education classes

	% Unemployed	Share of labour force
primary	15	8
lower secondary (mavo, lbo)	9	22
higher secondary, lower vocational	6	44
higher vocational	5	17
academic	6	8
total	7	100

Source EBB, Statistics Netherlands (1996)

Table 2 Labour market conditions in 1993 and 1995

	1993	1995	1993/1995
Indicator			
unemployment change	22.7	– 6.7	
employment change			
persons	– 0.1	2.1	
man year	– 0.5	2.1	
new vacancies x 1000	383	526	
filled vacancies x 1000	396	508	
employment (priv. sector x 1000)	5754	5897	
V/U ratio's			
elementary	0.002	0.030	0.067
lower secondary (mavo)	0.169	0.038	4.408
lower secondary (lbo)	0.068	0.133	0.511
higher secondary	0.025	0.075	0.328
lower vocational	0.076	0.172	0.574
higher vocational	0.099	0.003	0.574
academic	0.035	0.075	0.465

Source EBB (Statistics Netherlands) and AVO

Table 3 *Allocation of workers with a certain education over different jobs for 93 and 95*

job complexity level	low		intermediate		high		total
stock	1993	1995	1993	1995	1993	1995	
education							
low	27.0	27.8	72.7	72.1	0.4	0.1	100
intermediate	3.3	3.9	94.6	95.6	2.1	0.5	100
high	0.2	1.0	69.9	77.9	29.9	21.2	100

Table 4 *Allocation of workers with a certain education over different jobs based on the 1992-1993 sample*[a]

job complexity level	low		intermediate		high		total
	1993	1995	1993	1995	1993	1995	
education							
low	29.5	30.2	70.2	69.5	0.3	0.3	100
intermediate	3.7	4.0	94.3	94.1	2.0	1.9	100
high	0.2	0.3	70.6	71.0	29.2	28.8	100

[a] Based on stocks.

Table 5 *Allocation of workers with a certain education over different jobs based on the 1994-1995 sample*[a]

job complexity level	low		intermediate		high		total
	1993	1995	1993	1995	1993	1995	
education							
low	29.9	30.4	70.1	69.5	0.1	0.1	100
intermediate	4.3	5.1	95.2	94.4	0.5	0.6	100
high	1.6	0.9	77.8	77.8	20.7	21.3	100

[a] Based on stocks.

Table 6 Estimation Results: Ordered Logit estimates with and without wages 1993/1995 (dependent variable is job complexity level)[a]

variable		coefficient[b]		coefficient[c]		mean
intercept		5.37	(0.008)	4.79	(0.008)	
intercept intermediate		– 3.20	(0.006)	– 4.39	(0.007)	
year = 1995		– 0.08	(0.002)	– 0.09	(0.002)	0.53
lower education		– 4.96	(0.006)	– 4.72	(0.006)	0.21
intermediate education		– 2.94	(0.005)	– 2.83	(0.006)	0.66
age (years)		0.04	(0.000)	0.03	(0.000)	35.80
female		– 0.75	(0.003)	– 0.67	(0.002)	0.40
tenure (years)		0.01	(0.000)	0.004	(0.000)	7.53
gross hourly wage				0.03	(0.000)	31.11
shrinking firm		– 0.11	(0.002)	– 0.06	(0.002)	0.28
growing firm		0.07	(0.002)	0.10	(0.002)	0.32
firm size	10-19	– 0.31	(0.004)	– 0.37	(0.004)	0.09
	20-49	– 0.34	(0.003)	– 0.42	(0.003)	0.12
	50-99	– 0.42	(0.004)	– 0.55	(0.004)	0.09
	100-199	– 0.40	(0.004)	– 0.47	(0.004)	0.08
	200-499	– 0.37	(0.004)	– 0.52	(0.003)	0.13
	> = 500	– 0.50	(0.003)	– 0.66	(0.003)	0.33
part time		– 1.24	(0.003)	– 1.14	(0.003)	0.28
sector						
agriculture/fishing		– 0.42	(0.006)	– 0.36	(0.006)	0.02
construction		0.74	(0.004)	0.77	(0.004)	0.13
trade		– 0.23	(0.003)	– 0.16	(0.003)	0.13
hospitality		– 1.13	(0.005)	– 1.04	(0.005)	0.11
transport/communication		0.64	(0.004)	0.61	(0.004)	0.06
financial		0.28	(0.004)	0.17	(0.004)	0.11
health		0.22	(0.003)	0.37	(0.003)	0.17
occupation						
simple technical		– 0.18	(0.003)	– 0.18	(0.003)	0.29
administrative		0.99	(0.003)	0.91	(0.003)	0.15
computer		0.58	(0.008)	0.55	(0.009)	0.02
management		1.84	(0.005)	1.58	(0.005)	0.07
commercial		0.38	(0.004)	0.37	(0.004)	0.10
creative		1.67	(0.008)	1.75	(0.009)	0.01
log likelihood:		– 4010560.9		– 390061.6		

