# Apprenticeship versus vocational education: Exemplified by the Dutch situation

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**Abstract**
It is widely believed that a dual system of vocational education provides an efficient way to learn vocational skills and to lay the basis for an efficient insertion in the labour market. In the Netherlands students can choose between vocational schools and an education within the apprenticeship system. In this paper we analyze whether in the long run workers with an apprenticeship do better than workers who have gone through a vocational school. It is found that there are hardly any differences in earnings, earnings growth and employment opportunities between workers with an apprenticeship and those who went to a vocational school.

## 1 Introduction

Apprenticeships are as old as mankind and date back over 4,000 years when young individuals would go to live and work with a master of a craft. Today's apprenticeship programs are mostly fully institutionalized and provide on-the-job training in combination with classroom instruction in a skilled craft or trade. Its success to survive over time seems to point to high pedagogic and economic values for workplace trained individuals. To understand its success, economists show a new (or renewed) interest in apprenticeship systems. Steedman (1993) argues that the dual education system in Ger-

many produces high quality workers and is the best remedy against youth unemployment; Germany features an extensive apprenticeship system where about two third of all students participate in. The co-operative education system in Canada proofs to be beneficial for the employment probabilities of Canadian students. Also policy makers seem to be charmed by dual education systems. In the US where education is full-time orientated Clinton promotes education and job training in the workplace, see Heckman (1993). And in the Netherlands there are plans to extend the co-operative system to higher education as well.

Do these arguments imply that a system of apprenticeships outperforms a classroom orientated education system? Unfortunately, this question is not easily answered as it depends on how success of either system is measured. In fact, alternative success measures may predict negative performance of apprenticeships. For example, it appears that students in German apprenticeship programs have restricted career opportunities, see Winkelmann (1994). In Britain Elias, Hernaes and Baker (1994) promote more specific training within the traditional vocational schooling track. And recent analysis in France shows that there is no proof that the apprentices outperform their vocational colleagues in terms of successful job searching, see Bonnal & Mendes & Sofer (1997).

In this paper we study the Dutch apprenticeship system. Firstly, we present a brief discussion on whether a dual education system compares favourably to the more traditional full-time education system. Hereby, we will report briefly on some of contemporary studies where Dutch apprenticeship programs and traditional vocational education are compared and evaluated. Secondly, we will model the individual choice between formal (vocational) education versus apprenticeship programs; we will look at apprenticeship trainees and compare their performance with those who enrolled in intermediate vocational education where formal learning is more classroom orientated. By doing so, we refine the traditional measure of school to work transition and look not only at individual earnings, but also at earnings growth and unemployment rates. Combined, these alternative measures fit the economic model where individuals are pictured as life time earnings maximizers. In the end, we will deal with two interrelated questions. What are the determinants of choosing vocational schooling? And, what are the determinants indicating certain quality differences between both types of schooling?

We will proceed as follows. Section 2 provides arguments in favour of the part-time and full-time education and looks briefly at the Dutch vocational-

and apprenticeship system. In section 3 we move on to the individual choice of schooling. We project the model of Willis & Rosen (1979) on the decision between vocational schooling versus apprenticeship. In this context Section 4 considers a recent Dutch data set and examines the results. Section 5 gives some reflections on the empirical findings. The final Section 6 summarizes and concludes.

## 2 Apprenticeship versus vocational education

What are the advantages and disadvantages of the dual system relative to the traditional system of full-time education? The traditional system is an education-led system which is based on classroom teaching of vocational skills with an additional period of orientation in a firm. The transition into the labour market is a discrete transition. Part-time education system is an employer-led system. Here, the student spends one or two days in vocational schools and spends the rest of the week in the firm learning a trade. In this case the employer pays the student. The transition into the labour market evolves gradually. We briefly list some pros and cons.

#### Learning efficiency

If the dual system with part-time education is the alternative for traditional full-time education it may prevent some people from dropping out of school altogether. Another argument is that skills are learned more efficiently in a firm than in a classroom. The relevance of being equipped to the latest technological developments is for firms higher than for classrooms. As a consequence, new and relevant skills learned in the workplace are learned quicker, are more practical and better applicable.

However, both arguments cannot be maintained that strongly. First of all, the dual system does not only prevent students from dropping out the education system but it may also prevent students from returning to formal full-time education. And secondly, because of high job turnover rates of, for example, German apprentices, there seems to be no lifelong relationship between firms and apprentices, see Harhoff & Kane (1996). This points to only a short-term efficiency improvement in terms of the application of new and relevant skills. Further note that many occupations of today require a broader body of knowledge, thereby, increasing the probability of on the job training later on in life.

### Information efficiency

An apprenticeship system provides the opportunity for firms to screen the talented from the untalented within the firm itself. By means of this screening device, the firm is provided with fine-graded information on the productive qualities of students. This yields more detailed information about the abilities of workers than the certificates obtained in formal education would bring. This, however, we consider only a partial advantage. It is the firm where the student receives its education and training which has this information advantage. Other firms do not have this particular information. Whether the advantage of one firm outweighs the advantage of all firms under a system of formal education is questionable.

