Does subsidized adult apprenticeship improve the aggregate level of education?

by

Cecilie Dohlmann Weatherall

ced@sfi.dk

Abstract

Denmark introduced a very generous apprenticeship subsidy for adults over 25 years of age in 1997 to address the challenges of globalization and the increased demand for skills. The aim of the adult apprenticeship subsidy (AAS) was to increase vocational skills levels among the non-educated in order to fill job vacancies (i.e. prevent bottlenecks). The purpose of this paper is to evaluate the effect of the AAS on the attendance rate into vocational education from 1996 to 2003. Through a simple theoretical human capital model, I show that AAS is likely to influence education decisions in the whole population. Additionally, a simulation of the model illustrates the difficulties of finding an empirical strategy capable of evaluating the effect of a subsidy in the absence of an obvious control group. This paper empirically examines the effect of the subsidy, given the exogeneous shift in AAS in 1997, among the unskilled by the difference-in-difference estimator used in international educational evaluation studies on a rich panel data. The results show that the AAS has a significant positive effect on the vocational attendance rate among 25-year-old men in 1998. However 25-year-old unskilled women were not affected by the subsidy. Additionally, the AAS has no significant effect on the attendance rate after 1998. Thus, the results do not unambiguously find that a generous AAS increases the attendance rate among the non-educated.

1. Introduction

Due to increased globalization and international competition, developed countries compete by upgrading the skills of their labor force (OECD 2006). One method of development is to upgrade skills through adult apprenticeship programs for non-educated adults, a particularly vulnerable group with high unemployment risk. The focus of this paper is on skill upgrading through an adult apprenticeship subsidy (AAS).

Denmark and many other OECD countries have initiated many programs to increase the education level in the population. In contrast to other countries nearly all people involved in vocational or further education in Denmark are entitled to a very generous subsidy or wage. Furthermore vocational education in Denmark is mainly obtained through an apprenticeship. The apprenticeship program is a common way of receiving vocational skills in Denmark, Germany, Austria and Switzerland. On the other hand, in countries such as the UK, the US and various EU countries, apprenticeship programs play a rather small role.

The Danish AAS was introduced in 1997. To my knowledge, no other OECD country has ever introduced such a generous AAS. The AAS increase on average an apprentice's income by more than 30 percent. The Danish AAS is offered mainly to unskilled people over 25 years old, independent of their family background or income, so that they can receive a vocational education, which helps prevent bottlenecks in the labor market. An AAS is only available to people starting an apprenticeship in an industry listed as a "bottleneck" industry by the regional labor market board. In all regions (see sample list in appendix A) vocational fields with a high proportion of female students (e.g. office and trade, food and domestic production and healthcare) rarely make the list. This paper conducts separate empirical analyses for women and men because of the clear gender differences in potential subsidy areas.

The history of the AAS program is that the subsidy became permanent after a successful one-year tryout period. Figure 1 shows that, except for 1997, at least 2500 persons start an apprenticeship with an AAS every year.[1] About 10 percent of all people over 25 in an apprenticeship position receive AAS. More than 70 percent of all subsidized apprenticeships in 1997 and 1998 are men. Although, the gender distribution has become more balanced over the years, in 2004 men still comprise the majority.

[1] A late approval date in 1997 may explain the highest number of new starters in 1998, as section 2 will discuss in detail.

Moreover, Figure 2 shows that the overall number and share of new apprentices increased slightly in 1997-1999. That a reasonable share of the apprenticeships were subsidized and that the number of people starting apprenticeships increased in 1997 and 1998 led the authorities to claim that the AAS was a success (PLS Consult, 1999).

This paper questions the "success claim" after 1998 by examining whether the AAS increases apprenticeships among people over 25 years old at the expense of apprenticeships among people under 25 years old. Figure 3 supports the claim by showing that the apprenticeship attendance rate among unskilled men increases for 25-year-olds but not for 24-year-olds in 1998, the year in which the subsidy was expected to be fully introduced. Figure 4 shows that age does not appear to influence the attendance rate for 24-year-old and 25-year-old women to the same extent as for men.

Another obvious question to ask is whether it is a 'success' if the AAS made people who would have continued their academic education change to a vocational education instead. By simulating a simple human capital model with and without an AAS, this paper shows the relevance of both questions. The simulation results can also illustrate the complications arising from an empirical evaluation of a subsidy, given the lack of a perfect or obvious control group.

Previous empirical studies have evaluated the incentives and the returns to apprenticeships in Germany (Harhoff and Kane 1997), the Netherlands (Smits and Zwick 2004), Austria (Soshice 1994), Switzerland (Wolter and Mühlemann 2006), the US and the UK (Elbaum and Singh 1995). However, due to the non-existence of AAS in other countries, no studies have ever evaluated the effect of an AAS on the enrolment into vocational education. Instead, several international studies have looked at the effect of subsidies to college students. In a Danish study an increase in student aid increases the demand for college, but the increase is a lot less than found in other studies (Nielsen et al 2006). For example, US studies show that generous college subsidies to disadvantaged families increase enrolment into colleges significantly (Dynarski 1999, Manski & Wise 1983, Angrist 1993). These positive results of educational subsidies on college enrolment suggest that a generous AAS would increase the enrolment into vocational training. Introducing an AAS is expected to influence not only the individual's choice of skill level but also government spending, income and wage

distribution, which should also indirectly affect firm demand for labor.[2] However, this paper will only empirically evaluate if the AAS initiative increases the attendance rate of vocational education among non-educated adults (i.e. the direct effect).

The empirical analysis applies the different eligibilities among age groups and the introduction of the subsidy in 1997 on a rich Danish register panel from 1995 to 2004. The age-specific eligibility means that an AAS applicant has to be at least 25 years old. Groups above and below 25 years of age are represented in the Danish data. The AAS was first available in 1997, and the Danish data includes information on people receiving AAS and people not receiving AAS before and after 1997. Combining the facts and the available data makes it possible to identify the effect of AAS, by comparing the unskilled 25-year-olds who are eligible for an AAS with the non-eligible unskilled 24-year-olds from 1996 to 1998. One could argue that comparing all age groups above and below 25 years of age would capture the AAS effect better. However, doing so would jeopardize the identification strategy because the 20-year-olds are not obviously comparable to the 30-year-olds. Thus the empirical analysis focuses on the subsidy effect among the group of unskilled (who have delayed their studies), who are suddenly exposed to the possibility of a subsidy. Therefore the results revolve around an empirical partial analysis and should not be confused with the total effect of an AAS.

Countries such as the US, the UK and Germany treat apprenticeship programs as a good way of improving the skills of the non-educated. The question is if an AAS is the best way to improve vocational skills among the non-educated adults. As the results of this paper's empirical AAS evaluation are vital to the evidence on whether or not the AAS works in Denmark, this paper contributes to the international public debate on using subsidies to improve vocational skills in developed countries for the purpose of increasing future employment.

The paper is set up as follows: Section 2 describes Danish students financing possibilities when they take vocational or further education (i.e. short and long continued academic pursuits). Section 3 uses an extended theoretical human capital model to illustrate the effect of an AAS. In section 4, I simulate the theoretical model to

[2] The literature shows that introducing a subsidy can be optimal for society. Suppose individuals have less information about the future than the government and therefore individuals find it risky to start an education. Because the government has more information it intervenes (e.g. subsidy to education). The intervention removes individual uncertainty indirectly. Thus the individuals make educational choices that are optimal for society (Manski 1989; Dynarski 1999)

show that a subsidy influences all people's education decisions and that a proper control group is difficult to find. Section 5 discusses the implications of using the difference-in-differences estimator as a possible empirical strategy. Section 6 describes the rich Danish register panel data. The empirical results of the effect of an AAS on the attendance rate into vocational education are analysed in section 7. Section 8 concludes.

2. Institutional framework

This section describes the generous Danish educational system showing that non-educated people in Denmark have several financially supported education options for increasing skills. I put different educational financing possibilities into perspective through an example comparing a carpenter in a traditional apprenticeship with a carpenter in an apprenticeship with AAS and an economist taking further education.

In Denmark the share of skilled adults has increased drastically over the last decade. In 1995 around 60 percent of the adult population between 25-64 years of age had an upper secondary education and about 25 percent of the population between 25-34 years of age had no education (OECD 1997). By 1999 the share of Danish adults with an upper secondary education increased to 80 percent, while less than 15 percent of these 25 to 34 years of age had no education (OECD 2001). Thus, Denmark became part of a select group of countries (the Czech Republic, Germany, Japan, Norway, Switzerland and the US) with the highest skilled adult population. The higher skill level in the Danish population is a result of more people taking vocational and further education. In 1997 about 118.000 were registered in vocational education (including apprentices and apprentices with an AAS) and 173.000 students were taking a short or long term further education. In 2004, vocational education and further education increased to about 121.000 and 202.000, respectively (Statistical Yearbook 2006).

Although Denmark didn't have the highest skilled adult population in 1995, the government spent more than 6,5 percent of GDP on educational institutions. The share of government spending was one of the highest among OECD countries and still is today (OECD 2006). Furthermore, expenditure per student increased by 10 percent simultaneously with the increase in skill level among the Danish adult population from 1995-1999.

Overall, the Danish educational system is very generous. Tuition at Danish public and most private educational institutions is free for Danish students and for all EU/EEA[3] students, as well as for students participating in exchange programmes.[4] Nearly all trainees and students receive either a wage decided by a union agreement or a student state grant at some point during their education. Although there are multiple education possibilities in Denmark, for simplicity this paper will categorize education in three groups chosen to illustrate the differences in individual opportunities for financing education: apprenticeship (vocational education), apprenticeship with an AAS (vocational education) and further education.

The normal procedure for starting an apprenticeship is to apply at a vocational institution. For some education types the enrollment acceptance rate is every 5 weeks; for other types it is 10 weeks, depending on the availability. The education is divided in two parts. The first part is the introduction, consisting of course work, which lasts for a maximum of 20 weeks. The second part, the main education, takes place primarily at a workplace (if the apprentice finds a spot) and for a short period every year in an educational institution. An apprenticeship takes 3,5 years on average. Depending on the vocational field, the shortest education period is 2,5 years and the longest is 5,5 years.[5] The workplace pays the apprentice a wage agreed upon by the unions. When the apprentice is at school, although he or she still receives a wage, the employer is reimbursed from the Employers Reimbursement Fund during the schooling period. The wage increases dramatically over the education period even though the wage normally does not reach the minimum wage level.

Although the traditional apprenticeship system has been functioning for many years, subsidized adult apprenticeship only began in 1997. As mentioned earlier, AAS is offered by the authorities primarily to unskilled unemployed and employed people over 25 years old who want to take a vocational education in a bottleneck industry. The idea is to subsidize the employers so that the apprentices receive a regular wage, not a student wage. The aim is to create a win-win situation in which the employer gets a more qualified employee and the employee receives better future wages

[3] European Economic Area
[4] From 2006 all other students have to pay a tuition fee
[5] Including the basic education that takes between 5 and 20 weeks

and employment possibilities − with neither the employer nor the student suffering economically.[6]

In 1997, the first AAS to an employer hiring a previously unemployed apprentice was 40 DKK (Danish kroner) per hour. The AAS for hiring employed apprentices was 35 DKK per hour. The employer received the AAS for the first 2.5 years of employing the apprentice. Furthermore, the employer received a higher reimbursement when the subsidized apprentice attended school than when an ordinary apprentice attended school. In 1998 and 1999 minor changes were made to the regulation about complaints and details in the wage bargaining agreement. In 2003, the AAS was changed so that all employers received a wage subsidy of 35 DKK an hour no matter which kind of apprentice they employed. In 2005 a minor change mandated the Danish Labor Market Board to pinpoint the bottleneck industries.

An apprentice with or without an AAS obviously is very dependent on the current labor market situation and the availability of apprenticeship openings. An AAS application may possibly be rejected even if a workplace offers an apprentice a spot in a bottleneck industry. Table 8 shows that even though certain educational fields were specified as bottleneck areas in Greater Copenhagen in 2004, some of the apprentices did not have an AAS in these fields. The reason why not all apprentices over 25 years of age in bottleneck industries receive an AAS is that the local labor market authorities evaluate each individual application at the time they receive it. Thus, the labor market situation in which an apprentice negotiates a contract with a workplace might differ from when the authorities evaluate an application. Additionally, if someone in an apprenticeship program has no workplace connection in certain bottleneck industries, AAS application will be denied. Despite these rejections, however the majority of applications are accepted (e.g. Greater Copenhagen Area accepted about 65 percent of the applications between 1997 and 2004).

Although the AAS was a new initiative in 1997, in the early 1990s the unskilled workers unions were already encouraging their members to start an apprenticeship even without a subsidy. The motivation derived from the fact that a lot of members were working as unskilled workers in fields that were transforming into skilled labor occupations. Thus, the unions helped their members analyze their abilities

[6] The consequences for the state are debatable (i.e. it is not necessarily a socially optimal solution to subsidize apprenticeships). The debate is not included in this paper.

and skills, and found ways to help them begin further vocational education in the workplace. Additionally, the unions helped their members negotiate a reasonable wage during their studies. The unions also worked to get the employees' work experience to count in the education and thus shorten the educational period. Due to the union efforts, even in the early 1990s, the attendance rate among older people with work experience was expected to increase. But these union initiatives didn't stop in 1997. Therefore, one might think that these initiatives, and not the AAS, caused the increase in the vocational education attendance rate for people over 25 years old. If this is true, then the overall effect of an AAS would be overestimated. However, because the union initiatives have no age restriction, I expect that both 24-year-olds (not eligible for an AAS) and 25-year-olds (eligible for an AAS) are affected equally by these initiatives.

In early 1996, the unions knew about the upcoming AAS reform. They heavily promoted the reform to their members and to workplaces. Additionally, the unemployment offices informed the unemployed about the introduction of the new AAS. Thus workplaces, the unskilled employed, and the unemployed were well informed about the generous AAS. Although all the people eligible for a subsidy appeared well informed, there still existed a delay in applications and acceptances. For example, the Greater Copenhagen Area authority received its first application on April 21, 1997, and the application was not approved until June 19, 1997. Furthermore, the area received nearly four times as many applications in 1998 as in 1997. This paper evaluates the effect of AAS in 1998 because it is the first year with no obvious application and approval delays.

Compared to the apprenticeship system (with and without AAS) the structure and the financing of further education are very different. First of all, students apply once a year for further education and the enrolment occurs either once or twice a year. Every Danish resident over the age of 18 is entitled to public support for his or her further education. The support for students' living costs is awarded by the State Educational Grant and Loan Scheme. The subsidy system is managed by the State Educational Grant and Loan Scheme Agency in collaboration with educational institutions and is under the supervision of the Danish Ministry of Education.[7] Every student enrolled in a higher education course is entitled to a number of monthly grants

[7] The annual budget amounts to over 11 billion DKK, around 0.8 per cent of GNP.

corresponding to the prescribed duration of the chosen study, plus 12 months.[8] In combination with student grants, students are offered supplementary state loans with very favourable interest rates.[9]

To illustrate the financial differences among educations, I compare the financial situation of a Danish carpenter apprentice with and without an AAS and a Danish economics student (see table 2). Each column represents an average apprentice or student. The example in Table 2 shows that it is very beneficial for a person to postpone apprenticeship until he or she is 25. The reason is that taking an apprenticeship with an AAS increases the apprentice's pay for the entire education period to nearly 40 percent. Compared to the economics student, the apprentice with an AAS earns double in a shorter period. Thus, the carpenter apprentice with an AAS is financially better off than a carpenter apprentice without AAS or an economics student. In this example, even the employer is financially better off by hiring a carpenter apprentice with an AAS rather than a traditional apprentice. Furthermore, the employer might see an advantage in having a more mature apprentice (more than 25 years of age) who can finish his or her education more quickly due to work experience.

Overall, this example shows that during an education period an apprenticeship with an AAS is beneficial for the apprentice and his or her employer. However, choosing an education demands taking three other factors into account. First, the return on education is important. The example makes clear that the starting wage for an economist is dramatically higher than the starting wage for a carpenter. Second, the opportunity cost of postponing education due to the AAS can be quite extensive and can reduce life time earnings. Third, the personal cost of becoming a carpenter instead of an economist might be very extensive depending on a person's aptitudes. Taking a choice against one's aptitudes could reduce the lifetime earnings of a carpenter. The financial and personal costs and the lifetime earnings are included in the theoretical human capital model that follows.

[8] Within a maximum of 70 monthly grants students can change from one course to another. Further extension is possible due to sickness or childbirth. Students living at home with their parents or working extensively have reduced grants.

[9] The grants take up 2/3 of the total support and loans 1/3. The interest rate for the loans is set by Parliament. Students must start paying back state loans no later than one year after the end of the year in which they graduate or give up their studies. The loan must be repaid within 15 years. About half of all students make use of state loans.

3. The theoretical model for subsidized adult apprenticeship

By extending the traditional human capital theory (Becker 1962), this section shows the expected theoretical effect of introducing an AAS in Denmark. In Becker's traditional human capital framework, an individual maximizes discounted lifetime earnings net of schooling cost. Then the optimal choice of schooling occurs when the marginal cost of schooling equals the marginal benefit of schooling. Introducing a schooling subsidy reduces the cost of schooling, thereby increasing the demand for schooling.

Extending the human capital framework by introducing a subsidy to only one type of education and not to others makes the schooling decision framework more complicated. The basis for the model is that an AAS is given to non-educated individuals over 25 years of age taking an apprenticeship. The theoretical model assumes that individuals have information about the AAS from day one, meaning that they decide on education paths from day one.[10] Thus the model is static. Furthermore, all workers are assumed to receive jobs that match their skills. Although, Albrecht et al. (2006) point out that assuming all workers can get jobs is not realistic. Therefore this model is applied strictly for illustrative purposes. Thus, no need exists here for complicating the set-up of the model.

In this extended model, a person's life is divided into six discrete time periods that fit the real education-work life decision framework (i.e. t=1 18-24 years of age; t=2 25-31 years of age; t=3 32-38 years of age; t=4 39-45 years of age; t=5 46-52 years of age; t=6 53-59 years of age). The assumption is that a person who takes an education in the first time period of his or her career has five time periods in which to receive the return of the educational skills he or she obtained in the first period. If the person instead takes an education in the second time period, it is assumed that he or she has only four time periods in which to receive the return of the obtained educational skills. More specifically, the assumption is that the first period, $t = 1$, it is possible to work or study but without an AAS. In the second period, $t = 2$, it is possible to work or study and receive an AAS while being an apprentice. From the third to the sixth period, $t = 3,4,5,6$ it is only possible to work. Assuming at least four periods of work following

[10] This assumption is in contrast to recent dynamic human capital literature, which includes dynamics in the wage setting (i.e. the schooling decisions change over the lifecycle) (Wolpin & Keane 1997).

education is necessary in a model for the Danish labor market with high unskilled wages, because else no one would study.

Individual i can choose among five occupational alternatives: take an apprenticeship, s_{vs}, attend further education, s_{fs}, work as an unskilled employee, e_{ns}, work as an employee with vocational skills, e_{vs}, or work in high-skilled job, e_{fs}.[11] It is not possible to combine the different occupation alternatives in same time period, and not all alternatives are available at each period. Diagram 1 illustrates the different choices an individual can take at different time periods. The diagram shows that five different lifetime paths existing this extended human capital model. A person can obtain a job requiring vocational or further educational skills only if that person has previously taken the specific education. In other words, a person can only receive a vocational skilled wage if he or she has taken an apprenticeship in one of the previous periods.

The individual's maximization problem is to choose the lifetime path that maximizes lifetime income. Suppose $d_{k,t,i} = 1$ when individual i chooses occupation k in period t. The lifetime reward (benefits minus costs), R_i, for individual i can be written as

$$R_i = \sum_{t=1}^{6} R_{k,t,i} d_{k,t,i} \tag{1}$$

In this simple model the work and education reward is clearly separated because only the cost of education is a function of individual characteristics. For simplicity the reward of working ($d_{k,t} = 1$ when $k = e_{ns}, e_{vs}, e_{fs}$) is only a function of the wage related to a certain education level. [12] Thus the wage equation is a function of a constant term, see equation (2).

$$R_k = w_k \qquad \text{when } k = e_{ns}, e_{vs}, e_{fs} \tag{2}$$

[11] Unemployment is not included as a state. But in this model they could be a small group under the group working as non-skilled.