[a] Standard error in brackets, reference groups/states, year=93, higher education, male, firms which do not change size, firms with 0-9 employees, full time, IT/manufacturing sector, non technical occupations,
[b] excluding gross hourly wage
[c] including gross hourly wage

Table 7 Simulated probabilities to be employed at a certain job complexity level[a]

job complexity level:	low	intermediate	high
education:			
low			
– *including wage (total sample)*	21.7	78.2	0.0
– 1993	20.9	79.0	0.0
– 1995	22.5	77.5	0.0
– *excluding wage (total sample)*	24.8	75.2	0.1
– 1993	24.8	75.1	0.0
– 1995	26.3	73.6	0.0
– male	19.9	80.1	0.0
– female	34.4	65.6	0.0
– full-time	18.6	81.3	0.1
– part-time	44.2	55.8	0.0
intermediate			
– *including wage (total sample)*	4.0	95.7	0.2
– 1993	3.8	95.7	0.3
– 1995	4.2	95.6	0.2
– *excluding wage (total sample)*	4.5	95.1	0.1
– 1993	4.1	95.4	0.4
– 1995	4.5	95.1	0.1
– male	3.2	96.2	0.6
– female	6.5	93.2	0.3
– full-time	3.0	96.4	0.6
– part-time	9.5	90.3	0.2
high			
– *including wage (total sample)*	0.2	95.7	4.0
– 1993	0.2	95.5	4.2
– 1995	0.2	95.9	3.9
– *excluding wage (total sample)*	0.2	92.2	7.7
– 1993	0.2	92.0	7.7
– 1995	0.2	92.6	7.2
– male	0.2	90.0	9.9
– fewmale	0.4	94.9	4.7
– full-time	0.2	89.7	10.1
– part-time	0.6	96.2	3.2

[a] De probabilities are based on ordered logit estimates of table 6 evaluated at the mean characteristics of the workforce.

Table 8 *The relevance of crowding out, probabilities based on ordered logits for different years and different education groups*[a]

job complexity level:	low		intermediate		high	
	all	inflow	all	inflow	all	inflow
education:						
low						
1993	22.1	56.5	69.0	43.5	0.0	0.0
1995	24.5	61.1	75.4	38.9	0.0	0.0
difference:	6.8	– 4.6	– 6.4	4.6	0.0	0.0
intermediate						
1993	0.5	7.0	98.4	92.9	0.1	0.0
1995	4.9	3.3	95.1	96.7	0.0	0.0
difference:	– 4.4	3.7	3.3	– 3.8	0.1	0.0
high						
1993	0.2	0.4	87.3	95.2	12.5	4.4
1995	0.5	0.7	81.9	96.0	17.6	3.3
difference:	– 0.3	– 0.3	5.4	– 0.8	– 5.1	1.1

[a] The estimates are excluding wages and the probabilities of both 1993 and 1995 are based on average characteristics of the 1993 worker.

