CHAPTER 11

# The Return to Human Capital in Norway: A Review of the Literature

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# 1 Introduction[1]

The aim of this article is to review the existing Norwegian evidence on private returns to human capital, that is, formal education, labour market experience, tenure and on-the-job training. We concentrate on the period from the beginning of the nineteen eighties and we restrict the discussion to studies using econometric methods.

In recent years, many studies have been published which contain evidence with regard to the returns to human capital in Norway. The studies pursue a variety of subjects which, of course, affect the data sets used, the econometric specifications, and the definitions of variables. Some of the studies focus specifically on wage differences and gender and consequently run separate estimations for men and women. Another main issue is the difference in the wage structure between the private and the public sector. Some studies try to explain the stable wage dispersion in Norway after 1980, and discuss the role of changes in the educational systems as well as the wage setting institutions in this context. The variety of subjects and approaches makes the overall impression more comprehensive, but impairs the comparability of results over time and between data sets.

Most of the reviewed studies concentrate on the discussion of returns to formal education. Even though all studies control for experience and seniority, if available, only a few focus specifically on the returns to these other aspects of human capital. This emphasis on returns to education in the Norwegian literature is reflected in this review as well.

The returns to different types of human capital are determined by conditions on the supply and the demand side of the labour market. On the demand side, technology and international trade patterns are fundamental in the long run, while business cycles have a more temporary influence. On the supply side, demographics and the di-

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mensioning and quality of the educational system are decisive. Since the returns to different types of human capital are clearly interrelated, the shaping of the educational system not only influences the returns to formal education but also the returns to other types of human capital as well. If formal education and on-the-job training are alternative factors of production, a reduction in the quality of formal education may increase the returns to work experience. However, when these factors complement each other in the production process, a reduction in returns to experience may be the result.

Wage differentials are also influenced by the wage setting systems and bargaining regimes in force. Norway has a rather centralized bargaining system, with varying degree of possibilities of local adjustments. In Norway there have also been clear differences between the private and the public sector in this respect. Very roughly speaking, we may say that the wage formation in the public sector is characterized by rigid professional structures and scales of payment decided on a centralized level. In the private sector the wage formation has been more decentralized and, specifically with regard to highly educated people, the use of individual wage setting more widespread.

In this chapter we review the results from the last fifteen years, interpreted within a framework of both changes in supply and demand and of changing institutions. The chapter is organized as follows. In Section 2 we present a description of the main data sets used in the Norwegian studies of returns to human capital and give a short overview of the statistical techniques utilized. In Section 3 we review the reported results. In 3.1 we consider returns to formal education in relation to structural shifts in supply and demand, institutional changes in the wage setting system, and business cycles. In 3.2 we review the reported results on returns to labour market experience, tenure and specific on-the-job training. In Section 4 we make some concluding remarks.

# 2 Data sets and statistical techniques

## 2.1 Data

Roughly speaking, the existing studies of returns to human capital in Norway are based on two types of data: register based data sets and survey based data sets.

### 2.1.1 Register based data sets

These data sets are based on population registers established for administrative purposes. The registers are integrated into a register based data system (*Current System for Social Data, CSSD*) linked by Statistics Norway. To establish the data sets for research purposes, register files are merged to yield information about personal characteristics, income, industry affiliation and place of residence, among other things. The most commonly used registers are the register of employees and employers in connection with the register of salaries and taxes and the register of education. Even though it is quite possible to establish panel data sets from administrative registers, the data sets used in the Norwegian studies on returns to human capital are mainly cross-sectional, or only the cross-sectional properties of the data sets have so far been utilized.

The register based data sets may contain information on the total population or a random sample from one register. Typically the register based data sets involve large amounts of observations and, consequently, more significant differences between separate samples are found. While the register data has its shortcomings, particularly with respect to the measurement of hourly wages (see below), the large size enables the researcher to compare rather small sub-samples and various specifications in more detail.