### Labour market efficiency

Because the transition from school to work evolves more gradually labour demand can respond more easily to labour supply, and vice versa. As a consequence, the rates of youth unemployment should be relatively low among young apprentices. Van der Velden & Lodder (1995) show that in the Netherlands apprenticeship programs offer a more advantageous labour market position at the time of school leaving. In OECD (1996) it is found that youth unemployment rates in countries with a dual system of vocational education is 4 percentage points lower than in countries with a classroom based vocational system.

However, if firms are short-sighted, they will cut the number of training places during recessions. Due to possible myopic firm behaviour there may be excess labour demand and excess labour supply in accordance with the business cycle. Consequently, efficiency of the labour market can be harmed due to the mismatch between demand and supply for a dual trained labour force. Steedman (1993) points to the presence of procyclical movement in the supply of apprenticeship places. Den Broeder (1995) observes similar fluctuations in the Netherlands.

### Cost efficiency

Because firms benefit from dual education in terms of learning-, cost- and labour market efficiency, firms may co-finance a dual education system. Hence, there is a possible efficiency gain in terms of public spending on education. In the Netherlands, for example, Like the labour market argument, Van Imhoff & Ritzen (1989) show that this cost argument may suffer

if firms show short-sighted behaviour. That is, in booming periods firms are more willingly to train and pay for students than in periods of recession. The beginning of the Dutch recession in the late 1970s and the resulting mass unemployment resulted in a dramatic drop of the number of apprenticeships offered in the Netherlands. In an attempt to turn the tide, the Dutch government started to boost vocational education by means of extra subsidies in 1979, thereby increasing their expenditures.

### Increasing inequality of opportunity

Due to the screening and, consequently, the creaming of the best students the inequality of job opportunities and career perspectives increase. The most capable students are offered the highest wages and the best career opportunities whereas less capable students are excluded and face high unemployment risks and low wage expectations. This opportunity inequality will rise even further if the diversity of training providing firms yields diversity in learning environments. Students in large firms may receive better training and more learning opportunities and vice versa.

### Other negative external effect

Finally, an advanced dual system will produce mostly firm specific skills where general skills are relatively underrepresented yielding negative external effects. For example, a specifically trained labour force is less likely to attract foreign investors who seem to benefit most from general skilled workers.

### Apprenticeship versus vocational education in the Netherlands

In the Netherlands full-time education is compulsory at the age of 16. For people age 17-18 at least part-time education is compulsory. After leaving primary school children have to choose between lower vocational education or secondary general education. Secondary general education consists of a lower and intermediate track differing in length and difficulty.

At lower vocational education general educational and general vocational subjects are given. Students choose for an occupational sector but not for a particular occupation. After leaving lower vocational education or secondary general education students can join an apprenticeship, go to intermediate/higher vocational education or can go to university. An apprenticeship training or intermediate vocational education is in principle possible for

all secondary school graduates. This is also the sample we are looking at in this paper.

Apprenticeship training is given at two levels. The first takes about two years. After completing the first level one can continue its apprenticeship training by joining a second level. This will also take approximately two years. All apprentices go to college one or two days a week where they get their theoretical education and the rest of the week they work at a trainee post. They are trained in a particular profession. The training is completed with a national external exam. The Government, the social partners and the colleges offereing the theoretical part of the training are jointly responsible for the apprenticeship trainings.

# 3 The model

We now turn to the individual choice between vocational schooling versus apprenticeship. We will report briefly on the model and estimation procedure, proposed by Willis & Rosen (1979).

What is the blueprint of the individual's schooling decision? Like most economic exercises, the hedonic motivation for choosing is exploited. Individuals choose for a particular schooling career to gain in long run utility materialized by means of future earnings. Because uncertainty is a feature of any economic performance, future earnings are corrected for employment probabilities. This earnings stream is parameterized into a geometric growth process. If a person chooses for an apprenticeship, the earnings stream at period $t$ equals

$$w_1(t) = \pi_1 w_1 \exp(g_1 t) \tag{3.1}$$

If the alternative is chosen, life time earnings are represented by

$$w_2(t) = \pi_2 w_2 \exp(g_2 t) \tag{3.2}$$

The variables $w_1$ and $w_2$, $g_1$ and $g_2$ and $\pi_1$ and $\pi_2$ represent initial earnings, the rates of growth and the probability of being employed in each of the two alternatives. If we assume an infinite horizon, the probability of unemployment remains unchanged over time, a constant rate of discount for each person, $r$, where $r$ exceeds $g_1$ and $g_2$ and ignore the direct costs of schooling and unemployment benefits, the present value of earnings equals

$$V_1 = \int_0^\infty w_1(t) \exp(-rt) dt = \frac{\pi_1 w_1}{r - g_1} \tag{3.3}$$

if apprenticeship is chosen. The present value of the alternative reads as

$$V_2 = \int_0^\infty w_2(t) \exp(-rt)dt = \frac{\pi_2 w_2}{r - g_2} \tag{3.4}$$

Because it is assumed that individuals choose for a particular schooling career to gain long run utility, vocational schooling will be chosen if $V_2$ exceeds $V_1$ and vice versa. The ratio between the earnings streams of both alternatives is defined

$$\frac{V_2}{V_1} = \frac{\pi_2 w_2}{\pi_1 w_1} \frac{r - g_1}{r - g_2} \tag{3.5}$$