Table 9 *Crowding out, different probabilities based on stocks of the 1995 sample*[a]

job complexity level:	low		intermediate		high	
	excl. *w*	incl *w*	excl. *w*	incl. *w*	excl. *w*	incl. *w*
education:						
low						
low emp year 1994	22.1	16.8	77.8	83.1	0.0	0.0
high emp year 1995	21.0	18.0	79.0	81.9	0.0	0.0
difference:	1.0	–1.2	– 1.2	1.2	0.0	0.0
intermediate						
low emp year1994	3.4	2.9	96.2	96.9	0.0	0.0
high emp year1995	3.4	3.2	96.3	96.6	0.3	0.1
difference:	0.0	– 0.3	– 0.1	0.0	– 0.3	0.1
high						
low emp year 1994	0.1	0.1	92.3	95.6	7.6	4.3
high emp year 1995	0.1	0.1	90.1	95.2	9.7	4.7
difference:	0.0	0.0	2.2	0.4	– 2.1	– 0.4

[a] The probabilities of 1995 are based on average characteristics of the 1993 worker.

Table 10 *Gross hourly wages (including extra time payments etc.)*

	<10	10-15	15-20	20-25	25-30	30-35	35-40	>40	total
f1	14.6	42.8	33.4	4.1	1.8	1.2	1.1	0.9	100
f2	16.2	30.9	32.3	9.5	3.0	1.9	1.9	4.3	100
f3	1.2	10.7	27.0	26.6	11.7	4.1	5.7	13.1	100
f4	0.1	1.8	8.1	20.0	21.5	9.9	6.4	32.3	100
f5	0.0	0.5	1.6	5.0	14.2	13.2	11.9	52.5	100
f6	0.1	0.1	0.6	1.1	1.8	2.8	5.5	88.1	100
f7	0.0	0.0	0.0	0.3	0.0	0.0	0.2	99.5	100

Table 11 Hiring and firing rates for different job complexity levels

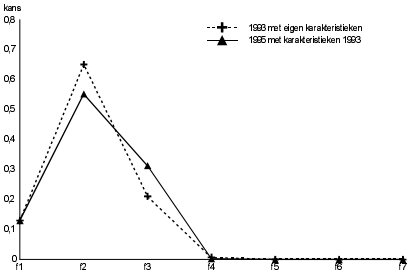
		firing	hiring	disability	job to job
job complexity level:					
low	1993	10.6	19.0	0.5	1.2
f1 - f2	1995	4.3	21.8	0.3	7.1
	ratio	2.5	0.9	1.6	0.2
	difference	6.3	– 2.8	0.2	– 6.5
intermediate	1993	7.1	8.8	0.3	1.0
f3 - f5	1995	2.7	11.5	0.2	5.2
	ratio	2.6	0.8	1.5	0.2
	difference	4.1	– 2.7	0.1	– 4.3
high	1993	4.9	5.4	0.0	0.3
f6 - f8	1995	1.5	15.0	0.1	5.3
	ratio	3.3	0.4	0.0	0.1
	difference	3.4	– 9.6	– 0.1	– 5.0

Figures

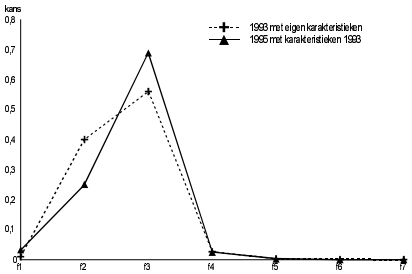
Shifts in job complexity distributions based on ordered logits for different education groups

solid (____) lines refer to 1995 and dashed (----) lines refer to 1994.