The *income* observations in the register based data sets are based on declarations sent by employers to the tax authorities. This source gives information from each employer about the individual's yearly income (wage) including most types of compensations, such as fringe benefits and overtime payment.

*Hours worked* are collected from the register of employers and employees and are recorded in rather broad categories: Full-time (more than 29 hours a week), long part-time (between 29 and 20 hours a week) and short part-time (between 19 and 4 hours a week). To avoid serious supply of hours bias, most studies based on this type of data use only full-time workers. Thus, the observation of *hourly wage* is calculated from yearly gross earnings divided by normal hours or average hours for full-time workers. In the following we call this variable *calculated hourly wage*.

Even if only full-time workers are included in the analysis, we must be aware of that a supply of hours bias may arise in the estimates of

returns to different types of human capital, when the calculated hourly wage is used as the dependent variable. More precisely, we over(under)estimate the returns to schooling if "overtime" in full-time work increases (decreases) with the human capital variable studied. In some of the register based studies effort has been made to diminish this supply of hour bias. In the study by Longva and Strøm (1998) the hourly wage is calculated by dividing annual income by normal hours for full-time workers plus mean overtime for each gender. Individuals who were registered for more than one job, and those who earned more than four times the standard deviation of the mean hourly wage were omitted. In the twin-study of Raaum and Aabø (1999) both full-time and long part-time workers are used in the wage estimations. The number of hours worked within each category are calculated as the means from the 1992–93 Labour Force Surveys, stratified by gender.[2]

The *educational* variable is based on a five digit code of highest completed education, which is merged from the administrative register recording the highest education of citizens. The register is updated on the basis of information from officially approved educational institutions, and covers completed degrees and exams from courses of at least 300 hours. The register is maintained and controlled for public assistance and student loan purposes, and should include very little measurement error. Years of schooling are usually defined as the standard number of years required to fulfil the individual's highest educational level.

One of the data sets we refer to as register based, is actually a combination of a register based data set and a survey. This is the so-called *Norwegian Flexible Study* (NFS). The starting point is an establishment level survey for a sample of Norwegian firms, conducted by the Institute for Social Research and Statistics Norway during the Spring of 1997. The sample is representative for private and public establishments in Norway with more than 10 employees. The net sample consists of 2,130 firms. To this sample register information on all employees working in these firms during the period November 1995 to February 1997 has been linked. The register data contain information on labour market related issues,

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[2] A description of the Labour Force Surveys is given in Labour Market Statistics, Statistics Norway.

including information on employment, wages, education and seniority with the present employer. The sample of wage earners consists of 164,102 individuals in 1,755 private and public establishments, who worked with the same employer during all of 1996 (see Barth and Schøne (1999) for a closer description).

Another register based data set is a twin sample established by matching several administrative registers of Statistics Norway (see Raaum and Aabø (1999) for a closer description). Twins are defined as individuals born at the same time (same day, next/previous day), by the same mother. The register matching procedure identifies about 80 per cent of Norwegian twins born in the period 1946–1965. After sample restrictions, altogether about 3,000 twin pairs of the same sex, with satisfactory income information, are recorded in the data set.

The main properties of the data used in the register based studies on returns to human capital in Norway are summarized in Table A1 of the Appendix.

### 2.1.2 Survey based data sets

The survey based studies of human capital endowment and wage formation in Norway employ two data sets:

*The Norwegian Survey of Organizations and Employees* (NSOE) was undertaken in 1989 and 1993. Each NSOE contains about 4,000 wage observations.

NSOE 1989 was a survey among Norwegian employers and employees, conducted by the Institute for Social Research and Statistics Norway. First, 1,050 employers were sampled with a probability proportional to the square root of the number of employees. Next, employees were drawn from each employer with a probability proportional to the square root of the number of employees. The sample is a self-weighting sample of all wage earners in Norway in 1989. Both employers (managers, personal managers and union representatives) and employees were interviewed.