After taking logarithms on both sides, a Taylor series approximation to the non-linear terms around the population average yields a linear decision function at this stage

$$I = \alpha_0 + \alpha_1[\ln \pi_2 - \ln \pi_1] + \alpha_2[\ln w_2 - \ln w_1] + \alpha_3 g_1 + \alpha_4 g_2 + \alpha_5 r + \eta$$

Because the discount variable $r$ is an unobserved variable, we add to the RHS of the decision equation a vector of observed variables that influences the schooling decision through its effect on the discount rate. If the discount rate value is assumed to vary with a person's social economic status, the additional RHS variables $x_r$ will reflect on a person's social economic status. Finally, because at the time of the schooling decision respondents base their choice on anticipated earnings streams, the decision function expresses earnings, growth and employment rates in terms of expectations

$$\begin{aligned} I = \quad & \alpha_0 + \alpha_1 E[\ln \pi_2 - \ln \pi_1] + \\ & \alpha_2 E[\ln w_2 - \ln w_1] + \alpha_3 E g_1 + \alpha_4 E g_2 + \alpha_5 x_r + \eta \end{aligned} \tag{3.6}$$

The student chooses vocational education if $I$ exceeds zero. He or she opts for an apprenticeship program otherwise.

Together with the latent decision variable $I$, earnings, employment and growth rates are considered endogenous variables. Earnings for the relevant stages read as[1]

$$\ln w_1 = \beta_1 x + \epsilon_1, \ \ln w_2 = \beta_2 x + \epsilon_2 \tag{3.7}$$

Earlier earnings together with the variables $w_1$ and $w_2$ define the growth rates for the relevant stages and read as

$$g_1 = \gamma_1 y + \varepsilon_1, \ g_2 = \gamma_2 y + \varepsilon_2 \tag{3.8}$$

Finally, employment rates are measured by employment status (employed/ unemployed) and are defined in terms of a probit functions, where the probability of being jobless if you have chosen apprenticeship is defined as

$$\begin{array}{lll} P(\text{unemployed}) & = 1 - \pi_1 & = 1 - \Phi(\theta_1 z) \\ P(\text{employed}) & = \pi_1 & = \Phi(\theta_1 z) \end{array} \tag{3.9}$$

The vectors $x, y$ and $z$ contain the explanatory variables for earnings, growth and employment rates, respectively. The vectors $x$ and $y$ contain variables that represent both individual and job type characteristics. The vector $z$ reflects on the probability of being with or without a job and contains only individual characteristics. The function $\Phi$ represents a standardized cumulative normal distribution function

### Estimation and self-selection

Because people (in a Mincerian world) base their own school choices on future earnings, we firstly focus on the earnings stream related variables. Using a SUR estimation procedure of the earnings and employment equations on both tracks separately would render inaccurate estimates. Knowing that the $w_1, g_1$ and $\pi_1$ are only observed for those people who have chosen for the option of apprenticeship, the relevant errors have conditional expectations, $\mathrm{E}[\epsilon_1 \mid I \leq 0]$, which are usually not equal to zero. Hence, we opt for a switching regression model where we estimate the model in three stages.

Firstly, we estimate equation (3.6) in a reduced form. This enables us to calculate the selection bias; the Mill's ratios are defined $-\phi/\Phi$ and $\phi/(1-\Phi)$. Secondly, we estimate earnings, growth rate and the probability of work simultaneously, adding the selectivity corrections to the RHS of each variable. The third and final stage is a probit estimation of the structural equation defined in (3.6) including the expected earnings, growth and job probabilities.

## 4 Data and results

The data that will be used in the empirical analysis are taken from the OSA-labour market survey 1985-1994. We use the most recent wave (1994 issue) as departure; the total number of people present in the 1994 wave is 4538. Contrary to the previous waves of the survey, the 1994 wave contains detailed information about schooling types.

People from the youngest cohorts are included if they left school in 1985. From either the OSA wave of 1985, 1986, 1988, 1990 or 1992 we extract information on earnings. Together with the yearly earned income in 1994 we define the growth rate. Because of school careers abroad, missings on earnings, growth rates, the present labour market status and (partial) non-response on other relevant variables 2204 observations had to be removed from analysis. Information on the public expenditures on schooling are taken from the Netherlands Central Bureau of Statistics (1992). These series are only available from 1950. For matching the series with the OSA sample, we excluded people who were older than 12 in 1950. Finally, from the sample all individuals who do not satisfy the required education standards and who are older than 66 in 1994 are excluded. We end up with a sample consisting of 573 observations of which 212 school careers fitted the apprenticeship system. Descriptive statistics appear in Table 1.