[12] Traditional human capital theory: Wage is a function of skill accumulation and years of experience in a certain occupation (often in a quadratic form)

The reward of attending school ($d_{k,t}=1$ when $k=s_{vs},s_{fs}$) is extended from the traditional human capital investment idea by including a fixed direct cost of schooling and an indirect cost of schooling. The direct cost is student fees, c_k, which do not change over time. The direct cost is reduced if the student can receive an AAS. In this case the AAS, $aid_{k,t}$, is both age- and education-specific. Thus only apprentices who start in the second time period (above 25 years of age) receive a subsidy. Therefore only $aid_{vs,2}>0$.[13] The indirect cost is divided into two parts. The first part captures an individual's initial aptitude for a certain education, which is education and individual specific, $ic1_{k,i}$. The second part of the indirect cost captures the individual's readiness for starting school, which is time- and individual-specific, $ic2_{t,i}$. Thus, if an individual's ability for studying varies with respect to the education stream, then the cost of studying different types of education varies, too. A key assumption is that the cost of education varies with time based on the idea that costs change when people mature or change social and economic status over time. For example, a person could mature over the years − thereby reducing the cost of studying − and then decide to take an education over a number of years. Then the reward of attending education for individual *i* in period *t* can be written:

(3) $$R_{k,t,i}=-c_k+aid_{k,t}+ic1_{k,t}+ic2_{t,i} \qquad \text{when } k=vs,fs$$

In Denmark one can think of $c_{ve}=c_{fe}<0$ because all students receive a fixed subsidy to live on while studying. Therefore the cost might be negative. Now it is possible to express an individual's choice of education over a lifetime by the following value function:

(4) $$V_i=\max_{d_{k,t,i}}\left[\sum_{t=1}^{6}\delta^{t-1}\sum_{k}^{K}R_{d,t,i}d_{k,t,i}\right]$$

[13] The students have to have an agreement with a workplace; this restriction is not taking into account in the simple framework.

More specifically, an individual *i*'s education-employment choice has to maximize the utility over life time. This means that the individual has a static optimization problem and thereby has to decide between the values discounted by δ of the five lifetime paths illustrated in diagram 1.

This analysis focuses on the optimization problem where the pathway including apprenticeship with an AAS is compared with the other four pathways, because this paper looks at the effect of an AAS. First, an analysis of the amount of subsidy that is necessary to make an individual indifferent between taking an apprenticeship with AAS or taking no education at all:

$$
\begin{aligned}
(5) \quad & w_{ns} + \delta(-c_{vs} - ic1_{vs,i} - ic2_{2,i} + aid_{vs,2}) + (\delta^2 + \delta^3 + \delta^4 + \delta^5)w_{vs} \\
& = w_{ns} + \delta w_{ns} + (\delta^2 + \delta^3 + \delta^4 + \delta^5)w_{ns} \\
<=> \quad & aid^*_{vs,2} = w_{ns} + (\delta + \delta^2 + \delta^3 + \delta^4)(w_{ns} - w_{vs}) + c_{vs} + ic1_{vs,i} + ic2_{2,i} \\
=> \quad & d^*_{k,t} = \begin{cases} e_{ns}, e_{ns}, e_{ns}, e_{ns}, e_{ns}, e_{ns} \\ e_{ns}, s_{vs}, e_{vs}, e_{vs}, e_{vs}, e_{vs} \end{cases} \quad \text{if} \quad \begin{matrix} aid_{vc,2} \le aid^*_{vc,2} \\ aid_{vc,2} > aid^*_{vc,2} \end{matrix}
\end{aligned}
$$

Similar to the traditional human capital framework, this simple extended model shows that an individual is indifferent to taking an apprenticeship with an AAS or taking no education if the return to a vocational education is equal to the opportunity cost of taking a vocational education. Clearly the small wage differences between no schooling and apprenticeship and the high costs of apprenticeship increase the amount of AAS necessary for making an individual choose apprenticeship over no education at all.

Second, an individual is indifferent to taking an apprenticeship as an adult with an AAS and taking an apprenticeship without an AAS earlier in the lifetime path when:

$$
\begin{aligned}
(6) \quad & w_{ns} + \delta(-c_{vs} - ic1_{vs,i} - ic2_{2,i} + aid_{vs,2}) + (\delta^2 + \delta^3 + \delta^4 + \delta^5)w_{vs} \\
& = -c_{vs} - ic1_{vs,i} - ic2_{1,i} + \delta w_{vs} + (\delta^2 + \delta^3 + \delta^4 + \delta^5)w_{vs} \\
<=> \quad & aid^{**}_{vs,2} = -\frac{1}{\delta} w_{ns} - \frac{1}{\delta} ic2_{1,i} + ic2_{2,i} + \frac{\delta - 1}{\delta}(c_{vs} + ic1_{vs,i}) + w_{vs}
\end{aligned}
$$

$$\Rightarrow \qquad d_{k,t}^{**} = \begin{cases} s_{vs}, e_{vs}, e_{vs}, e_{vs}, e_{vs}, e_{vs} \\ e_{ns}, s_{vs}, e_{vs}, e_{vs}, e_{vs}, e_{vs} \end{cases} \qquad \text{if} \qquad \begin{matrix} aid_{vc,2} \leq aid_{vc,2}^{**} \\ aid_{vc,2} > aid_{vc,2}^{**} \end{matrix}$$

This result indicates that if the costs of vocational education increase a lot over the lifetime, then the AAS for delayed education has to be comparably large for an individual to delay education rather than starting vocational education early. Furthermore, the higher the unskilled wage, the less money through an AAS is necessary for making an individual choose delayed apprenticeship − the opposite from the scenario of subsidized apprenticeship with no education at all.

The third scenario in which an individual is indifferent to taking an apprenticeship with an AAS or taking further education at an early age is the following:

$$\begin{aligned} & w_{ns} + \delta(-c_{vs} - ic1_{vs,i} - ic2_{2,i} + aid_{vs,2}) + (\delta^2 + \delta^3 + \delta^4 + \delta^5) w_{vs} \\ & = -c_{fs} - ic1_{fs,i} - ic2_{1,i} + \delta w_{fs} + (\delta^2 + \delta^3 + \delta^4 + \delta^5) w_{fs} \end{aligned} \tag{7}$$

<=>

$$aid_{vs,2}^{***} = -\frac{1}{\delta} w_{ns} + w_{fs} + (\delta + \delta^2 + \delta^3 + \delta^4)(w_{fs} - w_{vs}) + \frac{1}{\delta}(-c_{fs} - ic1_{fs,i} - ic2_{1,i}) + c_{vs} + ic1_{vs,i} + ic2_{2,i}$$

$$\Rightarrow \qquad d_{k,t}^{***} = \begin{cases} s_{fs}, e_{fs}, e_{fs}, e_{fs}, e_{fs}, e_{fs} \\ e_{ns}, s_{vs}, e_{vs}, e_{vs}, e_{vs}, e_{vs} \end{cases} \qquad \text{if} \qquad \begin{matrix} aid_{vc,2} \leq aid_{vc,2}^{***} \\ aid_{vc,2} > aid_{vc,2}^{***} \end{matrix}$$

If the return to further education is relatively high and the cost concerning further education is relatively small, then the AAS has to be relatively high to make the individual indifferent to apprenticeship with an AAS or taking further education early in life.

This discussion leads to the final scenario, in which the individual is indifferent to delayed apprenticeship with an AAS or delayed further education.

$$(8)\qquad \begin{aligned} & w_{ns} + \delta(-c_{vs} - ic1_{vs,i} - ic2_{2,i} + aid_{vs,2}) + (\delta^2 + \delta^3 + \delta^4 + \delta^5)w_{vs} \\ & = w_{ns} + \delta(-c_{fs} - ic1_{fs,i} - ic2_{2,i}) + (\delta^2 + \delta^3 + \delta^4 + \delta^5)w_{fs} \end{aligned}$$

$$<=> aid^{****}_{vs,2} = (\delta + \delta^2 + \delta^3 + \delta^4)(w_{fs} - w_{vs}) + c_{vs} - c_{fs} + ic1_{vs,i} - ic1_{fs,i}$$

$$=> \qquad d^{****}_{k,t} = \begin{cases} e_{ns}, s_{fs}, e_{fs}, e_{fs}, e_{fs}, e_{fs} & \text{if} \quad aid_{vc,2} \le aid^{****}_{vc,2} \\ e_{ns}, s_{vs}, e_{vs}, e_{vs}, e_{vs}, e_{vs} & \text{if} \quad aid_{vc,2} > aid^{****}_{vc,2} \end{cases}$$

Clearly, if the return to further education is relatively large compared to the return to vocational education, then the AAS has to be very large to make the individual indifferent to a lifetime path including an apprenticeship with an AAS or a lifetime path including delayed further education.

The discussion of the different scenarios makes evident that an introduction of an AAS affects the choice among all the different educational paths. The AAS actually increase the demand for attending apprenticeships, given an income effect, a substitution effect or a postponement effect.

An income effect is defined as the increase in demand for apprenticeships among the non-educated due to the indirect increase in the return to vocational education. The return increases because the AAS reduces the cost of taking the education, not because the wage of vocational skills increases. In this setting the income effect occurs when the introduction of an AAS makes a non-educated individual become an apprentice. The Danish authorities seem to have introduced the AAS because they believed that the income effect would be strong among the non-educated, thereby increasing their demand for vocational skills.

Another effect that has to be considered is the substitution effect. The substitution effect is defined as the increase in demand for subsidized apprenticeships among those who otherwise take further education. Again, the return of a delayed apprenticeship increases because the AAS reduces the cost of vocational education while the cost of further education remains the same. Thus, a person who previously wanted to delay further education prefers taking a delayed apprenticeship with an AAS instead. Actually, the person substitutes a further education with an apprenticeship at

the expense of a decreased demand for further education. The substitution effect increases the demand for vocational education.

Finally the introduction of an AAS can result in a postponement effect. The postponement effect is defined as the increase in demand for delayed apprenticeships with an AAS among young people who normally would have started education earlier in their life (i.e. before 25). The young person receives a higher return by postponing his or her studies because the AAS decreases the cost of taking an apprenticeship later. Thus, at the expense of a decreased demand for education among young people, the demand for vocational education increases among adults as a result of the postponement effect.

This analysis of the extended human capital model makes clear that the introduction of an AAS increases the attendance rate to vocational education among adults more than 25 years of age. The goal of the AAS is exactly to increase the demand for vocational skills. The problem is that the analysis also shows that the increased demand for vocational skills among adults is to some extent the result of a decreased demand for other education types. This result contradicts the general goal of trying to improve the overall skill of the workforce. The size of the partial effect and the total effect of introducing an AAS is better illustrated in a simulated theoretical model using "real" life numbers from Denmark. This is the focus of the next section.

4. A simulation of the introduction of the Danish AAS

The effect of an AAS can be difficult to analyze empirically because the total effect consists of different partial effects. Simulating the previous theoretical model with and without an AAS allows us to illustrate some of the different effects that occur. Thus, the simulated model can illustrate the increase in demand for vocational education due to substitution, income and postponement effects.

In the extended human capital model just described in section 3, individuals' heterogeneous preferences, costs and abilities are captured in the cost setup. As is common in the literature, this paper does not contain any information about each individual's cost function with respect to a certain education. Instead, I create and use different possible cost functions in the simulated model. Two cost scenarios illustrate the effect of an AAS on the educational attendance rate. In both cost scenarios the

assumption is that the costs of education, c, vary across *j* educations and *t* time periods as follows:

(9) $c_{j,t,i} = \alpha_{j,t,i} + \beta_{j,t,i}$ where $j = vs, fs$ $t = 1,2$

where the costs are a function of an individual's initial aptitude for a certain education, α , and time cost for taking a certain education, β. Thus, α and β are comparable to $ic1$ and $ic2$ in the theoretical model just described. The first simulation assumes that the costs of studying vary independently within and across education streams and time in the following way:

(9a) $c_{vs,1,i} = \alpha_{vs,1,i} + \beta_{vs,1,i}$

(9b) $c_{vs,2,i} = \alpha_{vs,2,i} + \beta_{vs,2,i}$

(9c) $c_{fs,1,i} = \alpha_{fs,1,i} + \beta_{fs,1,i}$

(9d) $c_{fs,2,i} = \alpha_{fs,2,i} + \beta_{fs,2,i}$

The independence assumption means that the aptitude-cost of an apprenticeship in the first time period is uncorrelated with the aptitude-cost of an apprenticeship in the second period. Furthermore, the cost of delaying the apprenticeship is uncorrelated with the cost of delaying further education. Even though the assumptions are simple, the simulated model predictions follow the results from the theoretical model described in section 3.

The second cost scenario assumes that costs vary across education streams and time but not within education and time:

(10a) $c_{vs1} = \alpha_{vs} + \beta_1$

(10b) $c_{vs2} = \alpha_{vs} + \beta_2$

(10c) $c_{fs1} = \alpha_{fs} + \beta_1$

(10d) $c_{fs2} = \alpha_{fs} + \beta_2$

In other words, it is assumed that a person who has high vocational aptitude when young also has high vocational aptitude as an adult. The same is true for the cost of time. Thus if it is costly to postpone vocational education, it is also costly to postpone further education. The second cost scenario might seem more realistic than the first, and the simulated models predictions will show the expected results as well.

As an illustration the changes in the educational distribution caused by introducing an AAS in Denmark, the simulated model includes some realistic numbers. Table 3 presents the actual wages and educational distribution from 1996 applied in the simulation. Table 3 shows that the non-educated are on average paid the least, and that employees with further education are paid the most. Employees with vocational skills in Denmark have on average not even earned 20 percent more per hour than non-educated employees. Table 3 also shows that approximately 37 percent of 30-year-olds have taken a vocational education before they turn 25, whereas not even 4 percent take one after they turn 25. However, among 30-year-olds who take a further education, the percentages are 20 and 7, respectively. Among 30-year-olds, more than 30 percent had no education at all.

As mentioned earlier, information on individuals' cost functions are missing. To make up for missing information, I create the two cost scenarios to fit the distributional education in 1996. Table 3 presents the distributional assumptions concerning the cost function in the two scenarios. For simplicity, the discount rate is assumed to be constant, but it is possible that it varies across persons and over time. Finally, I use the hourly wages and costs in Table 3 to calibrate wages and costs for the aggregated six time periods described in section 3.

It is expected that the educational distribution in table 3 changes when an AAS is introduced into the simulated model, because that is the prediction of the theoretical model in section 3. It is also expected that the size of the educational changes depends on the size of AAS. In the carpenter apprenticeship example in section 2, apprenticeship income during an apprenticeship increases by approximately 40 percent when an AAS is introduced. The income increase can also be interpreted as a cost reduction of 40 percent during studies. Therefore the model is simulated with an AAS that on average reduces costs by 40 percent. An AAS that reduces costs by 40 percent is very extensive, so the effect is expected to be extensive too. To test the consistency of

the results, I simulate the model using an AAS that reduces education costs on average only by 10 percent. Finally I simulate the model where an AAS that reduces costs by 40 percent is introduced after the first period. Thus, only the people who did not study in the first period can change their educational choice due to the sudden introduction of an AAS.

Tables 4 and 5 illustrate the simulation results, which show quite clearly that an AAS increases the attendance rate to vocational education among the adults regardless of cost structure. The elasticity of the demand for adult vocational education with respect to an AAS depends on the cost assumption and the time at which an AAS is introduced. For the independent cost scenario the elasticity is 1,32 when an AAS is introduced before period 1 and 0,41 when an AAS is introduced in period 1. The latter elasticity is the short-term effect and the first elasticity is the long-term effect. For the scenario with dependent costs, attendance is more elastic with an elasticity of 1,92. The large effect is mainly due to all the people who prefer to delay their apprenticeship when an AAS will later be possible.

Table 5 shows the mobility changes between educational paths when an AAS reduces the education cost by 40 percent in a scenario with dependent costs. Not surprisingly, all the people who choose a delayed apprenticeship without an AAS also choose a delayed apprenticeship with an AAS. Likewise interesting is that the new group of people choosing an adult apprenticeship with an AAS include not only the non-educated. Some of the new starters are people who previously would have chosen further education in the same period, further education in the previous period or vocational education in the previous period. Thus, the simulation results show that introducing a subsidy will make all individuals re-evaluate their education decision. Although one might argue that the results are due to the simulation of a simple static model, the results for the educational distribution changes in the whole population when introducing a subsidy are in line with Wolpin's & Keane's (1997) dynamic setting results.

In the scenarios with dependent and independent costs, the increase in the vocational attendance rate among adults can be divided into the income effect, the substitution effect and the postponement effect. In the dependent cost setting 12 percent of the increase is due to the income effect, where people prefer apprenticeship with an

AAS to no education. Eighty five percent of the increase is due to the postponement effect, where people postpone their vocational or further education. Finally, 3 percent of the increase is caused by the substitution effect, because people substitute delayed further education with AAS apprenticeships.

The simple exercise of simulating the theoretical model with an AAS illustrates two factors. First, the simulation results show that an AAS increases the attendance rate into vocational education among adults exactly as in the theoretical model. This result is not surprising, because the simulated model is set up as the theoretical model so an educational cost reduction is expected to increase the demand for education.

Second, the results show that the demand increase for delayed apprenticeship results from people deciding to start an apprenticeship, delay education, or change education. In other words, the "new attendees" come from *all* the different lifecycle educational pathways. This result is important for conducting an empirical AAS evaluation, because it illustrates the challenge of finding an obvious control group when the whole population is affected by AAS. This aspect is discussed further in the following sections on the empirical model and the empirical data at hand.

5. The challenges of an empirical evaluation model

The results of the simulated model show that an AAS influences the educational choices in the whole population. Therefore, the best empirical strategy for evaluating the total effect of an AAS is to split the population group into two, and to treat one half with an AAS and not the other half. Observing the two presumably homogeneous groups before and after the introduction of an AAS illustrates the true effect of an AAS if every other important factor is constant or on average has developed equally for the two groups. Thus a straightforward difference-in-difference estimator can find the effect of an AAS as follows:

$$(11) \qquad effect = (attend_{t=1}^{treat} - attend_{t=0}^{treat}) - (attend_{t=1}^{control} - attend_{t=0}^{control})$$

Where $attend_t$ is the vocational attendance rate among the treated (eligible for an AAS) or the controlled (not eligible for an AAS) at time t. Time period 0 is before the

introduction of an AAS and time period 1 follows the introduction of an AAS. This simple experimental method is not possible in this paper because the AAS was introduced in 1997 to everyone in the population over 25 years of age who fulfilled the conditions for receiving an AAS. Thus the empirical evaluation has to focus on partial effects, not on the whole *"true"* effect of an AAS in the Danish population. Even though the apprenticeship system is quite extensive in countries such as Denmark, Germany, Switzerland and Austria, Denmark is the only country to introduce an AAS. Therefore, no international studies have evaluated the effect of a subsidy on adult apprenticeships. In Addition, no empirical model is commonly used to evaluate apprenticeship subsidies.

In contrast, there are a great many studies evaluating the effect of different student aid programs on college attendance in the US. Some of the early studies by Manski and Wise (1983) focus on cross-sectional variation in aid and individual characteristics. These studies are vulnerable to bias induced by correlation between aid and unobserved propensity to attend college. Most of the first studies find no effect of aid on college attendance for young people. More recent studies such as Angrist (1993) focus on the GI Bill (veteran benefits) and find a positive effect on school completion by exploiting the change in benefit over time. More recently, Dynarski (1999) examined the effect of a shift in the federal financial aid policy. By using the exogenous shift in aid and eligibility of social security student benefits (death, disability or retirement of a parent), Dynarski finds a positive effect of aid on school attendance using a difference-in-differences estimator.

Inspired by the work of Dynarski and others, I use a difference-in-differences estimator to evaluate the effect of an AAS within a minor group of the Danish population, because the Danish data include both the period in which the exogenous change of an AAS occurs and comparable age groups around the age of 25. The data is a panel of a 10 percent sample of the Danish population over 16 years of age from 1995 to 2004. This data is described in detail in section 6. The age-specific eligibility means that an AAS applicant has to be at least 25 years of age. Both the age groups above and below 25 years of age are represented in the Danish data, which include information on AAS applicants and non-applicants before and after 1997, where the AAS was introduced. Combining these facts makes it possible to identify the effect

of an AAS, because comparing the unskilled 25-year-olds who are eligible for an AAS with the ineligible unskilled 24-year-olds from 1996 to 1998 is possible. I use 1998 instead of 1997 because, as previously mentioned, in 1998 the AAS was fully introduced. One could argue that comparing all age groups above and below 25 years of age would capture the AAS effect better. Unfortunately, such a comparison would jeopardize the identification strategy, which relies on comparable age groups.

Assuming no difference in covariates and time trends among the treatment group (25-year-olds) as well as the control group (24-year-olds) means that the effect of an AAS can be estimated by the following simple difference-in-differences estimation:

$$(12) \qquad attendvs_i = \alpha + \beta(age25_i * year98_i) + \delta age25_i + \lambda year98_i + \varepsilon_i$$

Where $attendvs_i$ is 1 if individual i starts an apprenticeship while $age25_i$ and $year98_i$ are dummies for eligibility for an AAS and the year for the full introduction of the subsidy, respectively. The effect of the AAS eligibility is captured by β. Equation (12) can be estimated by both OLS and probability models, depending on the assumption of a linear trend or a non-linear trend.