In 1993 the same individuals were interviewed again (NSOE 1993). In addition, the sample was expanded with employees hired by the employers in the period between 1989 and 1993 in such a way as to make the sample representative of wage earners in 1993. NSOE 1993 was not supplemented with interviews at the employer level.

*Level of Living Surveys* (LLS) which is an ongoing project at Statistics Norway, surveying a sample of the Norwegian adult population. In the period we cover, this survey has been undertaken in 1980, 1983, 1987, 1991 and 1995. In 1980 the sample was drawn among households. From then on, the samples have been drawn from individuals. LLS is a panel, with the addition of young persons in every wave. Every LLS contains about 5,000 individuals, comprising around 2,500 wage observations.

Since the NSOE copied a host of labour market related questions from the LLS, the two types of surveys may be used together and comparatively over time.

The *income* observations, in both data sets, are based on self-reporting among full-timers and part-timers. The individuals are asked to report their usual monthly/weekly/hourly gross wage.

*Hours worked* are observed as self-reported usual number of hours worked in the relevant period of time (month, week), including usual level of overtime. Thus, the *hourly wage* variable is calculated as reported monthly/weekly/hourly gross wage divided by the number of hours worked in the appropriate period. In the following, this variable is referred to as *actual hourly wage*.

The *education* variable in both LLS and NSOE is based on a three or five digit code of highest completed education. In the LLS surveys from 1980 to 1987, the variable is coded from self-reported completed education. In the LLS and NSOE surveys from 1989 and onwards, the educational variable is merged from the administrative registers described above.

One difference between the two surveys is that in the NSOE the individuals are asked to report their *actual work experience*, while in the LLS the number of years in the labour market must be calculated from school years and age, that is, as *potential experience*.

Even though both these data sets are panels, only one of the studies we review (Schøne, 1996) has utilized this property so far. With regard to the LLS surveys this may be due to a rather small size of the panel.

The main properties of the data used in the survey based studies on returns to human capital in Norway are summarized in Table A2 of the Appendix.

## 2.2 Statistical procedures

In nearly all the studies a semi-logarithmic specification of the wage equation is chosen, that is, the dependent variable is the logarithm of hourly (or yearly) wages (actual or calculated), which is regressed on a varying number of personal, market and job related characteristics. An exception is the study by Longva (1995) who uses a straightforward linear specification of the wage equation.

Given the semi-logarithmic specification, the estimated coefficient has an approximate interpretation as the per cent change in hourly (yearly) wages resulting from one unit of change in the independent variables. Thus, assuming that the semi-logarithmic specification is valid, i.e. that each additional year of formal education has the same proportional effect on earnings, the estimated coefficient (x100) for years of schooling expresses the per cent change in hourly wages resulting from one additional year of schooling.[3] In the economic literature this coefficient is conventionally referred to as the return to schooling, and this is also the terminology used in this paper. However, it only coincides with the internal rate of return to school investments given quite strict assumptions (see Willis, 1986, and Heckman et al., 1999). It should be emphasized that when using the concept return to schooling, or returns to other human capital variables, we always refer to average income effects, even though the effects may vary between individuals.

The dominant estimation technique is straightforward ordinary least squares (OLS). It is well known that this procedure ignores the fact that one or more of the explanatory variables may be endogenously determined, or that the dependent variable is truncated. Non-random selection into education and training, and into different labour market states, may arise from this endogeneity. The non-random selection may be the result of individual choice, i.e. self-selection, or other types of selection procedures, such as entrance requirements to schools and on-the-job training courses, or market failures, such as unemployment.

The problems associated with selection into education and training reflect that the population is heterogeneous with regard to *"innate earning ability"* (the intercept of the earnings function) and

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[3] The exact formula is $(e^{\beta}-1)x100$, where $\beta$ is the estimated coefficient.

the *return to investment in human capital* (the slope of the earnings function)(see Card, 1998). If these factors influence, or are correlated with, the individual's choice of – and access to – levels and types of training and formal education, the OLS procedure produces biased estimates of the returns to human capital. Taking years of schooling as an example, the question is whether the observed rate of return to years of schooling is a measure of wage differentials arising from different types of individuals choosing different numbers of school years, or whether it is a genuine measure of the return to education which could be obtained by anyone who chooses a specific number of school years.