At first sight there are no obvious differences between the two groups in terms of average income, growth rate and employment probability. But there are differences found in the composition of the two groups. Compared to vocational students, apprentices are mostly male and technically orientated. They are most likely to have a history in lower vocational education and have low educated fathers. Furthermore, the construction market favours part-time trained students.

**Step 1: Reduced decision function**

The econometric analysis on different schooling careers starts in Table 2. Here, we use a probit technique and apply this on the reduced form school choice equation between vocational education and apprenticeship. The first two columns present these estimates. The effects run almost parallel to the observed differences described in Table 1. An interesting observation is that if we drop the school type variables from our analysis, the gender dummy is significant and positive.[2] With the school type variables included the gender dummy is not significantly different from zero. All school type dummies have a significant influence on the full- or part-time schooling decision. Of course, because apprenticeship is largely technically orientated, students who desire an economic orientated education are more or less forced into the traditional vocational system. Students who have a history in general education are more likely to attend full-time education. Those who choose the apprenticeship track are much more vocationally orientated. This effect, however, is only weakly observed. This seems to suggest that the

decision that favours vocational education over an apprenticeship program is, at least, partly taken at an earlier stage in the schooling career. Notify that the reference group are those who had primary school only before they enjoyed one of the two tracks. The impact of social background variables shows that if the father is highly educated, the student favours vocational education. Age turns out to have a positive effect. It seems that younger people favour part time education more than earlier generations seem to do. On the other hand, due to the increase in public spending on education over time the age effect is not entirely clear cut. Public expenditures on lower and intermediate vocational education per student show a positive influence. The more money the government spends on vocational education, the more students will choose the vocational track.[3]

**Step 2: Earnings, growth and employment rates**

By means of the reduced form estimates we calculate Mill's ratios to correct for possible selectivity in the annual earnings, rate of growth and employment equations. To allow for possible correlation between earnings, earnings growth and the probability of having a job, the annual earnings, rate of growth and employment equations are estimated simultaneously using a maximum likelihood technique. Discussions on the results on earnings, growth and employment probabilities are presented separately.

To begin with annual earnings, in Table 3 we present the structural estimates of the net earnings functions of both school types.[4] It turns out that most of the explanatory variables have little effect on earnings in either the apprenticeship or vocational schooling track. Exceptions are the gender and experience variables. In this sample women's net earnings are close to 39% and 46% of male earnings. Because labour supply differences are also captured by this variable, the gender effect seems quite strong. The parameters of the variables experience and experience squared (divided by hundred) fit the traditional Mincerian parabolic relation. Maximum earnings are reached after a working period of 36 and 39 years respectively. The other variables have no significant impact on annual net earnings. Furthermore, there is no empirical support for a possible selection bias in both educational tracks.

The empirical results with respect to the growth rates in Table 4 show that almost all variables have little effect. Exceptions are experience variables and changes in labour supply. In the apprenticeship situation we find an U shape in experience. Minimum growth is reached after a working period of 24 years; in reality it means that on average growth decreases with

age. At the age of about 48 growth in earnings rises again. No significant experience effect is found for intermediate vocational education. Changes in labour supply has an obvious influence on income growth. The more you work, the more you will earn resulting in a positive effect on the rate of growth.[5] All other variables, including the selectivity corrections, have no significant impact on the rate of growth.

In Table 5 we present the results of the employment probabilities. Like the model of Kiefer and Neumann (1979) the employment equation can be regarded as a wage stream offer function where workers accept a particular earnings stream offer as long as it exceeds an individual specific reservation wage stream. Identification of all these equations is possible only if the set of variables used in the earnings, growth rate and employment equations is different. Therefore, the job type dummies are excluded from the employment equation. The significant age parameter in both educational tracks indicates that employability decreases in age. A remarkable result with respect to schooling history is that people who have a general education at the time of decision making have lower employment probabilities. General skills obtained at an earlier stage of the schooling career seem to affect labour market transitions negatively if people desire vocational education. In apprenticeship programs this general skill effect has faded away. Again, selectivity is not observed.

Finally, Table 6 presents the correlation coefficients. Income and growth rate are highly correlated. Note that correlation does not only point to correlation between the earnings and growth errors but also to correlation between omitted variables in both equations. For apprenticeships, we find for earnings and rate of growth no significant correlation with employment probabilities.[6]

**Step 3: Returning to a structural decision function**

Before we return to the estimates of the structural decision function in Table 7, we spend a few words on our identifying assumptions. Firstly, social background characteristics are in the choice equation and not in the earnings, growth and employment function. We realize that there is room for disagreement. We follow Willis & Rosen (1979) but accept that within a broad human capital context distinctions between determinants of earnings and the determinants of the discount rate are difficult, if not impossible, to make. Secondly, the job type dummies are excluded from the employment equation for obvious reasons. Finally, we have excluded the gender and mar-

ital status dummies in the choice equation. These identifying variables are chosen only because they were insignificant in the first stage. Due to the fact that the calculated selectivity corrections are nonlinear functions of the measured variables of the reduced form equation, the structural equation might also be identified off the nonlinearity. Hence, we added this version in the final two columns.