Suppose now that the covariates and time trends among the treatment and control groups are different. If so, then the AAS effect is not unambiguous and might indicate a heterogeneous time trend. Therefore, it is wise to include factors that pick up the different time trends in the difference-in-differences estimation.

$$(13) \qquad attendvs_i = \alpha + \beta(age25_i * year98_i) + \delta age25_i + \lambda year98_i + X_i\gamma + \varepsilon_i$$

Controlling for different sources of heterogeneous time trends, *X*, improves the β estimate. In other words, taking the individuals heterogeneous costs into account is important. These costs can vary due to observable characteristics and non-observable characteristics. An observable characteristic could be family situation, whereas an unobservable characteristic could be the ability to study. This paper takes only

observable characteristics into account.[14] The β still captures the estimated effect of an AAS among the 24-year-olds and 25-year-olds. As it is a reduced form estimate, the β is the total effect within the selected group, and the estimate is therefore the sum of the income effect, postponement effect, and substitution effect.

Although the treatment and control group in this analysis are narrowly defined, it is precisely among this group that one would expect to find a positive effect of an adult subsidy, since the 24-year-olds and the 25-year-olds are so similar. If an AAS doesn't increase the vocational attendance rate in this population it is difficult to claim that the AAS has an overall positive effect in society. To sum up, the difference-in-differences estimator used for this paper is chosen because it is the most sensible method for the rich data available.

6. Data and descriptive statistics on Danish education

The rich data at hand is a major reason why it is possible to use a difference-in-difference estimator to evaluate the effect of an AAS. The data, which comprises three data sources, is very informative about individual educational decisions.

The first source of data is register panel data from Statistics Denmark, including a 10 percent random sample of the population aged 16 years and over from 1995 to 2004. The data includes very detailed information on socio-economic individual characteristics, such as age, family status, educational skills, personal income, and unemployment history. All variables are measured annually except for the unemployment history variables. The unemployment and activation histories are reported as spells. The precise unemployment histories and occupation status allow us to identify precisely when individuals start apprenticeships or other education forms. The panel structure allows us to look at the population and the educational structure before the introduction of the AAS. Thus we can follow the individual's later educational choices. The panel data period is dictated by two incidences: First, it is important to have post and ex post data for 1997, when the AAS was introduced. Second, as the most reliable occupation information exists after 1995, I decided not to use information pre-dating 1995 (i.e. the unemployment information is best after 1995).

[14]Previous studies have attempted to take observable and unobservable heterogeneity into account as well (Grilliches 1977, Dynarski 1999, Angrist 1993, Manski & Wise 1983)

The second source of data includes records on all apprenticeships receiving an AAS from 1997 to 2005. The AAS is recorded in the DREAM register and collected by the National Labor Market Authority. The weekly observations are transformed into continuous spells to control for the length of the apprenticeships. The purpose of using this data is threefold. First, the data maps out an exact picture of all apprentices receiving an AAS from 1997 to 2005. Second, the data illustrates the relationship between application and approval rates in the Greater Copenhagen Area. Finally, the most important use of the DREAM register is to point out the apprentices with an AAS in the 10 percent population data because the population data does not have reliable information about the AAS before 2001. Thus, the DREAM register is both a complement and a support to the population register data.

The third data source is "The Databank of Statistics Denmark". From this data I obtained the macro-climate and education attendance rates (especially before 1995). Furthermore, the data helps to illustrate the comparability of the control group and treatment group for the difference-in-differences estimator.

Educational distribution and AAS in Denmark

In Denmark the educational distribution has changed from 1996 to 2004. Figures 5 and 6 show the educational distribution among 30-year-olds over time with respect to gender. The figures also illustrate when 30-year-olds start taking vocational or further education. The figures clearly show that the skill level improves over time among 30-year-olds, even though from 1996 to 2004 relatively few 30-years-olds started a vocational education before turning 25. In contrast relatively more 30-years-olds started a vocational education after turning 25. Finally, the percentage of students in further education increases for all age groups.

As a comparison to Figures 5 and 6, the overall picture among cohorts of the non-educated is that the vocational attendance rates decrease over a lifetime (see figures 7, 8, 9 and 10). A closer look gives the impression that dividing the cohorts in two groups is possible. One group is all the young people under 25 years of age in 1997 (cohort 1973 +). The second group of cohorts is the unskilled over 25 years of age in 1997, who in theory are eligible for an AAS. For the unskilled men under 25 years old in 1997, the attendance rate either increases or stops decreasing when they turn 25. For

the second cohort group, two tendencies occur. One tendency is that a decreasing attendance rate in 1997 is followed by an increasing rate in 1998 and a decreasing rate thereafter. The other tendency is an increased attendance rate in 1997 and 1998, followed by a decreasing rate thereafter. Both tendencies support the view that 1998 is the year when the AAS was fully implemented. For unskilled women, the figures are similar, except for small differences with respect to the 1975 and 1968 cohorts. No obvious reason for these exceptions exists.

If we now look more specifically at the AAS apprenticeships, Figure 11 and Figure 12 show that most men in an AAS apprenticeship participate in education periods within the fields of building and construction and iron steel and metal production.[15] The women were mostly in trade and office and food and domestic production. In addition, the entry into health increases for women, whereas the entry into building and construction decreases. Among men the attendance rate for entry into iron, steel and metal decreases. The distributional share is to some extent in line with the bottleneck list for subsidized educational fields (see appendix A).

A look at the AAS population by region shows that some differences occur, but in general the building and construction, iron, steel and metal production fields are the most subsidized for men (see table 6). For women, although the regional differences are bigger, the trade and office and food and domestic production fields are the most subsidized, whereas the building and construction fields are only popular in some regions (see table 7). Overall, a lot of regions subsidize many different educational fields. Only education, health, and services − which are typically female vocational education fields − are not subsidized. The lists of bottleneck areas from the Greater Copenhagen Area and the other regions in 2006 (from appendix A) support the impression that a lot of apprenticeship fields are subsidized. More specifically, the most populated areas (such as Greater Copenhagen, Århus, Fyn, Frederiksborg and Roskilde) are the regions with the most bottleneck areas.

Comparing apprentices with an AAS against apprentices without an AAS reveals some interesting characteristics. Table 1 shows that far from all apprentices over 25 years of age in the Greater Copenhagen Area receive an AAS, despite the fact their

[15] The information on field of education is taken from the year of entry and the year after entry. The entries for 2004 have a different distribution because there are many missing entries in the educational field. Thus the entries for 2004 are excluded.

educational fields are on the bottleneck list.[16] Compared to the theoretical set-up, where all adult apprenticeships are subsidized, the empirical data show that not all apprentices in bottleneck fields are subsidized. The unions and unemployment offices give several reasons for cases in which AAS is not received. First, caseworkers stress that lack of information about an otherwise favorable AAS can not explain why people enter a bottleneck education field without an AAS. Second, caseworkers point out that the lists of bottleneck areas are guidelines that change every three month. Therefore, within a person's application period, the list of subsidized fields could have changed. Third, caseworkers stress that in most cases the students in subsidized education fields can receive an AAS only if all the apprentices in the region have workplace connections. Finally caseworkers stress that the regional authorities have a budget limiting the number of students who can receive an AAS. Thus a denied application could simply be the result of a lack of financial resources.

Furthermore, one might expect that most employers and students make an agreement on apprenticeship with an AAS before the application is finally accepted. If they receive a rejection for the reasons just mentioned they probably still continue with the agreement without the AAS. Additionally, many of the applicants already work at the workplace where they make the educational agreement. Thus, the employees and employers are both mentally and economically already involved, and therefore they continue the educational agreement even without an AAS.

It is obvious that the subsidized apprentices are on average older than apprentices without an AAS because of the age restriction in the AAS regulation. Figure 13 illustrates the difference in age distribution among the subsidized and the non-subsidized apprentices. The descriptive statistics in Table 8 show the differences between the newly started apprentices with and without an AAS. The majority of subsidized apprentices are between 25-30 years of age, and a large proportion is older when starting an apprenticeship with AAS. Instead, among the non-subsidized apprentices, almost 85 percent of men and 65 percent of women are under 25 years old when they enroll. Due to the big differences in age distribution between apprentices with an AAS and those without an AAS, one would expect to observe other socioeconomic differences as well.

[16] Even more detailed educational categories show the same result.

Table 8 clearly shows socioeconomic differences exist between the two apprentice groups. There is an overrepresentation of men among the subsidized apprentices compared to the non-subsidized apprentices. Furthermore, it is common for persons in couples with children and without children to take a vocational education with an AAS. However, among the traditional apprentices, more than 50 percent of men and 40 percent of women are single. Surprisingly, no ethnic differences are apparent.

The apprentices work in all regions in Denmark and are distributed similarly with respect to gender and AAS. The major educational fields that the non-subsidized men enter include office and trade, building and construction and iron, steel, and metal. The majority of subsidized men mainly work in sectors like building and construction and iron, steel, and metal. In contrast, the non-subsidized women enter apprenticeships in fields such as trade and office and health, whereas the subsidized women are more diverse. The latter probably results from the authorities not including typically female educational fields on the bottleneck list.

The previous occupation of a new apprentice also differs among subsidized and non-subsidized men and women. The majority of all apprentices with an AAS are wage earners, but among the non-subsidized apprentices, a lot begin apprenticing directly after school. Therefore, both men and women who receive AAS have on average a previous income or wage significantly higher than the non-subsidized apprentices. Furthermore and not surprisingly the subsidized apprentices have remarkably longer work experience than the non-subsidized apprentices.

Control group versus treatment group

The difference-in-differences estimator explained in section 5 is appropriate for evaluating the AAS if a suitable control group and treatment group exists. Due to the age restriction, comparing people over 25 years of age with people under 25 years of age that have the same characteristics makes good sense. As previously illustrated, because age is correlated with a lot of other characteristics, those above and those below 25 is comparable as long as the actual ages are not too far apart (e.g. comparing the 24- and 25-year-olds, not comparing the 20- and 35-year-olds). The reason is that two age groups such as 20-year-olds and 35-year-olds are different with respect to family status, work experience, health conditions, etc. Most importantly, 35-year-olds have been

influenced by more than the 20-year-olds with respect to different exogenous business cycle shocks and changes in legal regulations. Thus comparing two similar age groups is a better idea.

Therefore, I narrow the control group and treatment group tremendously, using the 24-year-olds as a control group for the 25-year-old treatment group. Furthermore, employees who already have a vocational education are excluded because they do not have an obvious economic incentive for choosing a new vocational education. By contrast, the people who most likely are receiving an educational subsidy already are expected to have some economic incentive to start a new education because they receive a higher wage. They are therefore included in the sample. However, those who already had an apprenticeship position before the introduction of AAS are not included. Actually a maximum of 2.5 percent of the new apprentices were involved in other kinds of education the year before they became apprentices (see table 8).

The assumption that the unskilled 24-year-olds are a good control group for the unskilled 25-year-olds is valid if the two groups are identical with respect to attendance rates before the AAS was introduced and if they react in the same way to macro-shocks. Figures 14 and 15 demonstrate that apprentices attendance rates among 24- and 25-year-old men is split into two time periods: before and after the introduction of the AAS. The first period is 1991-1996, when the two age group attendance rates are parallel. In the second period, from 1997-2003, the attendance rates generally went in opposite directions − except for 2000 and 2003. Given the similar trend in attendance rates in the period before 1997, the 24-year-olds seem like a good control group for the 25-year-olds who are eligible for an AAS.

For the women, the vocational attendance rates among the relevant age groups are split into three time periods. In the first period, from 1991-1993, the attendance rate increases for the 24-year-olds whereas the rate decreases among the 25-year-olds. In the second period, from 1994-1997, the attendance rates are parallel for the two age groups. The last period, from 1998-2003, is characterized by the attendance rates going in opposite directions. The picture among women is more ambiguous than for the men because the rates do not exactly follow each other through the whole period before the 1997 introduction of the AAS. Furthermore, the difference in attendance rates after 1997 is puzzling, because both rates increased in 1997 (although relatively more

for the 25-year-olds). Thereafter, the attendance rate among the 25-year-olds actually decreases. Later the attendance rate increases again but relatively less than among the 24-year-old women. In this paper, the 24-year-olds are still used as a possible control group to the 25-year-olds women because the attendance rates of the two age groups are parallel before 1997. Obviously, the difference-in-differences estimation results for women is expected to be different from men because of the unexpected development in attendance rates after 1997 and the gender skewness in subsidized bottleneck fields. Therefore a slight skepticism about the results for women is advised because the identification criterion is to a certain extent questionable for women.

As section 5 describes, taking an individual's heterogeneous observable characteristics and non-observable characteristics into account can be important because these characteristics can influence the cost of taking a vocational education. Thus, the personal characteristics can be correlated with the vocational education attendance rate. Tables 9 and 10 show that on average the 24- and 25-year-olds starting apprenticeships do not differ significantly with respect to socioeconomic characteristics before the introduction of the AAS. Moreover, after the introduction of the AAS, there is no significant difference between them, although both the 25-year-old and the 24-year-old new apprentices seem to be exposed to a minor time trend from 1996 to 1998. Tables 9 and 10 to some extent support the assumption, that the 24-year-olds are a good control group for the 25-year-olds.

Even though the difference-in-differences estimator is a well-recognized estimator in the evaluation literature, we have to use it cautiously in evaluating the AAS. The reason is that the control group becomes the treatment group as well. To be more specific, when the 24-year-olds know they might be able to get a subsidy when they turn 25, some will behave accordingly, by delaying their apprenticeship for one year. The incidence of delayed studies might explain why a decrease in attendance rates among the 24-year-old men is observed right after 1997. In previous literature, this incidence is called the Ashenfelder's dip (Ashenfelder 1978). Therefore, a positive effect of AAS might not result from an increase in the apprenticeship attendance rates among the 25-year-olds, but rather from a decline in attendance rates among the 24-year-olds. This effect is referred to as the postponement effect in sections 4 and 5 of this paper. In other educational evaluations, geographical areas are often used as a control

group. Again, the problem of the control group becoming the treatment group exists, unless it is assumed that the people living in the control region can not move to the treated region. The same problem exists if an educational subsidy depends on household income, because people can work less and reduce their income to qualify for an educational subsidy. If they do so, they would end up in the treatment group. Thus, many studies suffer from the postponement effect, a condition important to keep in mind when interpreting the results.

Data sample for estimations

Even though the data at hand is rich in information about the entire Danish population, this paper uses only a minor sample for the final estimation. This choice is due to the importance of having a trustworthy control group and treatment group for the difference-in-differences estimation method. As previously argued, the unskilled 24-year-olds not already taking an apprenticeship make a good control group for the treatment group consisting of the unskilled 25-year-olds not yet apprenticed. The immediate analysis comes from looking at the effect from 1996 to 1998 among the unskilled 24- and 25-year-olds. For the men the immediate effect is estimated by the difference-in-differences method with 7687 observations. The sample for women has 9006 observations. For the delayed effect, all years are used. Thus, the sample for the men consists of 27571 observations and for the women there are 32787 observations.

To sum up, the rich Danish panel data on the non-educated 24-year-olds and the 25-year-olds and the exogenous introduction of the AAS in 1997 make it possible to evaluate the effect of the AAS by a difference-in-difference estimator for men and women. Section 7 describes the results.

7. Empirical results on the effect of an AAS

Using the difference-in-differences estimator from section 5 this section illustrates the effect of an AAS on the probability of attending apprenticeship. The discussion of the results and the use of methods concentrate around the results for men. The reason is that the difference-in-differences method seems more suitable for men than for women, given the preponderance of typical male-dominated education fields pinpointed for AAS subsidies.

The immediate effect of an AAS

Tables 11 and 13 present the results of the difference-in-differences estimator, illustrating the immediate effect of the AAS on the attendance rate. Table 11 shows the average probability of attending an apprenticeship as a 24-year-old and as a 25-year-old in 1996 and 1998. Among the unskilled 24-year-old men, 3.28 percent started an apprenticeship in 1996 before the AAS was introduced. The attendance rate increased a little in 1998 to 3.34 percent. By contrast, among the unskilled the attendance rate among 25-year-old men increased dramatically from 1.82 in 1996 to 4.39 in 1998. Here the 25-year-olds are eligible for an AAS in 1998 because they fulfill the age restriction, whereas the 24-year-olds are not. If there were no time trends and changes in socioeconomic factors, then the effect of the AAS would be the difference between the attendance rates over time between the 24-year-olds and the 25-year-olds. The difference for men is 2.51 percent, which is quite high considering the original attendance rate of 1.82 percent.

The difference-in-differences estimate can also be estimated through a simple OLS equation, as illustrated in equation 12 (see column 1 in table 13). The OLS estimate − 2.51 percent for the men − is highly significant. If the time trends among the 24-year-olds and the 25-year-olds are different, then the effect is a time trend instead of an AAS effect. I therefore include variables that pick up the time trends in the difference-in-differences estimation (see column 2 and 3 in table 13). The AAS still increases the probability of attending apprenticeship by 2.54 percent. Thus, including the socioeconomic variables does not change the subsidy effect, but it does increase the adjusted R^2.

The outcome variable regarding apprenticeship attendance is discrete rather than continuous, making a probit model more appropriate. Table 13 states the marginal effect of the probit model in column 4. The AAS effect of 2.7 percent is a bit bigger than the effect from the OLS estimates, but not significantly different. Although, the estimated subsidy effect does not change significantly, the adjusted R^2 increase significantly when the probit model is used. Thus the probit model fits the attendance decision better.

The first results for the immediate effect of an AAS for the unskilled 25-year-old men's attendance rate in 1998 compared to 1996 are significantly high as expected. The results are in line with Figures 3 and 8, where the 25-year-old men's attendance rate increased in 1998.

The delayed effect of an AAS

As Figure 8 shows, the apprentice attendance rate among unskilled men over 25 increases in 1998 and decreases thereafter. Therefore, one might expect the delayed effect of an AAS to be negative. The delayed effect of the AAS is thus estimated by the difference-in-differences estimator (see table 15-18). Table 15 shows the results for the effect of the AAS in 2002, whereas Table 17 illustrates the results for all years.

The 2002 result shows that the AAS effect is between 0.005-0.008 percent and insignificant. Thus, the vocational attendance rate among the unskilled 25-year-olds does not increase significantly compared to the attendance rate in 1996, before the introduction of AAS. Very small and insignificant AAS effects are also found for all other years after 1998 (see table 17). Once again, the probit models have the highest adjusted R^2. Therefore the difference-in-differences results from the probit models are the most reliable.

Gender differences regarding AAS

The results for men show that among unskilled 25-year-old men the effect of an AAS is strong and significant in 1998 but insignificant over the years. By contrast for the unskilled 25-year-old women the results in Tables 12, 14, 16, and 18 show that the AAS effect is very small and insignificant in all years.

It is not surprising that an AAS affects men and women differently. As discussed in section 2, the majority of educational fields that are on the regional bottleneck lists are traditionally male dominated. Therefore, many women probably do not see the AAS as being as attractive as the men do because these women want to study in educational fields not on the list.

Given the scarcity of typically female educational fields on the bottleneck lists, the difference-in-differences estimation method is of questionable value for women. One might think that the eligibility criterion needs to be narrowed if the

difference-in-differences method should be correctly used. Unfortunately, with the data at hand, creating better eligibility criteria is not possible. Instead, the conclusion is that the AAS has no measurable effect among the unskilled 25-year-old women.

The interpretation of the covariates in the attendance rate results

The results of the previous subsection clarify that the AAS has an immediate positive effect in 1998 among men but not in the rest of the observed time periods. Due to the generosity of the AAS, the high effect in 1998 is not surprising. The finding that men who are out of the labor force or studying (but not apprentices) have less risk of entering a vocational education than men working as wage earners or men who are self-employed is not surprising either. As an apprentice has to have an agreement with an employer to obtain an AAS, this agreement is easier to get for those who already have an employer. Therefore, the wage earners have a higher probability of entering an apprenticeship. The fact that a high income reduces the risk of becoming an apprentice is understandable because of the reduced economic incentive for starting an education.

Less easy to explain is the finding that long work experience increases the likelihood of becoming an apprentice. As long work experience is normally correlated with higher wages, the incentive to study would therefore be expected to be reduced. However, the group of people under analysis comprises unskilled and relatively young men. If an unskilled 25-year-old man has a lot of work experience, he might have already reached the top level of what an unskilled wage earner can earn. Therefore, the only way he can earn more money is to increase his skills. An unskilled man with many years of work experience might also have decreased his work ability through the effect of years of hard physical work. Therefore, he would need to get new skills to find another job with less physical pressure. Thus, the economic incentive to get an AAS apprenticeship exists among young unskilled people who take lifetime income into account.