Economic theory – optimal schooling models of the Becker type – clearly predicts that people with a higher expected return to education tend to acquire more schooling. Thus, the bias due to heterogeneity in returns is most likely positive as a result of self-selection. If the high earners tend to take more years of schooling, the bias resulting from heterogeneity in innate earning ability is positive, as well. However, different models – within the same optimal schooling approach – predict opposite results with regard to the relationship between innate earning ability and marginal costs of schooling. The same models, accordingly, give opposite results with regard to the direction of the bias in the OLS estimator due to this type of heterogeneity. One major argument substantiating a negative bias is that those who make a lot of money anyway have higher alternative costs to education since they give up a higher income while going to school (Griliches, 1977). Arguments pointing in the opposite direction are based on proposed negative relationships between the individual characteristics generating high earning ability and the necessary effort required (extent of sacrifice) to attain a good result in schools or universities.

Optimal schooling models consider the process of self-selection and assume no entrance restrictions to schools and universities. In Norway enrolment into colleges and universities is rationed on the basis of previous schooling performance. Empirical results from different countries (Kjellström, 1997) reveal a positive relationship between test results at young age and future earning abilities. Thus, the selection taking place at the entrance of higher education in Norway may bias the OLS estimator in a positive direction.

Different methods have been proposed to deal with this issue of endogeneity. Hægeland et al. (1998) estimate the return to years of schooling in 1980 and 1990. By using a two-step instrumental variable approach, they take the endogeneity of school years into consideration. Using an ordered probit procedure they estimate the probability distribution of school choice in the first step: They utilize region during adolescence and parental educational attainment as determinants of schooling and predict generalized residuals (selection terms). In the next step, these are included in the wage equation to correct for the selectivity bias. In line with the international literature reporting on the use of IV methods, they conclude that the OLS estimates tend to be downward biased due to the endogeneity of school choice.

Raaum and Aabø (1999) use a large representative sample of twins to estimate the causal effect of schooling on earnings in Norway. Using a within family (twin pair) OLS estimator, they remove the biasing influence from heterogeneity in initiate earning ability and in returns to schooling which prevails *across families*. They find that the standard OLS estimates of the effect on male hourly earnings are upward biased. While they report a return to schooling of 0.05 for hourly earnings for male twins in Norway, the corresponding within family coefficient is 0.032. They do not find a similar bias for women.

These findings are in line with most international evidence based on twins (see Card, 1998). It seems that the results from studies using instrumental variables techniques, like Hægeland et al. (1998), suggest that there is a downward bias, while twin studies suggest that there is an upward bias in the standard OLS estimates. There are potential problems with both methods. The instrumental variable method fails if those individuals most likely affected by the instruments have a different return to education compared to the average individual, or if ability is affected by the instruments. In the international literature, family background variables have been criticized as instruments for schooling due to correlation with abilities that are valued in the labour market. The twin method fails if the reduction in the total variance of schooling, going from the full sample to a comparison within pairs of twins only, is larger than the reduction in the correlation between schooling and earnings (see Bound and Solon, 1999). One of the objections to twin studies is that they are not representative, that is, twins are different from other people. In the Norwegian study

this does not seem to be a problem, since the twin sample is equally distributed as the population sample with regard to individual characteristics. All in all, we have to settle on the conclusion that the Norwegian studies find results similar to those from other countries, and that the nature of the biases thus is likely to be similar to those found elsewhere. But the debate over the direction of the bias remains unsettled.

Schøne (1996) uses an ordinary Heckman two-stage procedure to remove the selectivity bias in the estimates of the returns to *on-the-job training*. He concludes that the hypothesis of no selectivity bias cannot be rejected.