Our first observation is that our empirical findings seem pretty robust; there is no remarkable difference between both structural equations and between the corresponding variables in both the structural and reduced form equations in Table 2. With respect to the anticipated earnings gains, we find that all the relevant earnings variables, like differentials between wages, growth rates and uncertainty, show up insignificant in the decision equation. Also testing for joint significance does not come up with significant findings.

# 5 Empirical implications

Now that we have all the ingredients, we are able to shed some 'Dutch' light on both the dual system and the traditional system of full-time education. We highlight three interesting points.

Our first observation deals with the economic motivation on individual schooling choice. It turns out that we took a long and complicated route to find out that the economic theory of schooling demand does not particularly hold for the decision between apprenticeship programs and traditional intermediate vocational education. Dutch students in either the traditional intermediate vocational or the apprenticeship system are not affected by anticipated earnings gains. We should stress, however, that in this economic model on school choices we applied a restrictive utility measure and equated utility with life time future earnings implying that investment motives dominate consumption motives. Whether this is entirely true might be questionable. To us it is clear that with regard to schooling both investment and consumption motives are involved. Like ice cream, the consumption of schooling may yield distinct feelings of pleasure.

Our second point worth mentioning is that we find no self-selection in school choices. According to Willis (1986) this observation points to equality in comparative advantage. This means that those who choose apprenticeship perform financially like full-timers if they had chosen dual education. Still, there are structural differences between both type of students. Compared to full-time students, part-time students are mostly male, technically

orientated, likely to have a history in lower vocational education and have low educated fathers.

Whether a dual education system compares favourably to the traditional full-time education system is the third point of concern. More precisely, we look at differences in learning efficiency, labour market efficiency and information efficiency, as discussed in Section 2. Learning efficiency differences, if present, are easily transformed into restrictions on earning careers. If apprentices have an initial short-term skill advantage and face little career opportunities, we should find that their initial earnings are higher under a dual education system. The growth rate, on the other hand, should be smaller. In our sample we do not observe structural differences in annual earnings.[7] Differences in average earnings growth are also not observed; we find small differences in age effects. Growth is U-shaped in age with a minimum at the age of about 48 years old. In contrast to part-time education the vocational track shows only moderate age effects. Resuming, both apprenticeship programs and traditional vocational schooling turn out to be equally efficient in terms of learning. Labour market efficiency arguments predict relatively low rates of youth unemployment among young apprenticeships. Again, this is not observed in the OSA sample. Finally, if the aforementioned partial information advantage among young apprenticeships is present, firms will cream the best students and exclude less capable students. As such, a regime with a dual education system would predict more inequality than a regime with traditional vocational education. We have opposite findings; in Table 6 inequality among vocational students is significantly higher. This observation might be due to the fact that in the Dutch dual system graduates often face restricted job careers, see also Van der Velden & Lodder (1995). That is, the fact that there is less variation in job type offers is a dominating factor in explaining the variance in the earnings variables.

Bear in mind that the evaluation of one school system over another is a tricky exercise. In the ideal world where students are unconstrained in their choice between apprenticeship and vocational schooling, and where students form rational expectations about their earnings and employment, and where there are no externalities, choices are optimal, both individually and socially by definition. Hence, in the ideal world the answer to the question which system outperforms the other is already known. Finding an answer seems a redundant exercise.

However, once we allow for market imperfections our model is not perfectly suited to determine optimal educational assignments. Optimal edu-

cational assignments cannot be made because the model is unable to distinguish welfare losses that are soley due to capital market imperfections. looking at the modeled unobservables both talents and possible liquidity constraints are captured. Hence, in the less ideal but more realistic world the assignment of socially optimal eduction according to this model has become very difficult.

# 6 Concluding remarks

In the 1980s many countries tended to look upon the dual system in the German speaking countries as a highly successful model of vocational education and insertion of young workers in the labour market. This exemplary role of the German apprenticeship system was at that time seen as an important factor in the economic success of the German economy. Further, countries that were faced by high youth unemployment rates looked for measures to improve the efficiency of the transition from school to work. The relatively low youth unemployment rates in Germany in the 1980s appeared to be due to the dual system of vocational education. This notion was confirmed by studies that compared vocational education systems and youth unemployment rates across countries. Like the number of training places, the attention for the dual system seems to be counter-cyclical as well. The German economy has recently gone through a strong recession, resulting in high and rising unemployment rates. This has led to a debate in Germany about the future of the dual system. Some people have turned to the Dutch system of vocational education as a new role model. The Dutch system can best be described as a combined system of classroom vocational education and apprenticeship system. Students who for some reason do not go through the classroom oriented system of vocational education (vocational schools) have the opportunity to achieve the same level of qualification through the apprenticeship system. On the other hand students who are in the vocational schools spend one out of their four years in school as a trainee in a firm.