Personal characteristics such as ethnicity and family background are apparently not significantly important in the schooling decision among the unskilled young men. However, a few geographical areas have a significant, but small positive effect on the vocational education attendance rate compared to the Greater Copenhagen

Area, a finding that of course is to some extent correlated with the labor market situation in these areas.

For the women, the probability of getting an apprenticeship increases if they have the same characteristics as the young men just described. Additionally, unemployed women have a reduced likelihood of becoming an apprentice compared to female wage earners.

The income, substitution and postpone effect regarding AAS

Although in section 3 and 4, the effect of an AAS was split into substitution, income and postponement effects, the results of the difference-in-differences estimations can not be split into these three different effects. The effects are summed up in the total empirical effect of an AAS.

The increase in the attendance rate among unskilled 25-year-old men can result from 24-year-olds postponing their education because of their expectation of a future AAS or from the companies where the 24-year-olds work advising them to wait until they are 25-year-old. This postponement effect is expected to occur among all age groups below 25 years of age, but the effect should be the strongest among the 24-year-olds because they lose a maximum of one year of salary as a skilled employee by delaying their apprenticeship for one year, while the younger age groups lose more.

The substitution effect occurs when the 25-year-olds decide to take an apprenticeship instead of further education due to the AAS. Comparing apprenticeships and further education is very difficult for a number of reasons. For example, the aptitudes necessary for being a good carpenter are very different from those necessary for being a good economist. Thus, the possibility of switching education might not be possible, as the human capital theory predicted. Furthermore, Table 2 shows taking an apprenticeship even without a subsidy is financially a better idea than taking a further education during the study period. Therefore, one would think that strong preferences for further education and future income is more important than the income one receives while studying, in deciding on further education. Thus introducing an AAS is not expected to influence most young people who prefer further education without a subsidy.

The income effect exists if unskilled 25-year-olds who decide not to take an education due to high education costs suddenly decide to take an apprenticeship due to an AAS. This effect seems very possible, especially among the 25-year-olds, because they have had enough work experience as unskilled workers to see that education might be necessary for sustaining a future income. Additionally, if they decide to take an education under favorable economic conditions, they still have plenty of years to receive a better income from working as a skilled employee.

Even though it is not possible to separate the three effects of the AAS results, I have argued that the income effect and the postponement effect probably occur within the two age groups analyzed for 1998. However, because the AAS had no effect after 1998 it might be the case that none of the three effects occur after 1998.

Sensitivity analysis and elasticity with respect to AAS

The AAS effect from these results is true for the narrowly defined treatment and control group. As shown in the simple human capital simulation model in section 4, the whole population's education decisions are affected by the AAS. Unfortunately, the results of the AAS can not be transferred to the whole population immediately. Instead, I expand the control group to 23- and 24-year-olds and the treatment group to 25- and 26-year-olds. Tables 19 and 20 show the results. As expected, there is an immediate effect of the AAS in 1998 for men but not over the rest of the period. Interestingly the effect is smaller than the effect found among only 25-year-olds − a finding also expected because the older one gets, the less economic incentive one has for getting an education. Thus the 26-year-olds reduce the effect of an AAS. Furthermore the 23-year-olds have a higher cost than the 24-year-olds in postponing their education, which again reduces the effect of an AAS.

Because all people over 25 in theory could start an apprenticeship with an AAS if they wanted to, the control and treatment group includes students. As Table 8 shows few people start an education and then switch to an apprenticeship with a new subsidy. The analysis is therefore conducted on the unskilled 24- and 25-year-olds who have not participated in any studies in the previous year. The results in Tables 21 and 22 illustrate an even bigger effect of the AAS among men in 1998 as opposed to earlier than among men already studying in another educational field.

In the literature, when education subsidies are evaluated, researchers compare either elasticities or US$ 1000 increases or reductions. In this paper, the elasticity and a US$ 1000 change is only worth looking at for unskilled 25-year-old men in 1998 because for women and for all other years the AAS effect was insignificant.

Although the elasticity with respect to the AAS can be calculated in different ways, this paper uses the average numbers illustrated in Table 23. The average numbers from Table 23 show that the vocational attendance rate among 25-year-old unskilled men is highly elastic to an AAS. Thus, the elasticity is 4.64.[17] However the AAS is also quite extensive in Denmark. On average the AAS increased the apprenticeship income by 32 percent or US$ 23880 in the subsample of 24- and 25-year-olds. Given the estimated AAS result, a US$ 1000 increase would increase the vocational education attendance rate among unskilled 25-year-old men by 0.11 percent.[18] This percentage is quite low compared to other educational subsidy effects found in the literature (e.g. Dynarski 1999; Manski and Wise 1983; Angrist 1993).

As mentioned earlier, previous studies on subsidizing education have mainly looked at college attendance in the US. It is therefore very difficult to compare previous results with the results of this paper especially because the previous subsidies often have been reserved for certain social classes or for people with previous military experience. Still compared to other studies, this paper shows that the effect of an AAS has an immediate high and significant effect on unskilled men. However, the amount of AAS is also quite extensive compared to subsidies given in other countries. Compared to other international education evaluations, it is puzzling that this study finds no measurable effect of the very generous AAS subsidy after 1998.

8. Conclusion

This paper posed the question whether the AAS improves the aggregate education level in the population. By simulating an extended human capital model, this paper shows that all population groups reconsider their education decision when an AAS is introduced. The simulation results show that the level of vocational skills among adults increases with an AAS. However, because substitution, income and postponement effects occur when the subsidy is introduced, the increase in vocational skills among

[17] e= (147,8/31,84)
[18] Increase = (2,69/23880)*1000) = 0,11 confidence interval 0,03-0,20

adults (i.e. more than 25 years of age) is to some extent caused by a decrease of skills in other population groups.

Even though the simulation illustrates the difficulty of finding an optimal empirical strategy capable of evaluating the total effect of an AAS, because of the absence of an obvious control group, this paper makes a partial empirical evaluation. Using the difference-in-difference estimator this paper examines the effect of the AAS among the unskilled who delayed studying. The rich panel data and the exogenous shift in the AAS in 1997 as well as the specific age-eligibility criteria make the evaluation possible.

The empirical results show that the AAS had a clear positive effect on vocational education attendance rates among non-educated 25-year-old men in 1998. However, 25-year-old women were not affected by the subsidy. Additionally the AAS had no significant effect on the vocational education attendance rate after 1998, regardless of gender. The immediate elasticity of attendance with respect to AAS for men was very high and significant in 1998.

The results are important for Denmark and for other countries that want to invest in improving the skills of their adult workforce. First, they need to know that a generous AAS suitable for a certain population group (e.g. non-educated men over 25 years old) increases the skill level immediately within the specific population group. Second, they should be aware of the fact that there seems to be no long run effect of the very generous AAS. Thus, an economic incentive (e.g. an AAS) for a specific education (e.g. vocational education) might not permanently improve the skill level of the population as a whole.

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Appendix A

Number of bottleneck areas within the major industry categories in Danish regions, 2006 4th quarter.

	St.K.	Fred.b.	Rosk.	Vestsj.	Storstr.	Bornh.	Fyn
Office& Trade	2	2	0	2	1	1	2
Building & construction	18	18	12	12	8	10	12
Industrial engin. & other	0	1	1	1	1	1	0
Service	1	1	1	1	0	0	0
Food & domestic agricultural & fishing	4	4	3	4	4	3	3
Transportation	1	1	0	0	0	0	1
Health	2	3	4	1	3	4	1

	Sønderj.*	Ribe*	Vejle	Ringk.	Århus	Viborg*	Nordj.*
Office& Trade	0	0	1	1	1	0	0
Building & construction	7	8	15	13	13	4	5
Iron,steel & metal	0	1	1	9	5	3	1
Industrial engin. & other	0	1	1	1	1	0	0
Service	0	0	4	0	1	0	0
Food & domestic agricultural & fishing	0	0	0	4	3	0	0
Transportation	1	0	4	1	0	0	0
Health	0	1	3	4	4	0	1
				1	1	0	0

Note: No detailed list available

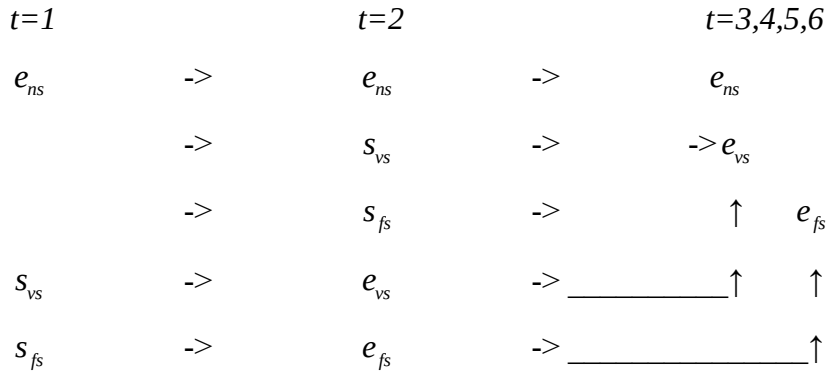
Source: Regional AF HomePages: www. af.dk.

New subsidized apprentices devided into industries in 1997 & 2005

	1997		2005	
	Men Pct	Women Pct	Men Pct	Women Pct
Total	100	100	100	100
Educational	0	0	0,62	2,47
Office and trade	24,7	39,98	18,77	32,13
Building and construction	20,31	2,1	29,33	4,66
Iron,steel and metal	24,85	1,63	23,43	3,49
Graphics	1,15	0,61	2,19	0,8
Industrial engin. And other	1,07	2,14	1,77	1,79
Service	0,47	3,25	1,7	7,93
Food and domestic	7,48	10,3	7,89	9,88
agricultural and fishing	12,03	4,72	6,44	4,26
Transportation	5,43	0,41	5,05	0,56
Health	2,5	34,86	2,77	32,03
Safety/security	0	0	0,04	0,01

Source: Dream register on AAS 1997-2005

Diagram 1: Educational pathways



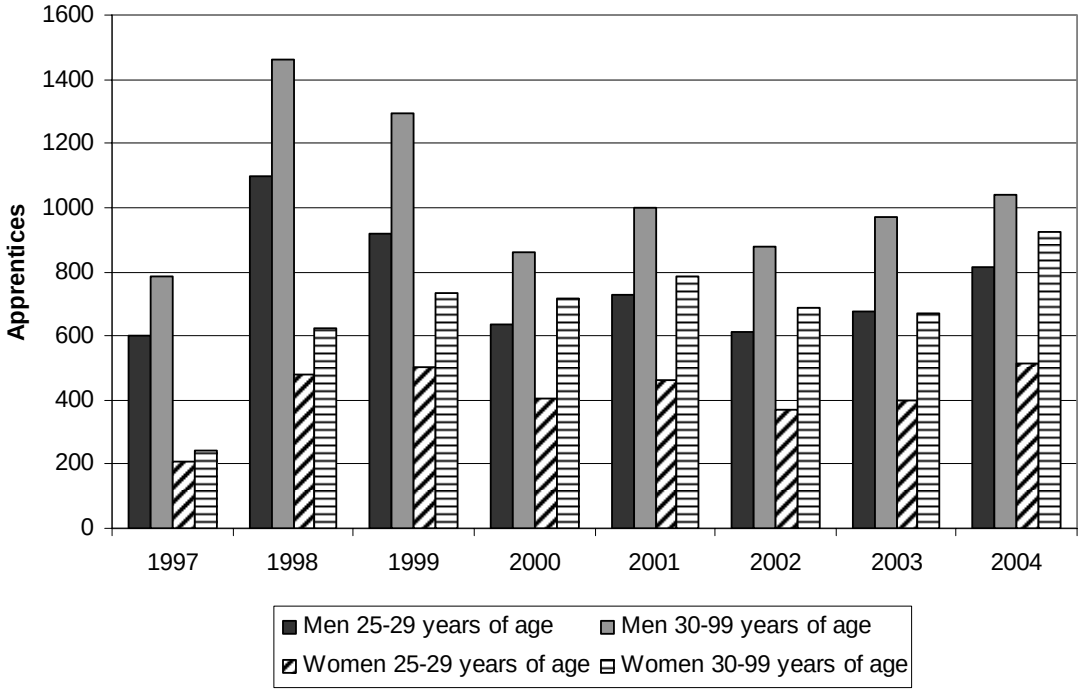
Alternative illustration

Path	**Reward at** $t=1$	**Reward at** $t=2$ **Discounted:δ**	**Reward at** $t=3,4,5,6$ **Discounted: δ^2 +δ^3 +δ^4+δ^5**
Unskilled	w_{ns}	w_{ns}	w_{ns}
Apprentice (<25)	$-c_{vs}-ic1_{vs,i}-ic2_{1,i}$	w_{vs}	w_{vs}
Apprentice with AAS (>25)	w_{ns}	$-c_{vs}-ic1_{vs,i}-ic2_{2,i}+aid_{vs,2}$	w_{vs}
Further education (<25)	$-c_{fs}-ic1_{fs,i}-ic2_{1,i}$	w_{fs}	w_{fs}
Further education (>25)	w_{ns}	$-c_{fs}-ic1_{fs,i}-ic2_{2,i}$	w_{fs}

Source: Weatherall (2007)

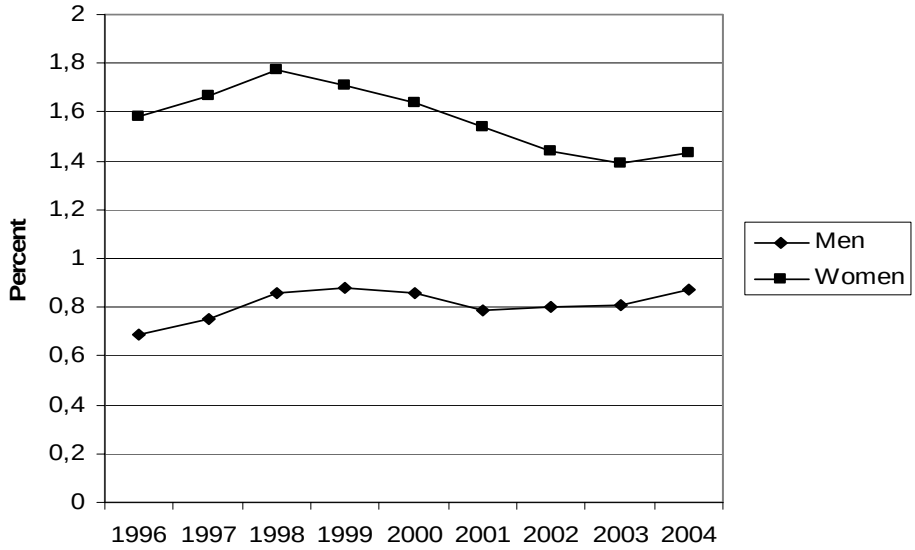
Figures

Figure 1: Persons participating in subsidized apprenticeship from 1997-2004.



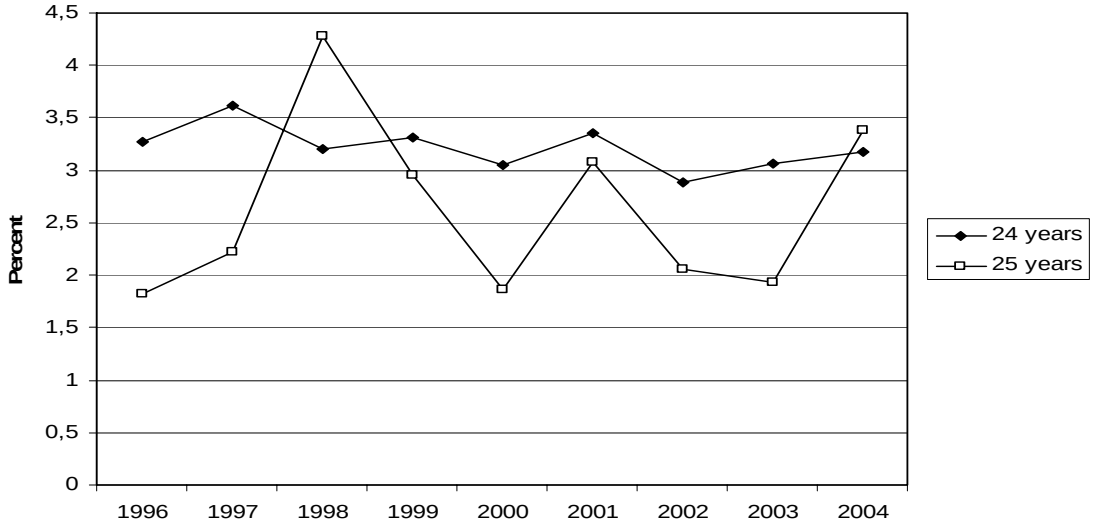
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figure 2: Persons starting apprenticeship out of the population between 25-39 years of age from 1996-2004.



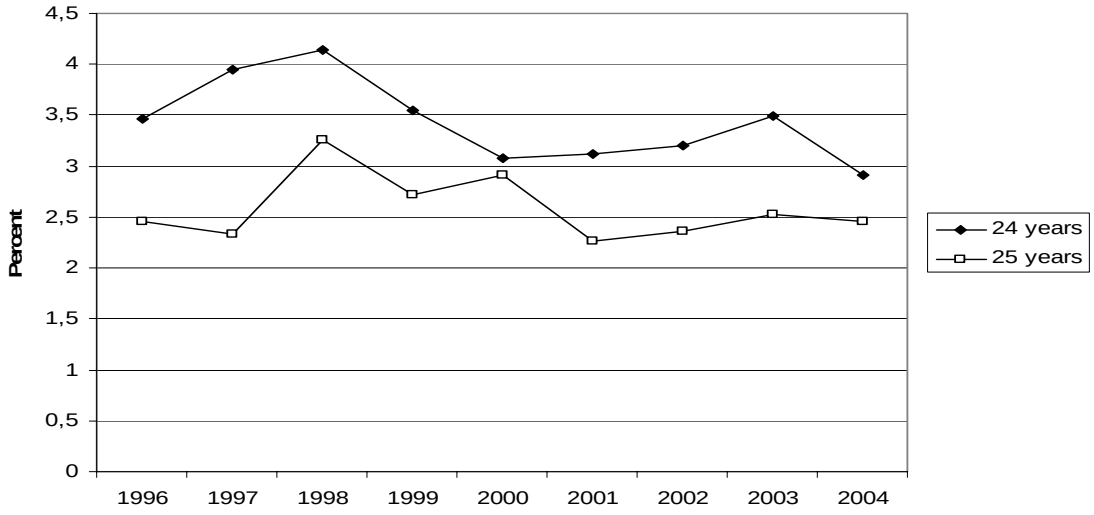
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figure 3. New male apprentices among people not already in education or have not finished an education by age from 1996-2004.



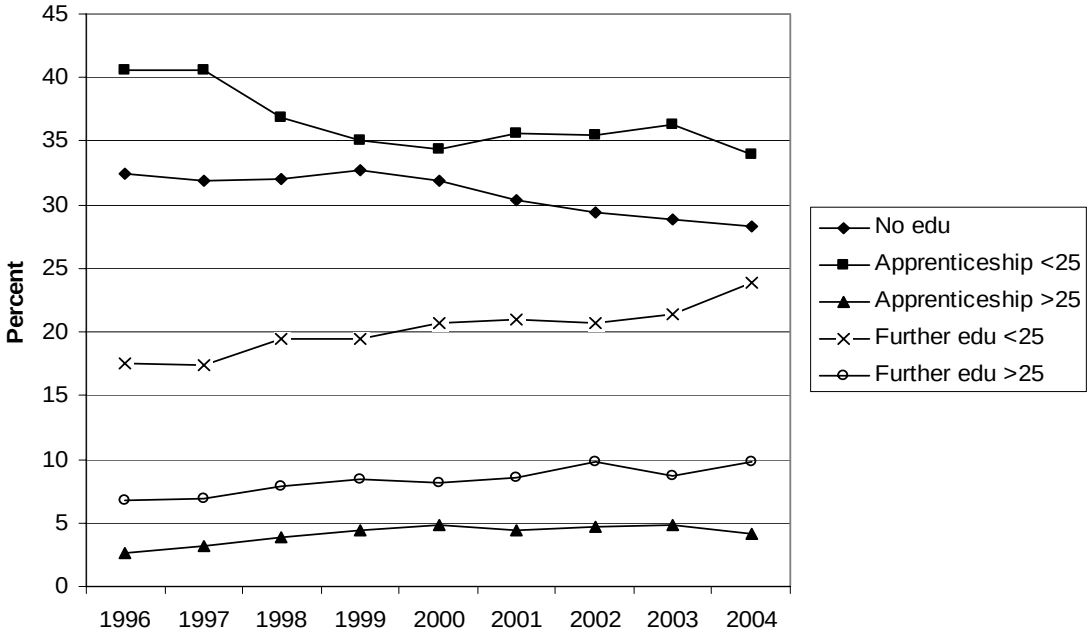
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figure 4. New female apprentices among people not already in education or have not finished an education by age from 1996-2004.