The problem of selectivity may also arise due to the fact that the wage equation is estimated conditional on labour market states. Assume, as a relevant example, that the wage equation is estimated on full-time workers only, and that the individual's choice of this labour market state is influenced by unobservable variables which increase the wage premium from full-time work. The direction and the degree of bias in the estimated coefficients of the observable human capital variables then depend on the structure of correlation between the unobservable wage determinants and the value of these human capital variables. If this correlation is zero, only the constant term is affected, and no problem arises. However, when this correlation is positive (negative) the returns to the human capital variables is over(under)estimated.

In the Norwegian case, most of the register based studies estimate the wage equation from full-time workers, while the samples used in the survey based studies (LLS, NOSE) are representative for the whole group of wage earners. Thus, the problem of selectivity, due to labour market state, is more present in the register based studies.

In their estimation of returns to levels of education, Hægeland et al. (1998) use a sample consisting of full-time workers only. In their wage equation the inverse Mills' ratio, from the estimation of a binary probit model describing full-time labour force participation, is added to correct for this problem. The probit equation for self-selection into full-time work includes the number of children in the family and several socio-demographic characteristics. In these estimations they use a sample of all grown-ups in the relevant age categories. They conclude that not controlling for employment choice, i.e. by using a one-step OLS procedure, gives an

upward bias in the returns to education. However, they also conclude that the upward bias due to labour market state, seems to be cancelled out by the downward bias due to the endogeneity of educational choice.

By a multi-step procedure, Longva (1995) estimates wage equations on a register based sample of full-time workers in 1990 and 1991. He uses a sample of grown-ups to estimate the probability distribution of different labour market states. For this purpose a multinomial logit procedure is chosen. In the wage equation estimation, the predicted probability distribution is used to construct selection terms which correct for bias due to endogeneity of labour market state. Quite contrary to Hægeland et al. (1998), Longva concludes that not controlling for employment choice when using a sample consisting of full-time workers only, gives a downward bias in the estimated rate of return to education.

The statistical techniques used in the different studies reviewed are summarized in Tables A1 and A2 of the Appendix.

# 3 Results

## 3.1 Returns to formal education in Norway

We focus on the same issues as the studies we review, that is, international comparison, development over time from the beginning of the eighties, differences between sectors and the gender gap. In explaining the different patterns discovered, the authors focus on shifts in supply and demand, gender specific labour markets and wage setting systems. The emphasis of this presentation is given by the focus of the existing literature.

Table 1 summarizes the Norwegian studies with regard to returns to school years in the labour market as a whole, and for men and women separately. The estimated rates of return to additional school years fall within the interval 3.2 and 7 per cent. It is notable that the extreme values of this interval are contributed by the two studies which, in quite different ways, try to correct for the endogenous choice of schooling.

Comparable results from most OECD countries seem to range between a 5 and 10 per cent wage premium for each additional year of schooling above compulsory education (OECD, 1997; Asplund et al., 1996). Thus, with regard to the return to years of formal education, the estimates in Table 1 place Norway at the lower end, but within the range of other countries.

The estimates provided by the studies using register based data sets (Barth and Dale-Olsen, 1999; Barth and Schøne, 1999; Hægeland et al., 1998) seem to be slightly higher than the estimates from the survey based studies. This is probably due to a supply of hours bias resulting from a positive correlation between the level of education and the hours worked in a full-time (or part-time) job (Nørstenes, 1998). As described in the preceding section, the register based studies use calculated hourly (or yearly) wages as the dependent variable. Thus, systematic differences in hours worked between full-time workers at different levels of education tend to bias the estimates of return to school years. However, this type of positive bias does not seem to affect the estimates provided in the register based studies of Longva and Strøm (1998) and Raaum and Aabø (1999). The reason may be that these studies have a stricter sample selection rule and use measures of average hours worked for each gender, instead of normal work hours, when calculating hourly wages from yearly earnings.