In this paper we have compared the apprenticeship system and the vocational school system in the Netherlands. Our findings shed further doubt on the assumption that the apprenticeship or dual system is a superior system of vocational education. Basically our finding is that in the long run there are hardly any differences in earnings, earnings growth and employment opportunities between workers who have gone through the vocational schools and those who have taken the apprenticeship route. Although it might well

be that initially apprenticeship workers are at an advantage because they are already partly in the labour market, this advantage seems eventually to disappear.

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## Notes

[1] In the absence of information on initial earnings, we use annual earnings observed in 1994 instead. In fact, we believe that in the Netherlands the 1994 earnings are a better measure to reflect on life time earnings. Using initial earnings would probably be incorrect for young workers because of the institutionally determined youth wages. Moreover, Willis & Rosen (1979) show that their model produces similar outcomes for both initial earnings and earnings observed later on on life.

[2] This version is estimated but not tabulated in this paper.

[3] Again, age and spending are definitely correlated. For example, in the late 1970 the quality of schooling eroded because the number of apprenticeship programs in the Netherlands dropped due to recession. In order to counter this cyclical effect Dutch government stimulated vocational education in order to meet or maintain some quality standard. Hence, age and public expenditures seem to affect school choices in opposite directions. Without average spending, the age effect reduces but remains positive.

[4] Willis & Rosen (1979) want to know whether expected earnings affect educational choice. They therefore include in their earnings equations (almost) only variables that were known at the time of the schooling decision, mainly a large number of ability scores. Our data do not have this information. In order to improve our expected earnings measure, we include the variables job type and having a partner. The inclusion of the job type variable seems permissable; it can be argued that students choose their schooling career having certain job type characteristics in mind. With respect to having a partner this is not the case. Only if we apply some farfetched argument that having a partner may point to certain social talents or skills, we may continue.

[5] In the Netherlands the labour supply decision is highly institutionalized through nation wide union contracts between the employer and employee. We find that institutionalized labour supply itself is decreasing over time. For example, in the seventies most contract workers worked 42 hours a week. Nowadays, most unions claim that the working week should consist of 4 days. That is, a labour supply of 36 hours. We believe that respondents anticipate these structural labour supply changes. Henceforth, changes in labour supply are included in the model.

[6] In theory, we should apply the same technique for vocational students. Unfortunately, the estimation procedure does not converge. We estimated earnings and rate of growth simultaneously. The employment rate is esti-

mated independently. Looking at the outcomes of Table 6 where dependency is modelled for the apprenticeship track, this econometric short cut seems admissible.

[7] Notify that these earnings are collected in 1994 and do not represent initial earnings. They do, however, account for age effects which seem to be identical in both tracks.

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**Table 1:** Descriptive statistics

| | apprenticeship | | vocational | |
|---|---|---|---|---|
| | mean | se | mean | se |
| gender | 0.278 | | 0.517 | |
| couple | 0.769 | | 0.776 | |
| age | 36.243 | *10.232* | 34.204 | *9.188* |
| **education type** | | | | |
| technics | 0.508 | | 0.256 | |
| economics | 0.039 | | 0.343 | |
| service trades | 0.119 | | 0.215 | |
| other | 0.331 | | 0.185 | |
| **education history** | | | | |
| primary school | 0.141 | | 0.054 | |
| lower vocational | 0.601 | | 0.253 | |
| lower general | 0.159 | | 0.435 | |
| intermediate vocational | 0.061 | | 0.043 | |
| intermediate general | 0.035 | | 0.212 | |
| **job characteristics** | | | | |
| food & clothing industry | 0.092 | | 0.054 | |
| chemical & metal industry | 0.274 | | 0.354 | |
| public utilities | 0.022 | | 0.019 | |
| construction | 0.146 | | 0.035 | |
| trade & catering | 0.172 | | 0.122 | |
| transport & communication | 0.066 | | 0.040 | |
| banking & commercial services | 0.048 | | 0.095 | |
| public services | 0.176 | | 0.275 | |
| **social background variables** | | | | |
| parental lower education | 0.477 | | 0.261 | |
| parental intermediate education | 0.194 | | 0.286 | |
| parental higher education | 0.137 | | 0.234 | |
| parental education missing | 0.190 | | 0.217 | |
| **earning stream related variables** | | | | |
| 1994 log earnings | 10.164 | *0.419* | 10.132 | *0.532* |
| growth | 0.057 | *0.101* | 0.044 | *0.100* |
| unemployed 1994 | 0.221 | | 0.288 | |
| **other variables** | | | | |
| public spendings per student | 4.009 | *2.176* | 4.616 | *2.057* |
| experience | 13.942 | *12.025* | 8.956 | *9.133* |
| change in labour supply | -0.397 | *6.188* | -1.053 | *6.340* |
| change in job type | 0.362 | | 0.307 | |
| *N* | 226 | | 367 | |