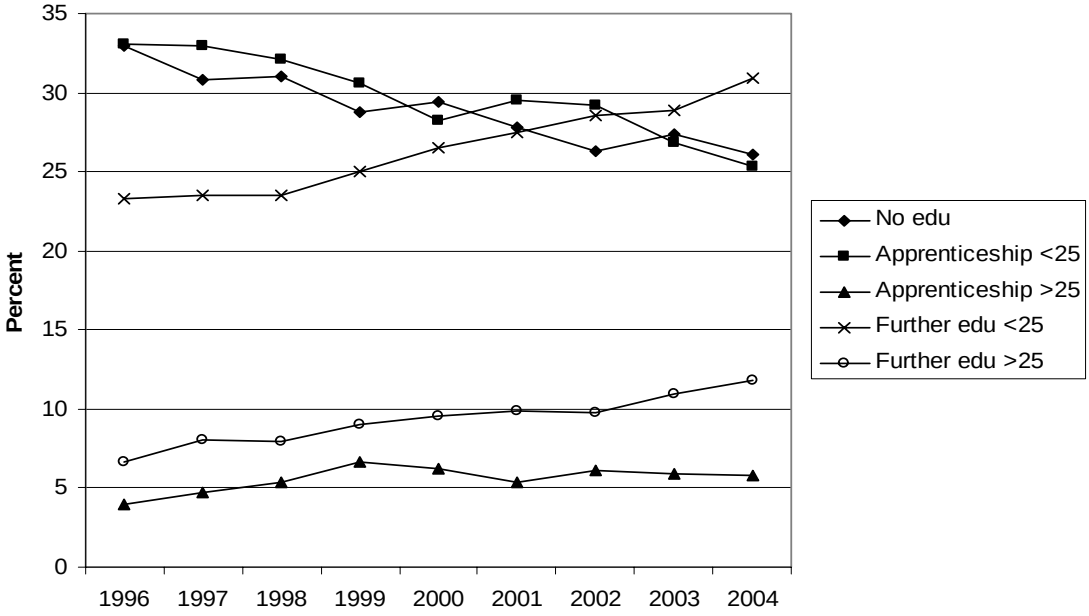
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figure 5. Educational distribution in Denmark for men over 30 years of age from 1996-2004



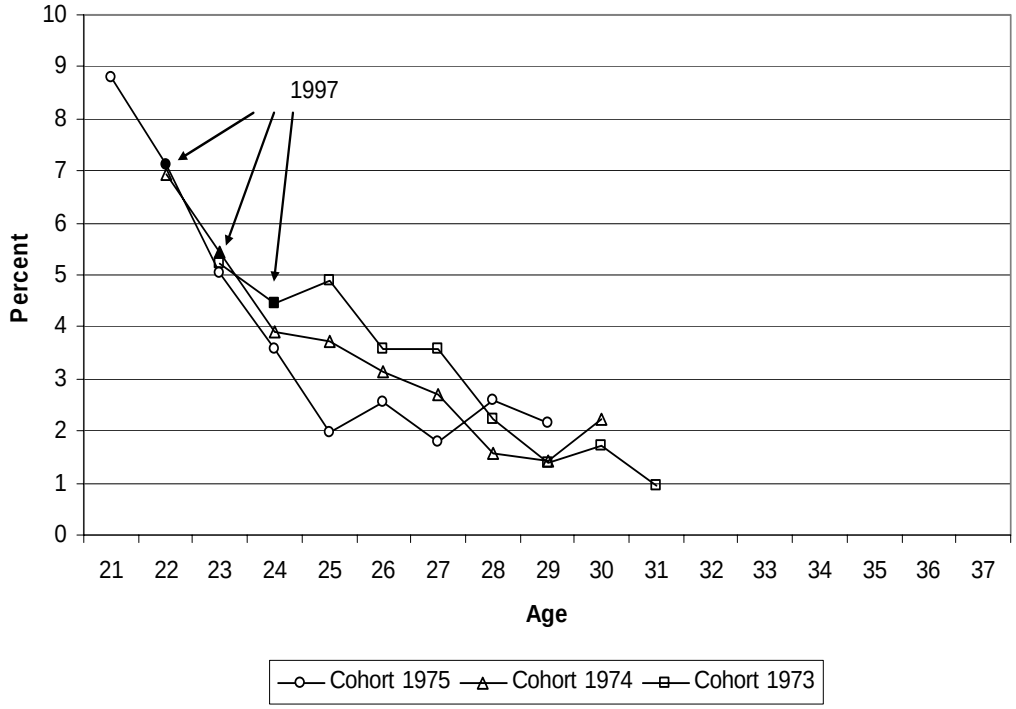
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figure 6. Educational distribution in Denmark for women over 30 years of age from 1996-2004



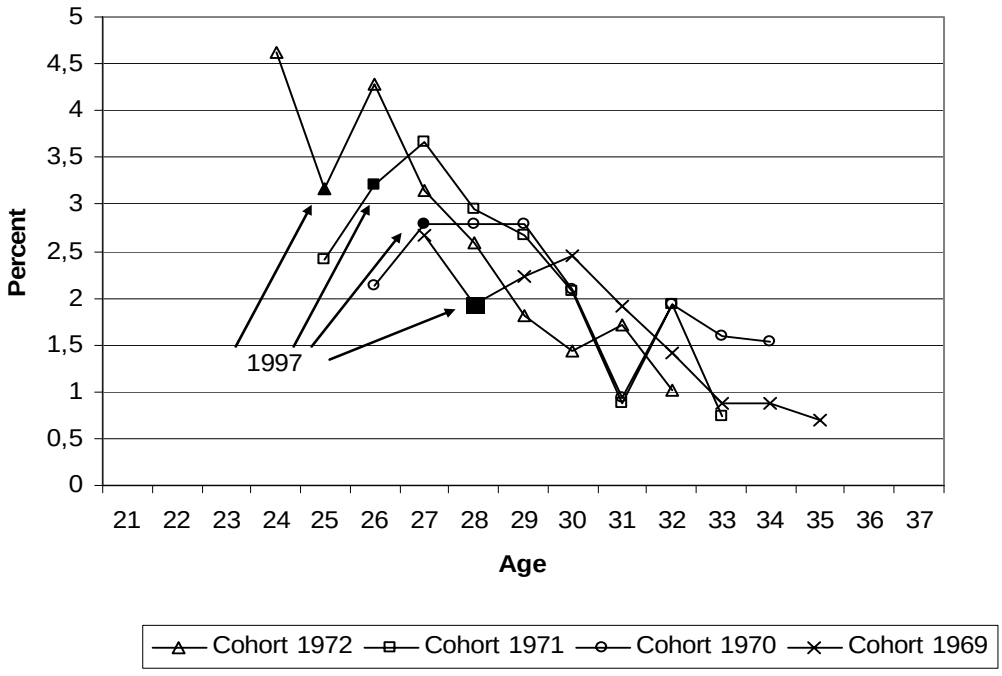
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figure 7. Cohort 1973-1975 vocational attendance rates for men from 1996-2004



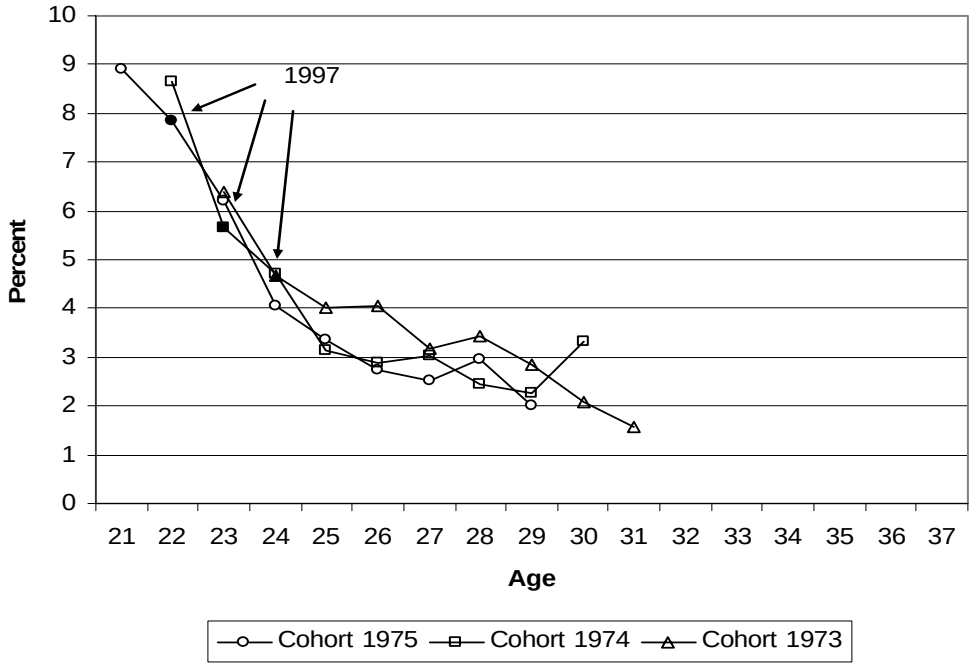
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figur 8. Cohort 1967-1972 vocational attendance rates for men from 1996-2004



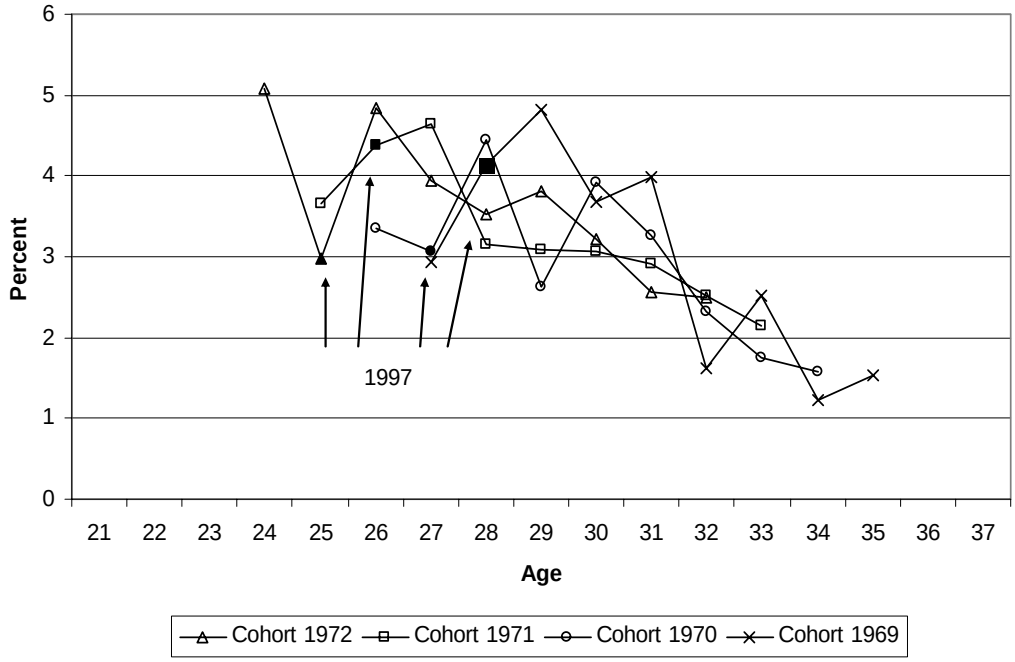
Source: Statistics Denmark register panel data from 1995 to 2004

Figure 9. Cohort 1973-1975 vocational attendance rates for women from 1996-2004



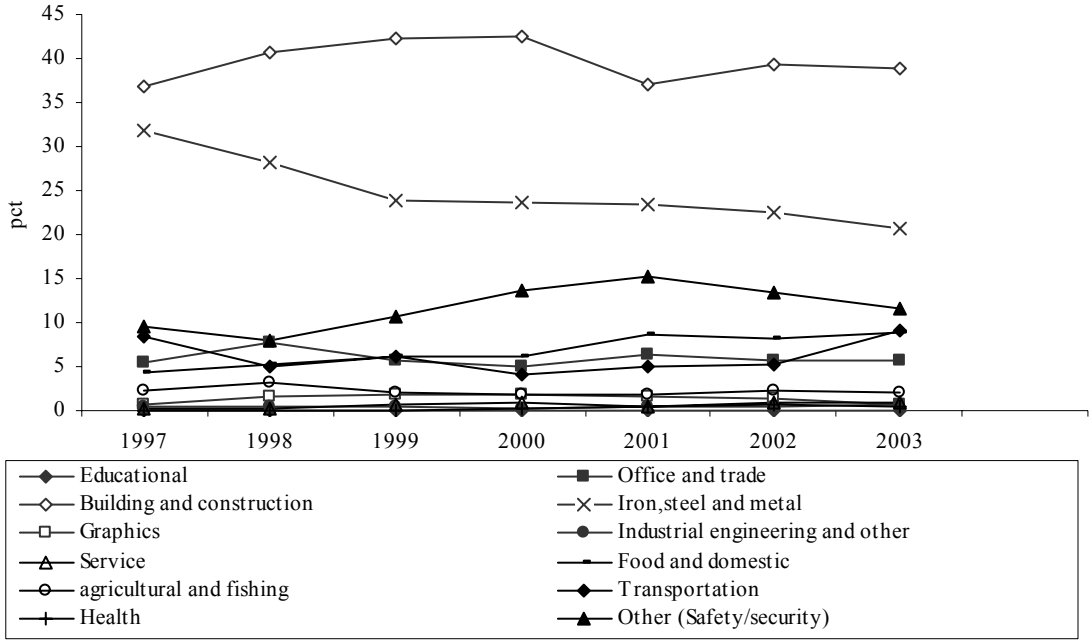
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figur 10. Cohort 1967-1972 vocational attendance rates for women from 1996-2004



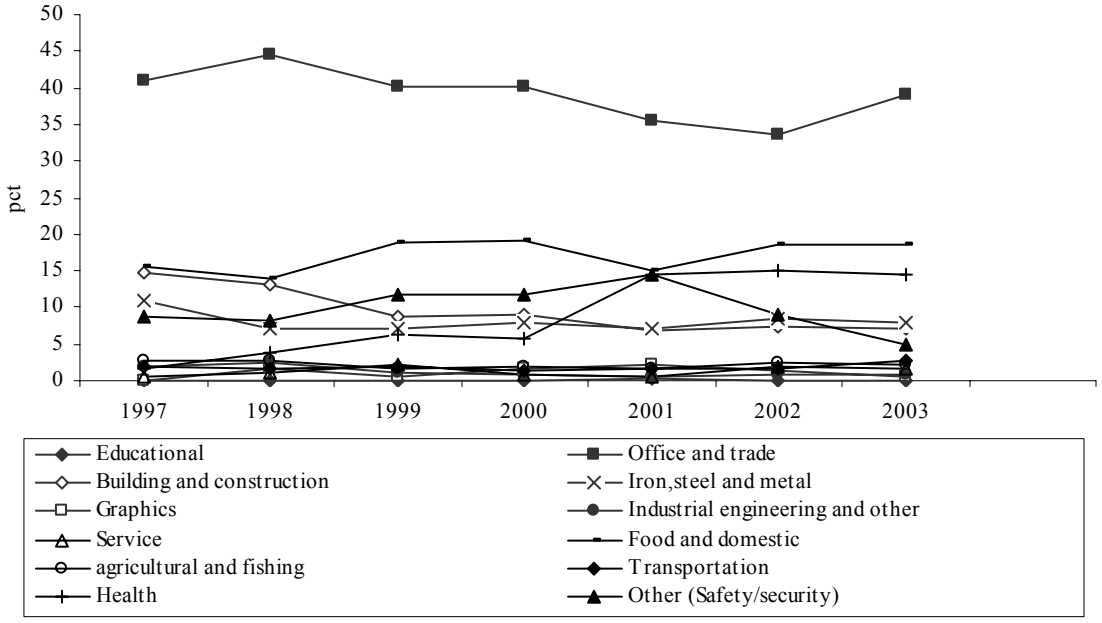
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figure 11. Subsidized apprenticeship by educational field for men from 1997-2003



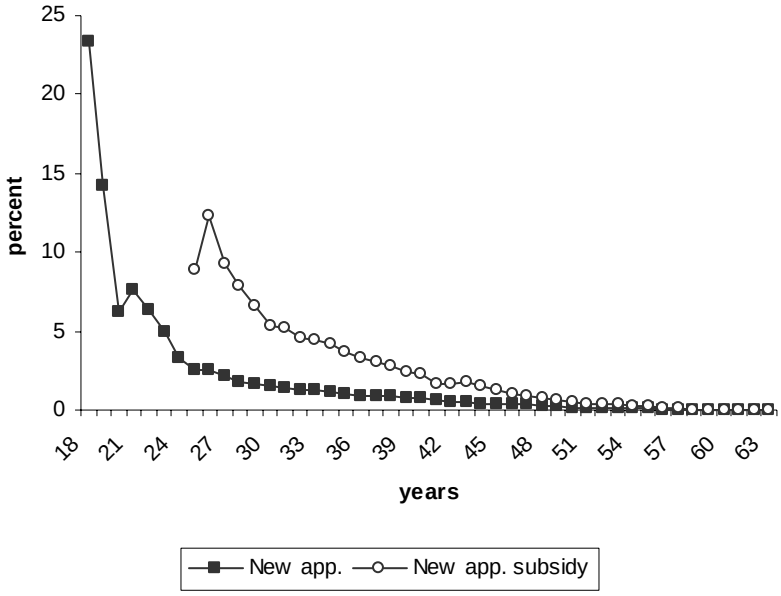
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figure 12. Subsidized apprenticeship by educational field for women from 1997-2003



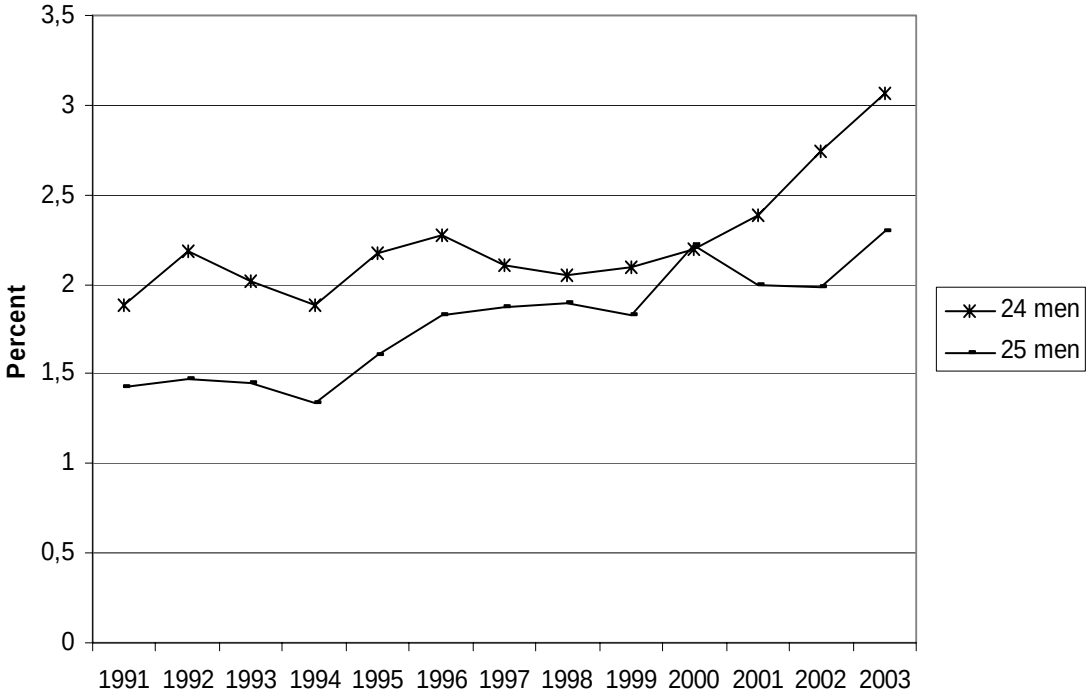
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figure 13. AAS Age distribution



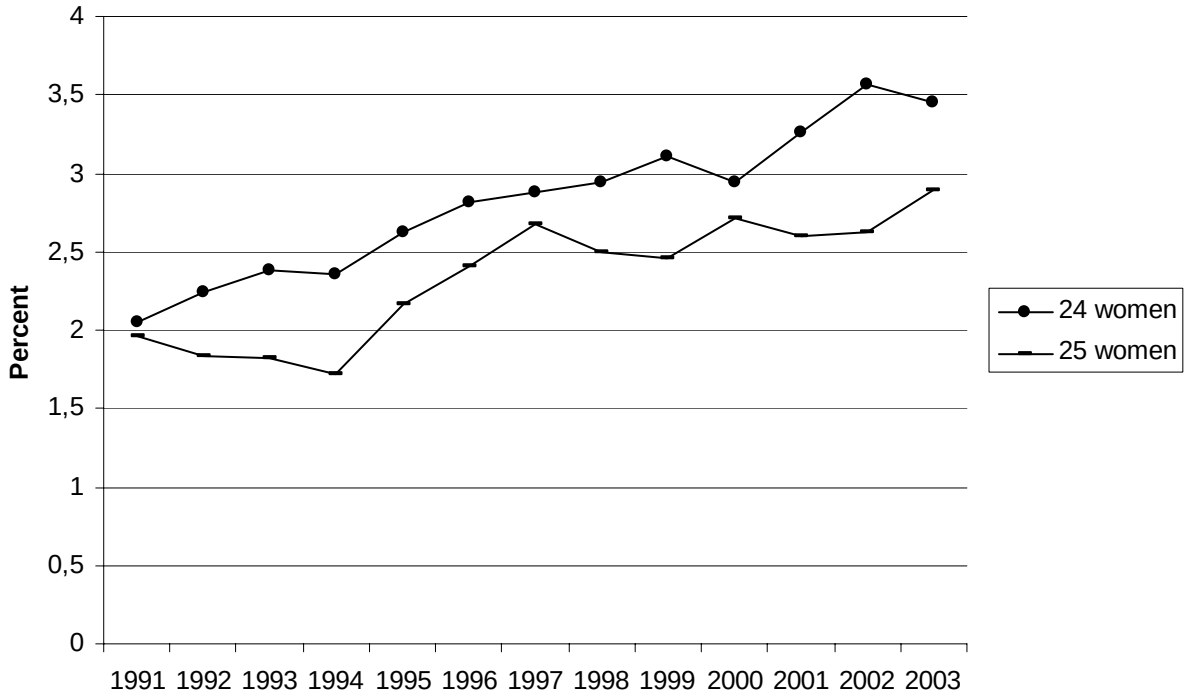
Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Figur 14. Attendance rate for men between 24-25 years of age from 1991-2003



Source: Statistics Denmark Data Bank (1991-2003)

Figur 15. Attendance rate for women between 24-25 years of age from 1991-2003



Source: Statistics Denmark Data Bank (1991-2003)

Tables

Table 1. Pct. of new apprenticeships for adults over 25 years of age that is subsidized/ not subsidized in Greater Copenhagen 2004.