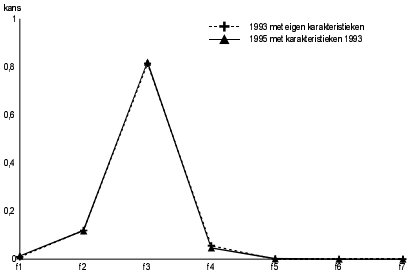
elementary



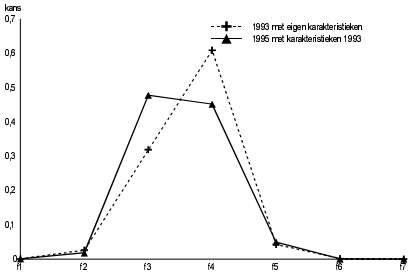
lower secondary I



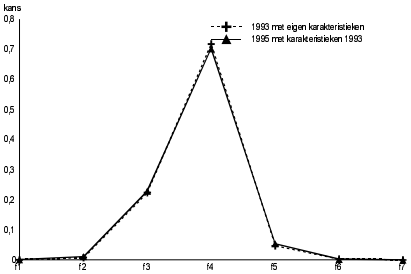
lower secondary II



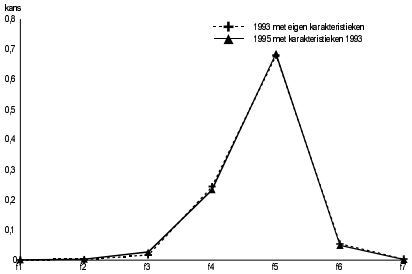
higher secondary



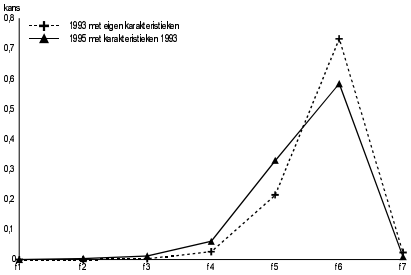
lower vocational



higher vocational



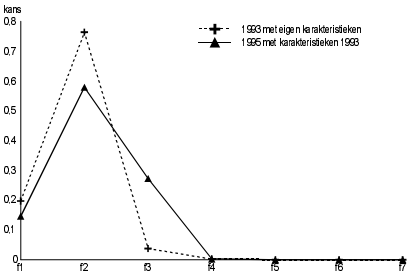
academic



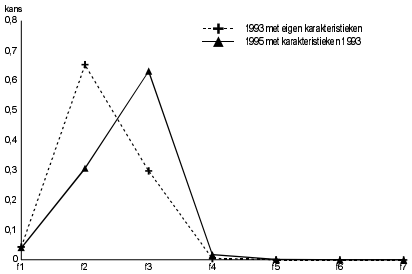
Shifts in job complexity distributions for employment inflow based on ordered logits for different education groups

solid (____) lines refer to 1995 and dashed (----) lines refer to 1994.

elementary



secondary I



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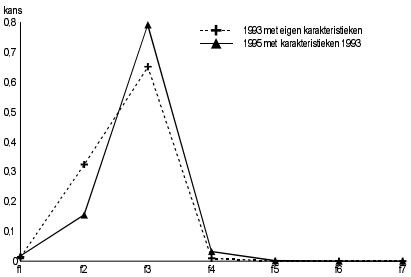

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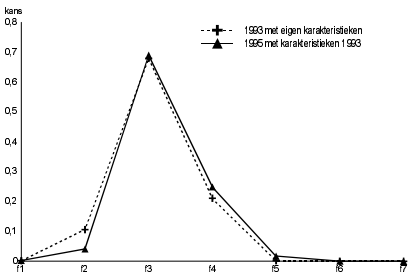
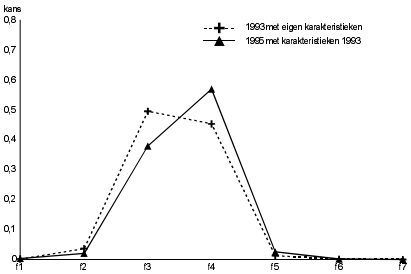
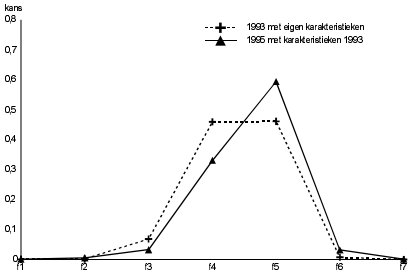


lower vocational



higher vocational



academic