**Table 2:** Decision function, reduced form

| | | |
|---|---|---|
| intercept | -4.121 | *1.554**** |
| **individual variables** | | |
| age | 0.068 | *0.029**** |
| gender | -0.012 | *0.168* |
| couple | -0.014 | *0.171* |
| **human capital variables** | | |
| **schooling history** | | |
| lower vocational | -0.314 | *0.244** |
| lower general | 0.881 | *0.258**** |
| intermediate vocational | -0.265 | *0.321* |
| intermediate general | 1.272 | *0.328**** |
| **school type** | | |
| economics | 1.394 | *0.272**** |
| service trades | 0.849 | *0.227**** |
| other | -0.412 | *0.161**** |
| **social background characteristics** | | |
| parent intermediate education | 0.597 | *0.177**** |
| parent higher education | 0.489 | *0.193**** |
| parent education missing | 0.388 | *0.166**** |
| **institutional effect** | | |
| public spendings per student | 0.280 | *0.128*** |
| | | |
| Mean log likelihood | -0.458 | |
| $N$ | 573 | |

Standard errors in italics;
*, ** and *** mean significant at 1%, 5% and 10% level respectively

**Table 3:** Estimates of log earnings

| | apprenticeship | | vocational | |
|---|---|---|---|---|
| intercept | 9.794 | *0.260**** | 10.122 | *0.395**** |
| **individual variables** | | | | |
| gender | -0.610 | *0.256**** | -0.536 | *0.105**** |
| couple | 0.134 | *0.072*** | -0.097 | *0.117* |
| **human capital variables** | | | | |
| experience | 0.025 | *0.012*** | 0.026 | *0.020** |
| experience squared | -0.034 | *0.029* | -0.033 | *0.054* |
| **schooling history** | | | | |
| lower vocational | 0.037 | *0.130* | 0.082 | *0.150* |
| lower general | 0.101 | *0.170* | 0.147 | *0.182* |
| intermediate vocational | 0.130 | *0.246* | 0.063 | *0.230* |
| intermediate general | 0.222 | *0.234* | 0.155 | *0.200* |
| **school type** | | | | |
| economics | -0.147 | *0.322* | 0.065 | *0.177* |
| service trades | 0.225 | *0.333* | -0.060 | *0.172* |
| other | 0.025 | *0.132* | 0.000 | *0.138* |
| **job type** | | | | |
| food & clothing industry | 0.074 | *0.213* | 0.014 | *0.213* |
| public utilities | 0.077 | *0.401* | 0.265 | *0.541* |
| construction | 0.006 | *0.164* | 0.037 | *0.302* |
| trade & catering | 0.006 | *0.156* | -0.069 | *0.194* |
| transport & communication | 0.156 | *0.200* | -0.052 | *0.254* |
| banking & commercial service | 0.033 | *0.243* | -0.031 | *0.196* |
| public services | 0.054 | *0.172* | -0.066 | *0.192* |
| **selectivity parameters** | | | | |
| $\phi/(1-\Phi)$ | -0.040 | *0.238* | | |
| $-\phi/\Phi$ | | | 0.062 | *0.237* |
| $N$ | 176 | | 261 | |

Standard errors in italics;
*, ** and *** mean significant at 1%, 5% and 10% level respectively

**Table 4:** Estimates of rate of growth

| | apprenticeship | | vocational | |
|---|---|---|---|---|
| intercept | 0.182 | *0.059**** | 0.088 | *0.067** |
| **individual variables** | | | | |
| gender | -0.023 | *0.061* | 0.008 | *0.021* |
| couple | -0.011 | *0.023* | -0.014 | *0.022* |
| **human capital variables** | | | | |
| experience | -0.011 | *0.003**** | -0.004 | *0.004* |
| experience squared | 0.023 | *0.008**** | 0.008 | *0.011* |
| **schooling history** | | | | |
| lower vocational | -0.023 | *0.035* | -0.023 | *0.028* |
| lower general | -0.005 | *0.043* | -0.001 | *0.037* |
| intermediate vocational | -0.034 | *0.054* | -0.056 | *0.039** |
| intermediate general | -0.061 | *0.071* | -0.025 | *0.040* |
| **school type** | | | | |
| economics | -0.085 | *0.076* | 0.040 | *0.032* |
| service trades | 0.004 | *0.069* | 0.022 | *0.034* |
| other | 0.011 | *0.032* | 0.020 | *0.025* |
| **job type** | | | | |
| food & clothing industry | 0.032 | *0.046* | 0.010 | *0.033* |
| public utilities | 0.026 | *0.233* | 0.005 | *0.038* |
| construction | 0.036 | *0.032* | 0.004 | *0.046* |
| trade & catering | 0.015 | *0.035* | 0.006 | *0.028* |
| transport & communication | 0.019 | *0.040* | -0.026 | *0.039* |
| banking & commercial service | -0.004 | *0.049* | -0.010 | *0.029* |
| public services | 0.002 | *0.035* | 0.002 | *0.027* |
| **growth related variables** | | | | |
| change in hourly labour supply | 0.005 | *0.001**** | 0.006 | *0.000**** |
| change in job type | 0.000 | *0.011* | -0.000 | *0.009* |
| **selectivity parameters** | | | | |
| $\phi/(1-\Phi)$ | 0.002 | *0.061* | | |
| $-\phi/\Phi$ | | | -0.008 | *0.044* |
| $N$ | 176 | | 261 | |