New starters	Not "bottleneck"	"bottleneck"	"bottleneck" (main category)	No info on edu.field	Pct
Apprenticeship	22,16	75,62	2,22	0	100
Apprenticeship with AAS	8,86	60,76	2,53	27,85	100
Observations	87	321	10	22	440

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 2: Student pay and apprentice pay in gross values for 2006

	Carpenter	Carpenter with AAS	Economist
Average length	3,5 years	3,5 years	5 years
Hourly pay*		101,40 Dkr	
1. period (26 weeks)**	49,55 Dkr		
2. period (52 weeks)	59,90 Dkr		
3. period (52 weeks)	68,20 Dkr		
4. period (52 weeks)	82,30 Dkr		
Average monthly pay (37,5h pr week)	10.919 Dkr	15.210 Dkr	4.852 Dkr
Average pay for the whole education period	458.591 Dkr	638.820 Dkr	291.120 Dkr
Hourly minimum wage when education finished *	101,40 Dkr	101,40 Dkr	153,60 Dkr
Average reimbursement pr m pr trainee in school*	8.500 Dkr	14.640 Dkr	
Hourly subsidy to employer (max 2,5 years)		35 Dkr	
Minimum age	16 years	25 years	18 years
Other conditions		only local bottlenecks industries	Extra funding 12m
Average employer cost taking subsidy (2,5 years) and reimbursement (6 m of schooling) into account	407.591 Dkr	393.480 Dkr	

** 26 is set by the author. Schooling time is between 6 and 11 month including introduction courses. The introduction course is not subsidized, thus in that period the vocational trainee and the adult vocational trainee are paid the same. Thus the introduction period is not included in this example.

*Source: Vocational education: Carpenter, Dansk Byggeri Bygningsoverenskomst. Further education: Economist, DJØF, Monthly wage (basistrin 3) in the public sector inclusive pension 23033,50/(37,5*4)*

Table 3. Relationship between "real life" numbers and scenarios with different costs/no subsidy

Important parameters		Related "real life" numbers for 1996*	Scenario with independent costs	Scenario with dependent cost
Wage	no education	160 Dkr/hour	160 Dkr/hour	160 Dkr/hour
	voc.education	190 Dkr/hour	190 Dkr/hour	190 Dkr/hour
	fur.education	260 Dkr/hour	260 Dkr/hour	260 Dkr/hour
Discount rate			0,9	0,9
Educational cost¨ Distribution	voc. period 1		N(0,170)	N(40,700)+N(0,90)
	voc. period 2		N(40,70)	N(40,700)+N(70,70)
	fur. period 1		N(220,30)	N(290,340)+N(0,90)
	fur. period 2		N(260,90)	N(290,340)+N(70,70)
Educational distribution	No education	32,68 pct	33,41 pct	31,77 pct
	voc. period 1	36,93 pct	36,17 pct	35,72 pct
	voc. period 2	3,27 pct	3,33 pct	4,44 pct
	fur. period 1	20,37 pct	20,51 pct	25,94 pct
	fur. period 2	6,75 pct	6,59 pct	2,14 pct

* Wage: hourly average wage from private sector 2000 (because no number available from 1996). The relative relationship between has not changed drasticly. Educational distribution: Is the education distribution among the 30 years old in 1996.

Source: Statistics Denmark Data Bank (1991-2003) & Weatherall(2007)

Table 4. The result of an adult vocational education subsidy in different cost scenarios

Education	Independent cost, full info t=0			Independent cost, info t=1	Dependent cost, full info t=0		
	No subsidy	Subsidy 10pct	Subsidy 40pct	Subsidy 40pct	No subsidy	Subsidy 10pct	Subsidy 40pct
No edu	33,41	33,18	32,27	32,92	31,77	31,68	31,36
Vocational period1	36,17	36,13	36,02	36,17	35,72	35,17	32,90
Vocational period2	3,33	3,73	5,09	3,87	4,44	5,13	7,85
Further period1	20,51	20,41	20,14	20,51	25,94	25,92	25,84
Further period2	6,59	6,56	6,48	6,53	2,14	2,10	2,05
no. obs	30000	30000	30000	30000	30000	30000	30000

Source: Weatherall (2007)

Table 5. The "mobility" changes due to a subsidy in a scenario with dependent costs

Subsidy 40pct / no subsidy	no edu	voc period1	Voc period2	Fur period1	fur period2	Total obs
No edu	98,71	0	1,29	0	0	9530
voc period1	0	92,12	7,88	0	0	10715
voc period2	0	0	100,00	0	0	1332
Fur period1	0	0	0,40	99,60	0	7782
Fur period2	0	0	4,06	0	95,94	641
Total pct	31,36	32,90	7,85	25,84	2,05	30000 / 100

Source: Weatherall (2007)

Table 6. Subsidized apprenticeship by region and educational field for men in 1998

	education	off. & tra.	build. & const.	iron etc.	graph.	Indu. eng.
Stor Kbh	0	8,59	45,4	17,79	1,23	0
Frederiksborg	0	6,82	44,7	20,45	0,76	0,76
Roskilde	0	12,09	45,05	12,09	2,2	0
Vestsjælland	0	10,71	40,71	25,71	1,43	0
Storstrøm	0	4,82	40,96	21,08	1,81	0,6
Bornholm	0	5,56	22,22	27,78	0	0
Fyn	0	11,36	39,55	25,45	1,36	0,45
Sønderjylland	0	7,1	34,91	36,09	1,18	0
Ribe	0	4,48	32,09	37,31	2,24	1,49
Vejle	0	5,06	28,09	42,7	2,81	0,56
Ringkøbing	0	0	43,68	36,21	0	0
Århus	0	6,18	41,01	35,39	1,69	0
Viborg	0	0,89	55,36	34,82	0	0
Nordjylland	0	9,43	40,38	29,81	2,26	1,13
Kbh & Fredriksb	0	15,51	43,67	11,84	2,45	0,82

Continued

	service	food & dom.	agri. & fish.	transport	health	other
Stor Kbh	0	2,45	9,2	7,98	0,61	6,75
Frederiksborg	0	6,82	6,82	1,52	0	11,36
Roskilde	0	4,4	10,99	2,2	0	10,99
Vestsjælland	0	2,14	5	6,43	0	7,86
Storstrøm	0	4,82	1,81	18,67	0	5,42
Bornholm	0	27,78	0	0	0	16,67
Fyn	1,36	6,36	1,82	6,36	0	5,91
Sønderjylland	0	2,96	0	6,51	0	11,24
Ribe	0	3,73	0,75	5,97	0	11,94
Vejle	0	6,18	1,12	1,12	0	12,36
Ringkøbing	0	5,17	2,87	3,45	0	8,62
Århus	0,28	4,49	3,09	1,69	0	6,18
Viborg	0	3,57	0	1,79	0	3,57
Nordjylland	0	6,42	2,26	0	0	8,3
Kbh & Fredriksb	0,41	7,76	3,27	8,16	0,41	5,71

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 7. Subsidized apprenticeship by region and educational field for women in 1998

	education	off. & tra.	build. & const.	iron etc.	graph.	Ind. eng.
Stor Kbh	0	59,42	7,25	1,45	0	4,35
Frederiksborg	0	48,08	7,69	5,77	5,77	5,77
Roskilde	0	59,52	7,14	0	0	0
Vestsjælland	0	59,02	4,92	6,56	4,92	1,64
Storstrøm	0	40,58	7,25	10,14	0	1,45
Bornholm	0	38,24	5,88	0	0	0
Fyn	0	43,1	14,66	10,34	0,86	2,59
Sønderjylland	0	42,5	16,25	7,5	1,25	0
Ribe	0	17,02	27,66	2,13	4,26	10,64
Vejle	0	33,82	14,71	23,53	0	1,47
Ringkøbing	0	0	42,42	15,15	0	6,06
Århus	0	41,48	17,78	8,89	2,22	1,48
Viborg	0	23,08	30,77	12,82	0	5,13
Nordjylland	0	57,36	11,63	5,43	1,55	0
Kbh & Fredriksb	0	53,17	3,17	0	2,38	2,38

continued

	service	food & dom.	agri. & fish.	transport	health	other
Stor Kbh	2,9	11,59	2,9	2,9	1,45	5,8
Frederiksborg	0	19,23	1,92	1,92	3,85	0
Roskilde	2,38	14,29	4,76	2,38	2,38	7,14
Vestsjælland	0	4,92	1,64	3,28	4,92	8,2
Storstrøm	0	14,49	5,8	8,7	4,35	7,25
Bornholm	0	2,94	0	0	0	52,94
Fyn	0,86	11,21	1,72	2,59	8,62	3,45
Sønderjylland	1,25	18,75	1,25	1,25	2,5	7,5
Ribe	0	34,04	0	2,13	0	2,13
Vejle	4,41	8,82	2,94	0	4,41	5,88
Ringkøbing	0	24,24	0	0	6,06	6,06
Århus	0,74	10,37	4,44	0	0,74	11,85
Viborg	0	12,82	5,13	0	0	10,26
Nordjylland	0	12,4	1,55	0	3,1	6,98
Kbh & Fredriksb	3,17	17,46	4,76	0	7,14	6,35

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 8. Descriptive statistics for subsidized and non-subsidized apprenticeships between 1997-2004

		Men		Women	
		Not subsidized	Subsidized	Not subsidized	Subsidized
Years	**1997**	16,5	13,15	15,62	7,4
	1998	15,53	23,37	16,02	15,89
	1999	14,94	18,65	14,61	17,81
	2000	14,23	10,6	14,63	15,89
	2001	14,82	12,9	14,36	16,99
	2002	11,26	10,47	12,6	11,78
	2003	12,72	10,86	12,15	14,25
Age	**<25 years**	84,81	0	64,44	0
	25-31 years	9,05	54,15	14,82	52,6
	32-51 years	5,9	44,83	19,21	45,75
	51+ years	0,25	1,02	1,53	1,64
Family Status	**Single**	52,51	41	39,06	18,63
	Single parent	6,48	1,02	10,49	15,62
	Couple	7,06	22,61	19,82	22,47
	Couple with children	32,77	35,38	29,57	43,29
	Child not at home	1,18	0	1,06	0
Ethnicity	**Danish**	93,53	94	94,08	95,89
	Immigrant	6,47	6	5,92	4,11
Education prev. y.	**No education**	98,34	97,19	97,59	97,53
	Short further edu	0,49	0,89	0,42	0
	Middle further edu	1,02	1,4	1,86	2,19
	Long further edu	0,14	0,51	0,13	0,27
Occupation prev. y.	**Employer & self emp.**	0,54	2,43	0,3	0,27
	Wage earner	51,99	72,54	53,73	53,15
	Unemployed	1,38	9,83	2,49	18,36
	Out of labour market	3,1	10,73	7,87	18,08
	Student (basic)	42,98	4,47	35,61	10,14
Geographical area	**Stor Kbh**	9,22	6,77	9,26	6,58
	Frederiksborg	5,52	4,34	5,34	2,74
	Roskilde	4,22	2,68	4,04	1,37
	Vestsjælland	5,93	4,09	6,64	6,03
	Storstrøm	5,56	5,62	5,22	6,58
	Bornholm	0,98	0,77	0,94	0,27
	Fyn	10,35	9,96	9,51	13,7
	Sønderjylland	5,47	3,07	5,16	5,21
	Ribe	4,81	4,6	4,89	4,93
	Vejle	7,03	7,28	7,09	10,96
	Ringkøbing	6,22	10,34	5,76	6,03
	Århus	11,79	14,94	12,33	11,51
	Viborg	4,99	6	5,01	4,11
	Nordjylland	10,22	9,32	9,29	11,23
	Kbh & Frederiksberg	7,71	10,22	9,52	8,77

Continued

Educational field	**Education**	0,49	0	3,5	0
	Office & Trade	25,51	5,75	43,17	33,7
	Building & construction	27,4	39,21	2,81	12,33
	Iron, steel & metal	25,88	27,33	1,87	11,78
	Graphic	1,57	0,89	1	0,55
	Industry engineer	1,19	0,64	2,18	1,37
	Service	0,5	0,38	4,42	1,37
	Food & domestic prod	7,55	6,26	9,33	18,9
	Agricultural & fishing	4,47	1,92	2,82	1,92
	Transport	4,07	6,51	0,49	2,74
	Health	1,36	0	28,41	7,4
	Other	0	11,11	0	7,95
Years of experience	**Mean**	1,566011	8,08046	2,817961	6,131507
	Sta.dev.	3,060407	5,309107	4,264548	4,585479
Previous a-income	**Mean**	62960,58	169144	81701,09	129772,8
	Sta.dev.	60627,47	87462,99	62408,58	66007,52
Wage prev. y.	**Mean**	51498,57	135634,6	54486,2	69377,44
	Sta.dev.	57479,94	104835,8	53658,7	81106,13

Note: A-income is total taxable income

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 9. New apprenticeship, men 24 -25 years of age from 1996-1998.

Men		1996		1998	
		24 years	25 years	24 years	25 years
Family status	**Single**	71,64	68,57	73,44	59,49
	Single parent	0	0	0	1,27
	Couple	23,88	20	25	31,65
	Couple with children	4,48	11,43	1,56	7,59
Ethnicity	**Danish**	98,51	97,14	96,88	91,14
	Immigrant	1,49	2,86	3,12	8,86
Education prev. y.	**No education**	95,52	91,43	93,75	92,41
	Short further edu	0	0	1,56	1,27
	Middle further edu	4,48	8,57	4,69	5,06
	Long further edu	0	0	0	1,27
Occupation prev. y.	**Employer & self emp.**	0	0	1,56	0
	Wage earner	76,12	80	65,62	78,48
	Unemployed	7,46	8,57	3,12	2,53
	Out of labour market	1,49	2,86	7,81	1,27
	Student (basic)	14,93	8,57	21,88	17,72
Geographical area	**Stor Kbh**	7,46	2,86	4,69	7,59
	Frederiksborg	2,99	2,86	7,81	3,8
	Roskilde	7,46	2,86	1,56	1,27
	Vestsjælland	5,97	0	6,25	3,8
	Storstrøm	5,97	2,86	6,25	6,33
	Bornholm	0	2,86	0	1,27
	Fyn	13,43	11,43	9,38	5,06
	Sønderjylland	7,46	2,86	4,69	2,53
	Ribe	5,97	8,57	4,69	1,27
	Vejle	7,46	8,57	9,38	8,86
	Ringkøbing	2,99	2,86	4,69	2,53
	Århus	10,45	22,86	12,5	20,25
	Viborg	2,99	5,71	0	2,53
	Nordjylland	4,48	11,43	15,62	13,92
	Kbh & Frederiksberg	14,93	11,43	12,5	18,99
Educational field	**Education**	0	0	0	1,27
	Office & Trade	53,73	48,57	35,94	35,44
	Building & construction	14,93	14,29	25	17,72
	Iron, steel & metal	10,45	20	14,06	18,99
	Graphic	0	0	3,12	1,27
	Industry engineer	4,48	2,86	0	2,53
	Service	1,49	0	0	0
	Food & domestic prod	4,48	2,86	7,81	8,86
	Agricultural & fishing	7,46	5,71	7,81	7,59
	Transport	1,49	5,71	4,69	2,53
	Health	1,49	0	1,56	2,53
	Other	0	0	0	1,27

Continued

Years of experience	**Mean**	2,223881	2,971429	2,46875	2,835443
	Sta.dev.	1,485494	2,00713	1,563155	1,897572
Previous a-income	**Mean**	107699,4	120800,3	104023,3	131881,7
	Sta.dev.	38314,68	36548,38	35147,11	63666,04
Wage prev. y.	**Mean**	83713,22	93343	71662,56	111091,8
	Sta.dev.	51569,28	53202,62	51040,7	77530,22

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 10. New apprenticeship, men 24 -25 years of age from 1996-1998.

Women		1996		1998	
		24 years	25 years	24 years	25 years
Family status	**Single**	53,57	45,28	45,45	42,25
	Single parent	5,95	13,21	5,05	11,27
	Couple	39,29	33,96	37,37	30,99
	Couple with children	1,19	7,55	12,12	15,49
Ethnicity	**Danish**	97,62	100	91,92	92,96
	Immigrant	2,38	0	8,08	7,04
Education prev. y.	**No education**	95,24	92,45	89,9	90,14
	Short further edu	0	0	0	0
	Middle further edu	3,57	7,55	8,08	9,86
	Long further edu	1,19	0	2,02	0
Occupation prev. y.	**Employer & self emp.**	0	0	1,01	0
	Wage earner	80,95	75,47	68,69	73,24
	Unemployed	2,38	3,77	4,04	2,82
	Out of labour market	0	0	2,02	1,41
	Student (basic)	16,67	20,75	24,24	22,54
Geographical area	**Stor Kbh**	5,95	5,66	8,08	7,04
	Frederiksborg	7,14	7,55	2,02	2,82
	Roskilde	3,57	13,21	9,09	5,63
	Vestsjælland	1,19	1,89	5,05	7,04
	Storstrøm	3,57	5,66	3,03	5,63
	Bornholm	2,38	0	2,02	0
	Fyn	2,38	7,55	8,08	9,86
	Sønderjylland	4,76	7,55	4,04	2,82
	Ribe	5,95	3,77	5,05	1,41
	Vejle	8,33	5,66	4,04	1,41
	Ringkøbing	7,14	5,66	1,01	5,63
	Århus	16,67	7,55	18,18	21,13
	Viborg	2,38	1,89	3,03	1,41
	Nordjylland	10,71	11,32	10,1	12,68
	Kbh & Frederiksberg	17,86	15,09	17,17	15,49
Educational field	**Education**	0	0	0	7,04
	Office & Trade	54,76	28,3	35,35	36,62
	Building & construction	1,19	1,89	3,03	1,41
	Iron, steel & metal	0	1,89	2,02	1,41
	Graphic	1,19	1,89	5,05	0
	Industry engineer	3,57	7,55	3,03	4,23
	Service	5,95	1,89	7,07	2,82
	Food & domestic prod	4,76	9,43	12,12	11,27
	Agricultural & fishing	1,19	5,66	3,03	2,82
	Transport	0	0	0	1,41
	Health	27,38	41,51	29,29	30,99
	Other	0	0	0	0

Continued

Years of experience	**Mean**	2,095238	2,132075	1,818182	2,239437
	Sta.dev.	1,266996	1,569392	1,146099	1,448791
Previous a-income	**Mean**	97311,6	107711,1	97952,44	108297
	Sta.dev.	25987,61	33561,27	29926,6	38945,75
Wage prev. y.	**Mean**	75031,99	73007,19	69720,43	72918,28
	Sta.dev.	36780,52	45476,57	43659,8	51522,98

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 11. Difference in differences for men

	1996	**1998**	**Difference**
24 years apprentices	3,28	3,34	-0,06
25 years apprentices	1,82	4,39	-2,57
Difference	1,46	-1,05	2,51

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 12. Difference in differences for women

	1996	**1998**	**Difference**
24 years apprentices	3,46	4,31	-0,85
25 years apprentices	2,45	3,34	-0,89
Difference	1,01	0,97	0,04

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 13. Difference in differences for men from 1996-1998

	D in d (ols)			D in d cov (ols)			D in d cov & time cov (ols)			D in d cov & t. cov (probit)		
	Coef	St.err.		Coef	St.err.		Coef	St.err.		Coef.	St.err.	
24 years	ref.			ref.			ref.			ref.		
25 years	0,0005879	0,0055769		-0,0158113	0,0055863	***	-0,0149715	0,0056249	***	-0,0150963	0,00502	***
1996	ref.			ref.			ref.			ref.		
1998	-0,0145621	0,0055739	***	0,0018565	0,0055759		-0,0223738	0,0271131		-0,0332218	0,02705	
25*1998	0,0251003	0,0080137	***	0,0259448	0,0079689	***	0,023974	0,008107	***	0,0268847	0,0101	***
Dane				ref.			ref.			ref.		
Immigrant				-0,0001108	0,0089459		-0,0058848	0,0141781		-0,0080738	0,01129	
Single				ref.			ref.			ref.		
Couple				0,0091865	0,0051536	*	0,0062644	0,0071957		0,0071078	0,00688	
Couple & children				-0,004177	0,0102781		-0,0068957	0,0143223		-0,0079689	0,01129	
Wage earner				ref.			ref.			ref.		
Unemployed				-0,0061882	0,0095603		-0,0077221	0,0112495		-0,0032727	0,00804	
Out of lab.force				-0,0460124	0,006795	***	-0,0437695	0,0096671	***	-0,0304015	0,0035	***
Student				-0,0291484	0,0064151	***	-0,0363918	0,0091612	***	-0,0236731	0,0039	***
Prev. Income				-3,33E-07	4,37E-08	***	-3,23E-07	6,27E-08	***	-3,06E-06	0	***
Work experience				0,0051421	0,0014916	***	0,0030367	0,0020277		0,003641	0,00175	**
Great Copenhagen				ref.			ref.			ref.		
Frederiksborg				0,0178869	0,0118698		0,0046492	0,0162942		0,0063495	0,01946	
Roskilde				0,0161829	0,0130347		0,0332117	0,0177354	*	0,046358	0,0341	
Vestsjælland				0,0226543	0,0119518	*	0,0133357	0,0160924		0,0191672	0,02429	
Storstrøm				0,0358411	0,0119935	***	0,0231024	0,0164596		0,030593	0,02714	
Fyn				0,0147991	0,0092522		0,019921	0,0126278		0,0282458	0,02058	
Sønderjylland				0,0278612	0,0129654	**	0,035562	0,0179327	**	0,0524949	0,03671	
Ribe				0,0251263	0,0127808	**	0,0402032	0,0175072	**	0,0588555	0,03747	
Vejle				0,0343108	0,010767	***	0,0282679	0,0150694	*	0,0497836	0,03113	
Ringkøbing				0,0114406	0,0125148		0,0092371	0,0167823		0,0158452	0,02467	
Århus				0,0126842	0,0081489		0,0108735	0,0114319		0,0162544	0,01544	
Viborg				0,0112186	0,0136014		0,0212565	0,018347		0,0316425	0,03126	
Nordjylland				0,0193987	0,0091062	**	0,0063266	0,0127589		0,009294	0,01602	
Cph & Frederiksb.				-0,0012223	0,0075388		0,0004115	0,0106184		-0,0000798	0,01087	

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Immigrant*1998							0,0115363	0,0183218		0,0134271	0,01794	
Couple*1998							0,0062056	0,0103222		0,0008671	0,00801	
Couple&child*1998							0,0038266	0,0206072		0,0079338	0,02449	
Unemployed*1998							0,0019803	0,0218295		0,0000393	0,01604	
Out of lab.for.*1998							-0,0043624	0,013627		0,0270547	0,02968	
Student*1998							0,0143017	0,0128546		0,0284736	0,01792	
Prev. Income*1998							-2,92E-08	8,78E-08		1,02E-06	0	
Work exp.*1998							0,0048666	0,0030091		0,0015305	0,00238	
Frederiksborg*1998							0,0285624	0,0238098		0,0204681	0,03407	
Roskilde*1998							-0,0370296	0,0261763		-0,0184944	0,00593	***
Vestsjælland*1998							0,0213447	0,0240852		0,0096121	0,02636	
Storstrøm*1998							0,0271544	0,0240436		0,0068894	0,02284	
Fyn*1998							-0,0125398	0,0185794		-0,0107976	0,00964	
Sønderjylland*1998							-0,016635	0,0259807		-0,0126853	0,01024	
Ribe*1998							-0,0326307	0,0256463		-0,0165827	0,00699	**
Vejle*1998							0,0124747	0,0215521		-0,0050859	0,01377	
Ringkøbing*1998							0,0043777	0,0252415		-0,0027477	0,01929	
Århus*1998							0,0044117	0,0163253		-0,0012818	0,01378	
Viborg*1998							-0,0227753	0,0273579		-0,015055	0,00962	
Nordjylland*1998							0,0266463	0,0182327		0,0157197	0,02402	
Cph & Fred.*1998							-0,0028496	0,0151055		-0,0005159	0,01398	
Constant	0,0327628	0,0038803	***	0,0608346	0,0091847	***	0,0670165	0,012235	***			
Obs	7687			7687			7687			7687		
Adj R2	0,0022			0,0146			0,0149			0,0777		

Source: Statistics Denmark register panel data from 1995 to 2004 &Dream register on AAS 1997-2005

Table 14. Difference in differences for women from 1996-1998.

	D in d (ols)			D in d cov (ols)			D in d cov & time cov (ols)			D in d cov & t. cov (probit)		
	Coef	St.err.		Coef	St.err.		Coef	St.err.		Coef.	St.err.	
24 years	ref.			ref.			ref.			ref.		
25 years	0,0084981	0,0052821		-0,0098945	0,005357	*	-0,0095025	0,0053883	*	-0,0030283	0,00173	*
1996												
1998	-0,0100908	0,0053669	*	0,0087732	0,0052644	*	-0,0082374	0,0269884		-0,0090105	0,01016	
25*1998	0,0003339	0,0076554		0,0011039	0,0075933		0,0004126	0,0076817		0,0005737	0,00241	
Dane				ref.			ref.			ref.		
Immigrant				0,0064988	0,0082241		-0,0050312	0,0119181		-0,0035855	0,0038	
Single				ref.			ref.			ref.		
Couple				0,0068794	0,0043708		0,001874	0,0060845		0,0001624	0,00185	
Couple & children				0,0093798	0,0066378		-0,0001936	0,0093187		-0,0011192	0,00327	
Wage earner				ref.			ref.			ref.		
Unemployed				-0,0265183	0,0092483	***	-0,0321726	0,0108503	***	-0,006371	0,00152	***
Out of lab.force				-0,0598068	0,006046	***	-0,0549118	0,0084287	***	-0,0819374	0,00457	***
Student				-0,0368977	0,005843	***	-0,0387061	0,0083676	***	-0,0081825	0,00176	***
Prev. Income				-3,89E-07	5,65E-08	***	-3,84E-07	7,94E-08	***	-1,03E-06	0	***
Work experience				0,0041906	0,0016653	**	0,0040834	0,0022802	*	0,0014993	0,00072	**
Great Copenhagen				ref.			ref.			ref.		
Frederiksborg				0,0085899	0,0117287		0,0314613	0,0160121	**	0,0158107	0,01213	
Roskilde				0,0565103	0,0128472	***	0,0429169	0,0168873	**	0,0247019	0,01619	
Vestsjælland				0,0082491	0,0118986		-0,0019805	0,0170704		-0,0015329	0,00563	
Storstrøm				0,0259607	0,0119768	**	0,0282769	0,0162862	*	0,0155521	0,01262	
Fyn				-0,0061267	0,0089675		-0,0058802	0,0124367		-0,0018507	0,00391	
Sønderjylland				0,0161985	0,0123024		0,0291645	0,0167683	*	0,0140544	0,01201	
Ribe				0,0128281	0,0123314		0,0259373	0,0169329		0,0143173	0,0124	
Vejle				0,0009565	0,010545		0,0167754	0,0142796		0,0079066	0,00818	
Ringkøbing				0,0044254	0,0115453		0,0216558	0,0156824		0,0095522	0,00939	
Århus				0,0060518	0,0082986		0,002523	0,0112724		0,0013875	0,00439	
Viborg				-0,0042741	0,0128683		-0,0001925	0,0178102		0,0002452	0,0064	
Nordjylland				0,0139661	0,0093507		0,0213083	0,0129516	*	0,010659	0,00833	
Cph & Frederiksb.				-0,009727	0,0077508		-0,0004264	0,0106968		0,0003988	0,00389	

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continued

Immigrant*1998							0,0218507	0,0164753		0,0101422	0,00674	
Couple*1998							0,0109523	0,0087489		0,0036134	0,00328	
Couple&child*1998							0,0196577	0,0132855		0,009901	0,0088	
Unemployed*1998							0,0329645	0,0213698		0,0195701	0,01834	
Out of lab.for.*1998							-0,0104216	0,0120999		0,9212091	0,00681	***
Student*1998							0,003583	0,0117023		0,0030111	0,00416	
Prev. Income*1998							-5,00E-09	1,13E-07		2,09E-07	0	
Work exp.*1998							-8,65E-06	0,0033469		-0,0003651	0,00098	
Frederiksborg*1998							-0,0495631	0,0235271		-0,0070406	0,00138	***
Roskilde*1998							0,0344527	0,0260415		-0,0003108	0,00631	
Vestsjælland*1998							0,0174384	0,0238707		0,0077061	0,01453	
Storstrøm*1998							-0,004726	0,0240392		-0,0033895	0,00413	
Fyn*1998							-0,0013849	0,0179738		8,04E-05	0,00601	
Sønderjylland*1998							-0,0286383	0,0246729		-0,0054559	0,00255	**
Ribe*1998							-0,0278775	0,0247135		-0,0058266	0,00227	***
Vejle*1998							-0,0357881	0,0211889	*	-0,0065029	0,00177	***
Ringkøbing*1998							-0,0376717	0,0231728		-0,0061946	0,00196	***
Århus*1998							0,0078085	0,0166542		0,00102	0,00569	
Viborg*1998							-0,0099733	0,0257692		-0,0027854	0,00567	
Nordjylland*1998							-0,015298	0,0187423		-0,00462	0,0028	*
Cph & Fred.*1998							-0,0184819	0,0155479		-0,0045699	0,0031	
Constant	0,0346392	0,0036832	***	0,0820905	0,0100286	***	0,0798105	0,0134352	***			
Obs	9006			9006			9006			9006		
Adj R2	0,001			0,0189			0,02			0,0832		

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 15. Difference in differences for men from 1996-2002.

	D in d (ols)			D in d cov (ols)			D in d cov & time cov (ols)			D in d cov & t. cov (probit)		
	Coef	St.err.		Coef	St.err.		Coef	St.err.		Coef.	St.err.	
24 years	ref.			ref.			ref.			ref.		
25 years	0,002031	0,0055148		-0,0161921	0,0052179	***	-0,0149715	0,0052436	***	-0,0123349	0,00413	***
1996	ref.			ref.			ref.			ref.		
2002	-0,0145621	0,0052036	***	0,0065126	0,0055501		-0,0296625	0,0260353		-0,0255189	0,0203	
25*2002	0,0048236	0,0080089		0,0065267	0,0079646		0,0043918	0,00806		0,0053854	0,00708	
Dane				ref.			ref.			ref.		
Immigrant				0,0011719	0,0086954		-0,0058848	0,0132169		-0,0065734	0,00912	
Single				ref.			ref.			ref.		
Couple				-0,0011388	0,0051614		0,0062644	0,0067078		0,005862	0,00571	
Couple with children				-0,003963	0,0103692		-0,0068957	0,0133513		-0,0064802	0,0091	
Wage earner				ref.			ref.			ref.		
Unemployed				-0,0000392	0,0097373		-0,0077221	0,0104868		-0,0026747	0,00657	
Out of labor force				-0,0439967	0,0068433	***	-0,0437695	0,0090117	***	-0,0240327	0,00295	***
Student				-0,0273208	0,0061431	***	-0,0363918	0,0085401	***	-0,0196862	0,00349	***
Prev. Income				-2,68E-07	3,95E-08	***	-3,23E-07	5,85E-08	***	-2,10E-06	0	***
Work experience				0,0045661	0,001453	***	0,0030367	0,0018903		0,002985	0,00144	**
Great Copenhagen				ref.			ref.			ref.		
Frederiksborg				0,0097038	0,0116963		0,0046492	0,0151896		0,0052311	0,0161	
Roskilde				0,0390919	0,0130734	***	0,0332117	0,0165331	**	0,0391272	0,02943	
Vestsjælland				0,0020407	0,0118248		0,0133357	0,0150014		0,0160491	0,02069	
Storstrøm				0,0270644	0,0123233	**	0,0231024	0,0153437		0,0256627	0,02319	
Fyn				0,0183198	0,0090488	**	0,019921	0,0117717	*	0,0235167	0,01738	
Sønderjylland				0,0590319	0,0130402	***	0,035562	0,016717	**	0,0444529	0,03184	
Ribe				0,027417	0,0128248	**	0,0402032	0,0163203	**	0,0499673	0,03263	
Vejle				0,0311602	0,0108818	***	0,0282679	0,0140478	**	0,0421665	0,02701	
Ringkøbing				0,0110875	0,0118337		0,0092371	0,0156446		0,0131144	0,02059	
Århus				0,0106615	0,0079225		0,0108735	0,0106569		0,013387	0,01278	
Viborg				0,016957	0,0133208		0,0212565	0,0171032		0,026476	0,0266	
Nordjylland				0,0003834	0,0090169		0,0063266	0,0118939		0,0076721	0,01332	
Cph & Frederiksberg				0,0016732	0,0073692		0,0004115	0,0098985		-0,0000654	0,00891	

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Immigrant*2002						0,0124855	0,0175876		0,0125503	0,01536	
Couple*2002						-0,0163734	0,0105129		-0,0096441	0,0047	**
Couple&child*2002						0,0080174	0,0212489		0,012085	0,02697	
Unemployed*2002						0,0488422	0,0306335		0,0266466	0,03412	
Out of labor force*2002						-0,0017229	0,0138661		-0,0063753	0,01399	
Student*2002						0,0186064	0,0123102		0,0192228	0,01514	
Prev. Income*2002						8,69E-08	7,99E-08		9,04E-07	0	
Work experience*2002						0,0050223	0,0030397	*	0,0033823	0,00225	
Frederiksborg*2002						0,0120071	0,0238189		0,0101457	0,02672	
Roskilde*2002						0,0187132	0,0271003		0,006458	0,02245	
Vestsjælland*2002						-0,0305911	0,0244616				
Storstrøm*2002						0,012856	0,0259346		0,0099153	0,02517	
Fyn*2002						-0,0037635	0,0184258		-0,0040702	0,01151	
Sønderjylland*2002						0,0631111	0,0267594	**	0,0222954	0,03233	
Ribe*2002						-0,0321893	0,0264677		-0,0137273	0,00606	
Vejle*2002						0,0077589	0,0222622		-0,003264	0,0132	
Ringkøbing*2002						0,0045689	0,0239094		-0,0005222	0,01824	
Århus*2002						-0,0011835	0,0159449		-0,0024637	0,01157	
Viborg*2002						-0,0081845	0,0273081		-0,0056149	0,01498	
Nordjylland*2002						-0,0145372	0,0182362		-0,0105398	0,00831	
Cph & Frederiksberg*2002						0,002438	0,0148332		0,0043356	0,01459	
Constant	0,0327628	0,0036225	***	0,0558864	0,0087519	*** 0,0670165	0,0114055	***			
Obs	6877			6877		6877			6784		
Adj R2	0,0013			0,0156		0,0168			0,0944		

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 16. Difference in differences for women from 1996-2002.

	D in d (ols)			D in d cov (ols)			D in d cov & time cov (ols)			D in d cov & t. cov (probit)		
	Coef	St.err.		Coef	St.err.		Coef	St.err.		Coef.	St.err.	
24 years	ref.			ref.			ref.			ref.		
25 years	0,0022089	0,0054141		-0,0101358	0,0051238	**	-0,0095025	0,0051488	*	-0,0024195	0,00141	*
1996	ref.			ref.			ref.			ref.		
2002	-0,0100908	0,0051193	**	0,0039545	0,0054583		-0,0490407	0,0274273	*	-0,0137315	0,00918	
25*2002	0,0005817	0,0078334		-0,0003588	0,0077794		-0,0021465	0,007878		-0,0007178	0,00192	
Dane				ref.			ref.			ref.		
Immigrant				0,0078135	0,0082773		-0,0050312	0,0113883		-0,0028438	0,003	
Single				ref.			ref.			ref.		
Couple				0,0012832	0,0043984		0,001874	0,005814		0,0001298	0,00148	
Couple with children				0,004869	0,0069826		-0,0001936	0,0089045		-0,0008909	0,00259	
Wage earner				ref.			ref.			ref.		
Unemployed				-0,0324463	0,0098727	***	-0,0321726	0,0103679	***	-0,0049644	0,00129	***
Out of labor force				-0,0526453	0,0063324	***	-0,0549118	0,008054	***	-0,0560031	0,00372	***
Student				-0,0285598	0,0057353	***	-0,0387061	0,0079956	***	-0,0067063	0,00167	***
Prev. Income				-3,19E-07	5,46E-08	***	-3,84E-07	7,59E-08	***	-1,01E-06	0	***
Work experience				0,0048782	0,0017028	***	0,0040834	0,0021788	*	0,0011978	0,00059	**
Great Copenhagen				ref.			ref.			ref.		
Frederiksborg				0,034881	0,0119406	***	0,0314613	0,0153002	**	0,0129328	0,01017	
Roskilde				0,0500606	0,0127602	***	0,0429169	0,0161366	***	0,0203216	0,01372	
Vestsjælland				0,0045376	0,0123079		-0,0019805	0,0163115		-0,0012199	0,00447	
Storstrøm				0,0234166	0,0122767	*	0,0282769	0,0155622	*	0,0127246	0,01058	
Fyn				0,0007115	0,0091096		-0,0058802	0,0118838		-0,0014715	0,0031	
Sønderjylland				0,0154316	0,0128158		0,0291645	0,0160228	*	0,0114939	0,01005	
Ribe				0,0334755	0,0125233	***	0,0259373	0,0161801		0,0116903	0,01035	
Vejle				0,0221439	0,0107657	**	0,0167754	0,0136448		0,0064073	0,00674	
Ringkøbing				0,0139852	0,0115525		0,0216558	0,0149852		0,0077437	0,00774	
Århus				0,0022176	0,008224		0,002523	0,0107713		0,0011089	0,00352	
Viborg				0,0103851	0,0128898		-0,0001925	0,0170184		0,000196	0,00511	
Nordjylland				0,0113703	0,0093976		0,0213083	0,0123758	*	0,0086529	0,00691	
Cph & Frederiksberg				-0,0005953	0,007716		-0,0004264	0,0102213		0,0003187	0,00311	

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Immigrant*2002						0,0258679	0,0166213		0,0087541	0,00558	
Couple*2002						-0,0006971	0,0089136		0,0003532	0,00229	
Couple&child*2002						0,0151666	0,0144299		0,0087602	0,00856	
Unemployed*2002						-0,0171087	0,0422147				
Out of labor force*2002						0,0055721	0,0131079		0,9214622	0,00916	***
Student*2002						0,0208199	0,0114977	*	0,0058121	0,00471	
Prev. Income*2002						1,25E-07	1,10E-07		3,04E-07	0	
Work experience*2002						0,0019318	0,0035304		0,0004231	0,0009	
Frederiksborg*2002						0,0080686	0,024512		0,0007661	0,00641	
Roskilde*2002						0,0204864	0,0264461		0,0001797	0,00594	
Vestsjælland*2002						0,0154037	0,0248895		0,006337	0,01364	
Storstrøm*2002						-0,0127478	0,0253781		-0,0023032	0,00427	
Fyn*2002						0,0173459	0,0185306		0,0064949	0,00979	
Sønderjylland*2002						-0,0377762	0,0268022		-0,0053173	0,00155	***
Ribe*2002						0,0196423	0,0255658		0,0025138	0,00813	
Vejle*2002						0,0160005	0,0222775		0,0026651	0,00759	
Ringkøbing*2002						-0,017156	0,0235787		-0,0035935	0,00297	
Århus*2002						0,0008478	0,0167042		-0,0000461	0,00464	
Viborg*2002						0,0252543	0,0260784		0,0083942	0,01458	
Nordjylland*2002						-0,0210029	0,019044		-0,0038962	0,00236	*
Cph & Frederiksberg*2002						0,0015721	0,0156507		0,0004146	0,00463	
Constant	0,0346392	0,0035133	***	0,0677051	0,0099073	*** 0,0798105	0,0128379	***			
Obs	7994			7994		7994			7976		
Adj R2	0,0005			0,016		0,0161			0,0916		

Source: Statistics Denmark register panel data from 1995 to 2004 &Dream register on AAS 1997-2005

Table 17. Difference in differences for men from 1996-2003.