Standard errors in italics;
*, ** and *** mean significant at 1%, 5% and 10% level respectively

**Table 5:** Estimates of employment rates

| | apprenticeship | | vocational | |
|---|---|---|---|---|
| intercept | 2.698 | *0.977**** | 2.993 | *0.629**** |
| **individual variables** | | | | |
| age | -0.035 | *0.015**** | -0.032 | *0.008**** |
| gender | -1.244 | *0.331**** | -0.827 | *0.219**** |
| couple | -0.101 | *0.380* | 0.454 | *0.192**** |
| **human capital variables** | | | | |
| **schooling history** | | | | |
| lower vocational | -0.139 | *0.440* | -0.612 | *0.380** |
| lower general | -0.316 | *0.626* | -1.043 | *0.373**** |
| intermediate vocational | -0.050 | *0.768* | -0.209 | *0.597* |
| intermediate general | -0.150 | *1.061* | -1.154 | *0.402**** |
| **school type** | | | | |
| economics | -1.274 | *0.905**** | 0.121 | *0.360* |
| service trades | -0.912 | *0.625**** | -0.606 | *0.337*** |
| other | -0.388 | *0.468* | 0.090 | *0.255* |
| **selectivity parameters** | | | | |
| $\phi/(1-\Phi)$ | 0.644 | *0.817* | | |
| $-\phi/\Phi$ | | | 0.539 | *0.467* |
| $N$ | 226 | | 367 | |

Standard errors in italics;
*, ** and *** mean significant at 1%, 5% and 10% level respectively

**Table 6:** Correlations and variations

| | apprenticeship | | vocational | |
|---|---|---|---|---|
| standard deviation earnings | 0.290 | *0.024**** | 0.420 | *0.015**** |
| standard deviation earnings growth | 0.076 | *0.007**** | 0.085 | *0.003**** |
| correlation earnings & growth | 0.225 | *0.147** | 0.197 | *0.060**** |
| correlation earnings & employment rate | 0.126 | *1.647* | | |
| correlation growth & employment rate | -0.126 | *1.404* | | |

Standard errors in italics;
*, ** and *** mean significant at 1%, 5% and 10% level respectively

**Table 7:** Decision function, structural model

| | | | | |
|---|---|---|---|---|
| intercept | -4.351 | *1.619**** | -3.996 | *1.653**** |
| **individual variables** | | | | |
| age | 0.069 | *0.029**** | 0.070 | *0.029**** |
| gender | | | -0.055 | *0.317* |
| couple | | | -0.198 | *0.296* |
| **human capital variables** | | | | |
| **schooling history** | | | | |
| lower vocational | -0.030 | *0.317* | -0.249 | *0.240* |
| lower general | 1.101 | *0.161**** | 0.916 | *0.252**** |
| intermediate vocational | 0.022 | *0.268* | -0.266 | *0.356* |
| intermediate general | 1.441 | *0.311**** | 1.221 | *0.371**** |
| **school type** | | | | |
| economics | 1.412 | *0.597**** | 1.465 | *0.610**** |
| service trades | 0.601 | *0.317*** | 0.473 | *0.426* |
| other | -0.445 | *0.179**** | -0.510 | *0.180**** |
| **social background characteristics** | | | | |
| parent intermediate education | 0.580 | *0.179**** | 0.593 | *0.179**** |
| parent higher education | 0.485 | *0.195**** | 0.499 | *0.196**** |
| parent education missing | 0.398 | *0.167**** | 0.402 | *0.169**** |
| **institutional effect** | | | | |
| public spendings per student | 0.279 | *0.131*** | 0.284 | *0.132*** |
| **earning stream variables** | | | | |
| $E \ln \pi_2/\pi_1$ | -0.029 | *0.322* | 0.039 | *0.338* |
| $E \ln w_2/w_1$ | -0.590 | *0.707* | -1.024 | *1.079* |
| $Eg_2$ | 2.698 | *3.252* | 2.186 | *3.294* |
| $Eg_1$ | -0.376 | *2.082* | -0.173 | *2.109* |
| | | | | |
| Mean log likelihood | -0.457 | | -0.456 | |
| $N$ | 573 | | 573 | |

Standard errors in italics;
*, ** and *** mean significant at 1%, 5% and 10% level respectively