	Dif in dif (ols)			Dif in dif with cov (ols)			Dif in dif with cov (probit)		
	Coef	Stand. Err		Coef	Stand. Err		Coef	Stand. Err	
24 years	ref.			ref.			ref.		
25 years	-0,0145621	0,0055467	***	-0,0153408	0,0055332	***	-0,0160366	0,00536	***
1996	ref.			ref.			ref.		
1997	0,0037298	0,0055103		0,0039384	0,0054892		0,0038297	0,00501	
1998	0,0005879	0,0055496		0,0022568	0,005533		0,0025596	0,00499	
1999	0,0032497	0,0055519		0,0053715	0,005538		0,0046132	0,00517	
2000	0,0010761	0,0057183		0,0037778	0,0057098		0,0045853	0,00536	
2001	0,0074216	0,0059157		0,0100707	0,0059049	*	0,0094071	0,00599	
2002	0,002031	0,0058784		0,0060039	0,0058714		0,0055556	0,00567	
2003	0,0052731	0,0059997		-0,0254107	0,0064917	***	-0,0190016	0,00271	***
25*1997	0,0005414	0,0079078		0,0015035	0,0078733		0,0032196	0,00798	
25*1998	0,0251003	0,0079745	***	0,0254089	0,0079365	***	0,0334358	0,01314	**
25*1999	0,0096055	0,0079935		0,0111425	0,0079586		0,0162124	0,01037	
25*2000	0,0011661	0,008116		0,0023706	0,0080817		0,0023376	0,0081	
25*2001	0,0088164	0,0083843		0,010637	0,0083477		0,0149137	0,01042	
25*2002	0,0048236	0,008537		0,0060155	0,0084985		0,0088604	0,00982	
25*2003	0,0001537	0,0085464		-0,000387	0,0085084		0,0019137	0,00816	
Dane				ref.			ref.		
Immigrant				-0,0000299	0,0042546		-0,000205	0,0039	
Single				ref.			ref.		
Couple				-0,0032788	0,0027416		-0,002818	0,00223	
Couple with children				-0,011663	0,0056258	**	-0,0102077	0,00386	***
Wage earner				ref.			ref.		
Unemployed				-0,0018899	0,0058638		-0,000422	0,00473	
Out of labor force				-0,0416576	0,0036573	***	-0,0290865	0,00141	***
Student				-0,0201521	0,0032362	***	-0,0148072	0,00194	***
Prev. Income				-2,46E-07	2,08E-08	***	-2,05E-06	0	***
Work experience				0,00457	0,0007748	***	0,004512	0,00066	***
Great Copenhagen				ref.			ref.		
Frederiksborg				0,0156164	0,0063463	**	0,01571	0,00763	**
Roskilde				0,0224486	0,0070881	***	0,0227628	0,00933	**
Vestsjælland				0,0181875	0,0065366	***	0,0199447	0,00852	**
Storstrøm				0,0189506	0,0065952	***	0,0186613	0,00831	**
Fyn				0,0077603	0,004866		0,0074801	0,00512	
Sønderjylland				0,0230695	0,0070268	***	0,0239736	0,00942	**
Ribe				0,0099943	0,0069097		0,0095001	0,00755	
Vejle				0,0154719	0,0057872	***	0,0150868	0,00696	**
Ringkøbing				0,0098816	0,0065072		0,0098517	0,00719	
Århus				0,0025645	0,0042428		0,0030146	0,00407	
Viborg				0,0160391	0,0072571	**	0,017115	0,00895	*
Nordjylland				0,0050377	0,0048255		0,0050217	0,00485	
Cph & Frederiksberg				-0,0052789	0,0039124		-0,0046445	0,00336	
Constant	0,0327628	0,0038613	***	0,0578278	0,0057464	***			
Obs	27571			27571			27571		
Adj R2	0,0012			0,011			0,0503		

Source: Statistics Denmark register panel data from 1995 to 2004 &Dream register on AAS 1997-2005

Table 18. Difference in differences for women from 1996-2003.

	Dif in dif (ols)			Dif in dif with cov (ols)			Dif in dif with cov (probit)		
	Coef	Stand. Err		Coef	Stand. Err		Coef	Stand. Err	
24 years	ref.			ref.			ref.		
25 years	-0,0100908	0,0052866		-0,0108064	0,005266	**	-0,009377	0,00454	**
1996	ref.			ref.			ref.		
1997	0,0054125	0,0051875		0,0057362	0,0051612		0,0051781	0,00458	
1998	0,0084981	0,0052031		0,008343	0,0051815		0,0072338	0,00474	
1999	0,0032816	0,0051734		0,0040009	0,0051537		0,0039979	0,00451	
2000	-0,0009758	0,005382		0,0002162	0,0053648		0,00165	0,00451	
2001	0,0008966	0,0055576		0,0010743	0,0055409		0,0023174	0,00469	
2002	0,0022089	0,005591		0,0036737	0,0055793		0,0049066	0,005	
2003	0,005931	0,0055375		-0,0217798	0,0061235	***	-0,0184783	0,00251	***
25*1997	-0,0063108	0,0074793		-0,006082	0,0074375		-0,0046519	0,00546	
25*1998	0,0003339	0,0075409		0,0010903	0,007497		0,0023758	0,00659	
25*1999	0,0010937	0,0075289		0,000623	0,0074863		0,0012727	0,00654	
25*2000	0,0078362	0,0076482		0,0080319	0,0076048		0,0081242	0,00787	
25*2001	-0,0005246	0,0079119		0,0010121	0,0078659		0,0016097	0,00699	
25*2002	0,0005817	0,0080893		-0,0000237	0,0080421		-0,0001977	0,00672	
25*2003	-0,00089	0,0080452		-0,0002078	0,0080002		0,0008363	0,00676	
Dane				ref.			ref.		
Immigrant				-0,0026201	0,0040205		-0,0036179	0,00346	
Single				ref.			ref.		
Couple				-0,0022928	0,0022454		-0,0018118	0,00175	
Couple with children				0,0126674	0,0035806	***	0,0132074	0,00398	***
Wage earner				ref.			ref.		
Unemployed				-0,0237761	0,0056314	***	-0,0130689	0,00275	***
Out of labor force				-0,0496615	0,0032446	***	-0,0359184	0,0013	***
Student				-0,0227747	0,002834	***	-0,0167712	0,00172	***
Prev. Income				-2,17E-07	2,45E-08	***	-2,05E-06	0	***
Work experience				0,0036322	0,0008491	***	0,0038704	0,00069	***
Great Copenhagen				ref.			ref.		
Frederiksborg				0,0058866	0,0061775		0,0060741	0,00582	
Roskilde				0,0294097	0,0070073	***	0,0253741	0,00884	***
Vestsjælland				0,0110574	0,0062781	*	0,0113704	0,00664	*
Storstrøm				0,0202966	0,0063301	***	0,0195269	0,00759	***
Fyn				-0,0020987	0,0047398		-0,001183	0,00385	
Sønderjylland				0,0126841	0,0065998	*	0,0105973	0,00676	
Ribe				0,0127009	0,0064593	**	0,0103929	0,00656	
Vejle				0,0115736	0,0055407	**	0,0106356	0,0057	*
Ringkøbing				0,0063895	0,0060104		0,0044841	0,00542	
Århus				0,0008445	0,0042955		0,000887	0,00363	
Viborg				0,0011929	0,0067711		0,0013239	0,00575	
Nordjylland				0,0014982	0,0048562		0,0015131	0,00416	
Cph & Frederiksberg				-0,0118183	0,003999	***	-0,0092961	0,00293	***
Constant	0,0346392	0,0036281	***	0,0653414	0,0058782	***			
Obs	32787			32787			32787		
Adj R2	0,0006			0,0127			0,0588		

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 19. Difference in differences for between 23-26 years of age from 1996-1998.

	D in d (ols)			D in d cov (ols)			D in d cov & time cov (ols)			D in d cov & t. cov (probit)		
	Coef	**St.err.**		**Coef**	**St.err.**		**Coef**	**St.err.**		**Coef.**	**St.err.**	
24 years	ref.			ref.			ref.			ref.		
25 years	0,0037347	0,0039752		-0,0199999	0,004167	***	-0,0177095	0,0042733	***	-0,0186235	0,004	***
1996	ref.			ref.			ref.			ref.		
1998	-0,0195749	0,004063	***	0,0049879	0,0039672		-0,0128528	0,0192951		-0,0317006	0,01952	
25*1998	0,0177983	0,0058093	***	0,0186932	0,0057777	***	0,0142074	0,006088	***	0,0192316	0,00711	***
Dane				ref.			ref.			ref.		
Immigrant				-0,0067836	0,0064744		-0,011735	0,0096274		-0,0145997	0,0064	**
Single				ref.			ref.			ref.		
Couple				0,0069235	0,0038296	*	-0,0022253	0,005394		-0,0014708	0,00479	
Couple & children				-0,003187	0,0070372		-0,006384	0,009632		-0,0073137	0,0084	
Wage earner				ref.			ref.			ref.		
Unemployed				-0,0128663	0,0068634	*	-0,0112771	0,0081712		-0,0058675	0,00596	
Out of lab.force				-0,0448089	0,0049104	***	-0,0443552	0,0070171	***	-0,031462	0,00272	***
Student				-0,0255396	0,0046978	***	-0,0292842	0,0067188	***	-0,0199368	0,00329	***
Prev. Income				-3,33E-07	3,16E-08	***	-3,20E-07	4,48E-08	***	-3,06E-06	0	***
Work experience				0,0050309	0,0010411	***	0,0033777	0,0014162	**	0,0043003	0,0013	***
Great Copenhagen				ref.			ref.			ref.		
Frederiksborg				0,0213701	0,0083523	**	0,0189184	0,0115027	*	0,0218983	0,01525	
Roskilde				0,0136411	0,0096368		0,0168925	0,0132454		0,0171842	0,01688	
Vestsjælland				0,0214953	0,0085793	**	0,0237037	0,0117118	**	0,0262609	0,01704	
Storstrøm				0,0276385	0,0085549	***	0,0156136	0,0118774		0,0150032	0,01455	
Fyn				0,0059094	0,0066823		0,005132	0,0091829		0,0054191	0,00949	
Sønderjylland				0,0220633	0,0090977	**	0,0274488	0,012505	**	0,0335005	0,01952	*
Ribe				0,0067787	0,0091034		0,0091697	0,0126285		0,0097586	0,01458	
Vejle				0,0179972	0,0078518	**	0,0175932	0,0109177		0,0243576	0,0156	
Ringkøbing				0,0070171	0,0087827		0,0050524	0,0119091		0,0057884	0,01301	
Århus				0,002905	0,0058975		-0,0002755	0,0082179		0,0005977	0,00773	
Viborg				-0,0044067	0,0096574		0,0039576	0,0132132		0,0047215	0,01403	
Nordjylland				0,0029108	0,0066302		-0,0035245	0,0091934		-0,0022262	0,00825	
Cph & Frederiksb.				-0,0099446	0,0054911	*	-0,0051451	0,0076917		-0,0053468	0,00664	

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Immigrant*1998							0,009629	0,0130206		0,0172027	0,01389	
Couple*1998							0,0182287	0,0076644	**	0,014316	0,0087	*
Couple&child*1998							0,0060299	0,014121		0,0105454	0,01804	
Unemployed*1998							-0,0067933	0,0152805		-0,0056067	0,01061	
Out of lab.for.*1998							-0,0014848	0,0098358		0,0250945	0,01921	
Student*1998							0,0070493	0,0094025		0,0138991	0,01004	
Prev. Income*1998							-3,17E-08	6,33E-08		1,00E-06	0	*
Work exp.*1998							0,0038068	0,0020947	*	0,0009196	0,00176	
Frederiksborg*1998							0,0055285	0,0167362		-0,0018296	0,01205	
Roskilde*1998							-0,006561	0,0193085		-0,0061778	0,01226	
Vestsjælland*1998							-0,0044134	0,0172135		-0,0056126	0,01098	
Storstrøm*1998							0,0252078	0,0171247		0,0109536	0,01766	
Fyn*1998							0,0019205	0,0133894		-0,0007197	0,01095	
Sønderjylland*1998							-0,0115496	0,018234		-0,0108062	0,00892	
Ribe*1998							-0,005043	0,0182269		-0,0051033	0,01263	
Vejle*1998							0,0010382	0,0157169		-0,0065449	0,00986	
Ringkøbing*1998							0,0042416	0,0176427		0,0000603	0,0148	
Århus*1998							0,0069193	0,0118097		0,0049424	0,01147	
Viborg*1998							-0,0175251	0,0193639		-0,0135141	0,00964	
Nordjylland*1998							0,0131427	0,0132731		0,0102706	0,01489	
Cph & Fred.*1998							-0,0086894	0,0109949		-0,0058853	0,0084	
Constant	0,0365472	0,0027784	***	0,0729766	0,006547	***	0,076949	0,0087303	***			
Obs	15290			15290			15290			15290		
Adj R2	0,0025			0,0149			0,015			0,0662		

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 20. Difference in differences for women between 23-26 years of age from 1996-1998.

	D in d (ols)			D in d cov (ols)			D in d cov & time cov (ols)			D in d cov & t. cov (probit)		
	Coef	St.err.		Coef	St.err.		Coef	St.err.		Coef.	St.err.	
24 years	ref.			ref.			ref.			ref.		
25 years	0,0088415	0,0039153	**	-0,0187154	0,0041538	***	-0,0177061	0,0042373	***	-0,0164157	0,0037	***
1996	ref.			ref.			ref.			ref.		
1998	-0,0185785	0,0040932	***	0,0088444	0,0038955	**	0,0203999	0,0201664		-0,0052455	0,01883	
25*1998	0,0035899	0,0057786		0,0049051	0,0057342		0,0027985	0,005968		0,0058907	0,00549	
Dane				ref.			ref.			ref.		
Immigrant				-0,0078134	0,0062066		-0,0082557	0,0091601		-0,0140766	0,00719	**
Single				ref.			ref.			ref.		
Couple				-0,0011627	0,0033314		-0,0034415	0,0046967		-0,0031712	0,00376	
Couple & children				0,0129888	0,0049393	***	0,0041375	0,006978		0,004893	0,00735	
Wage earner				ref.			ref.			ref.		
Unemployed				-0,0282747	0,0070826	***	-0,0280525	0,008294	***	-0,0166949	0,0041	***
Out of lab.force				-0,0620341	0,0044685	***	-0,0587497	0,0062822	***	-0,0442002	0,00307	***
Student				-0,042882	0,0044419	***	-0,0460016	0,0064032	***	-0,0267618	0,00318	***
Prev. Income				-4,15E-07	4,17E-08	***	-4,56E-07	6,09E-08	***	-4,02E-06	0	***
Work experience				0,0044022	0,0012146	***	0,0046643	0,0016674	***	0,0050402	0,00142	***
Great Copenhagen				ref.			ref.			ref.		
Frederiksborg				-0,0087936	0,008687		0,0097535	0,0121597		0,0096463	0,01288	
Roskilde				0,02855	0,009619	***	0,0299537	0,0131612	**	0,03178	0,01848	*
Vestsjælland				0,0030888	0,0088185		0,0086092	0,0123834		0,0103356	0,01391	
Storstrøm				0,0244899	0,0089553	***	0,024199	0,0126488	*	0,025729	0,0168	
Fyn				-0,0123678	0,0068255	*	-0,0051431	0,0095867		-0,0037071	0,00813	
Sønderjylland				0,0067855	0,0092352		0,0270859	0,0129618	**	0,0283461	0,01754	
Ribe				0,000434	0,0091465		0,0160265	0,0127871		0,018724	0,01546	
Vejle				-0,0006662	0,0078832		0,0102441	0,0110004		0,0113674	0,01208	
Ringkøbing				0,0028132	0,0085947		0,0225889	0,0119479	*	0,0222691	0,01492	
Århus				-0,0096997	0,0062482		-0,0029837	0,0087202		-0,0032988	0,0074	
Viborg				0,0068492	0,0095002		0,0227058	0,0131184	*	0,0238041	0,01687	
Nordjylland				-0,0046308	0,007066		0,0030196	0,0098968		0,0038824	0,00956	
Cph & Frederiksb.				-0,0217872	0,005853	***	-0,0047202	0,0082386		-0,0038462	0,00703	

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Immigrant*1998							0,0009841	0,0124595		0,0106114	0,01394	
Couple*1998							0,0045854	0,0066648		0,0045118	0,00581	
Couple&child*1998							0,0177152	0,0098827	*	0,0135314	0,01135	
Unemployed*1998							0,0069528	0,0163209		0,0120204	0,01732	
Out of lab.for.*1998							-0,0066286	0,0089432		0,0249224	0,01738	
Student*1998							0,0056774	0,0088956		0,0101496	0,00843	
Prev. Income*1998							7,34E-08	8,38E-08		1,04E-06	0	*
Work exp.*1998							-0,0004894	0,0024389		-0,001673	0,00195	
Frederiksborg*1998							-0,0385191	0,0173783	**	-0,0187171	0,00588	***
Roskilde*1998							-0,0024624	0,0192877		-0,0084956	0,01005	
Vestsjælland*1998							-0,0118391	0,0176434		-0,0084481	0,0104	
Storstrøm*1998							-0,0013691	0,0179215		-0,0070407	0,01029	
Fyn*1998							-0,0156716	0,0136587		-0,0079984	0,00889	
Sønderjylland*1998							-0,0418797	0,0184753	**	-0,0190758	0,00555	***
Ribe*1998							-0,0328076	0,0183	*	-0,0178805	0,00616	***
Vejle*1998							-0,0233341	0,0157773		-0,0137937	0,00723	*
Ringkøbing*1998							-0,0414115	0,0172031	**	-0,0188201	0,00537	***
Århus*1998							-0,0144308	0,0125021		-0,0062309	0,00855	
Viborg*1998							-0,0338171	0,0190246	*	-0,01743	0,00644	***
Nordjylland*1998							-0,0165783	0,0141383		-0,0101556	0,008	
Cph & Fred.*1998							-0,03433	0,0117143	***	-0,0190117	0,00554	***
Constant	0,0420237	0,0027535	***	0,1063789	0,0074648	***	0,1011044	0,0102316	***			
Obs	17932			17932			17932			17932		
Adj R2	0,0024			0,0203			0,0206			0,0763		

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 21. Difference in differences for unskilled men from 1996-1998.

	D in d (ols)			D in d cov (ols)			D in d cov & time cov (ols)			D in d cov & t. cov (probit)		
	Coef	St.err.		Coef	St.err.		Coef	St.err.		Coef.	St.err.	
25*1998	0,0368532	0,011492	***	0,0394337	0,0113076	***	0,0386336	0,0116229	***	0,0352807	0,01359	***
Adj R2	0,0037			0,0378			0,0373			0,1292		

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 22. Difference in differences for unskilled women from 1996-1998.

	D in d (ols)		D in d cov (ols)		D in d cov & time cov (ols)		D in d cov & t. cov (probit)	
	Coef	St.err.	Coef	St.err.	Coef	St.err.	Coef.	St.err.
25*1998	0,0018973	0,0117872	0,0015598	0,0114965	0,0016218	0,0117359	-0,0000238	0,00127
Adj R2	0,0013		0,0531		0,0538		0,1802	

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005

Table 23. Averages applied for calculating elasticities.

	Yearly ave. wage DkK	Ave. edu. Income (3,5 y)	Entrance rate	95% conf.inte
New voc.train. 25y 1996	121269	424442		
New adult voc. Train. 25 y 1998	159886	559601		
Wage difference Dkr	38617	135159		
Wage difference in pct	31,84	31,84		
Voc. Train. 25y 1996			1,82	
Estimated increase 25y 1998			2,69	0,71-4,67
Entrance difference in pct			147,8	39,01-256,59
Exchange rate 1000US$ (2007)	5664			

Source: Statistics Denmark register panel data from 1995 to 2004 & Dream register on AAS 1997-2005