The separate estimations for men and women, shown in Table 1, give ambiguous signs for the gender difference in returns to formal education, and in all the studies the gender gap is quite small. Thus, the studies provide no support for the hypothesis that the return to education varies between men and women in Norway. This is contrary to the results from similar studies for the other Nordic countries, which indicate higher returns to education in the male population (Asplund et al., 1996).

In order to investigate whether it is reasonable to assume that the level of education enters the earnings model in a linear fashion, dummy variables are used to represent the main classes of education, in Asplund et al. (1996). From the results reported in Table 2, the authors conclude that the linear specification is a reasonable approximation for Norway. The majority of studies adding a quadratic term for school years $(S^2)$ to the linearly specified models reported in Table 1, indicate that the relationship between wage increases and additional school years is slightly decreasing.

**Table 1. Returns to years of schooling in Norway for all, men and women. Dependent variable: log hourly wage[1]**

| | | All | Men | Women |
|---|---|---|---|---|
| Asplund et al. (1996) | 1989 | .040 (.002)[7] | .041 (.003) | .039 (.003) |
| Barth and Zweimüller (1992) | 1989 | | .053 [2]<br>$a_1$=.054 (.008)<br>$a_2$=-.0001 (001)[z] | .046 [2]<br>$a_1$=.046 (.013)<br>$a_2$=.0003 (.002)[z] |
| Barth and Dale-Olsen (1999)[3] | 1990 | .056 [2]<br>$a_1$=.060 (.001)<br>$a_2$=-.0007 (.000) | | |
| Longva and Strøm (1998) | 1991 | | .046 [2]<br>$a_1$=.037 (0.001)<br>$a_2$=.0004 (.000) | .040 [2]<br>$a_1$=-.002 (.002)[z]<br>$a_2$=.002 (.000) |
| Hægeland and Klette (1998)[4] | 1980 | .07 | | |
| | 1990 | .07 | | |
| Kahn (1998)[5] | 1980 | | .032 | .049 |
| | 1983 | | .047 | .055 |
| | 1987 | | .043 | .062 |
| | 1991 | | .042 | .053 |
| Barth and Mehlum (1993) | 1980 | .055 | | |
| | 1983 | .061 | | |
| | 1987 | .054 | | |
| Barth and Kongsgården (1996) | 1991 | .054 | | |
| | 1995 | .055 | | |
| Raaum and Aabø (1999):<br>OLS, non-twin sample<br>OLS, twin sample<br>twin approach | 1992/93 | | <br>.049 (.000)<br>.050 (.002)<br>.032 (.004) | <br>.044 (.000)<br>.044 (.006)<br>.040 (.006) |
| Barth and Schøne (1999) [6] | 1989 | | .045[2]<br>$a_1$=.056 (.007)<br>$a_2$=-.00.2 (.000) | .039[2]<br>$a_1$=.039 (.008)<br>$a_2$=-.0002 (.001)[z] |
| | 1996 | | .061[2]<br>$a_1$=.071 (.001)<br>$a_2$=-.0019 (.000) | .048[2]<br>$a_1$=.043 (.002)<br>$a_2$=.0010 (.000) |

*Notes:* [z] signifies that the estimated coefficient is not significantly different from zero on a 5 per cent level.

[1] When nothing else is noted, the estimates are generated by the models described in Tables A1 and A2 of the Appendix.

[2] The equation estimated is: $\log(w) = c + a_1S + a_2S^2 + Zg + u$. The value is calculated for the sample mean value of schooling (S).

[3] In this study the log yearly wage is the dependent variable.

[4] The figures reported by Hægeland et al. (1998) are calculated average effects. The calculations are kindly done by T. Hægeland.

[5] The figures reported by Kahn (1998) are calculated effects based on mean values of school years within the intervals he uses for the educational dummy variables. Our calculations.

[6] The reported figures are the results of pooled OLS estimation.

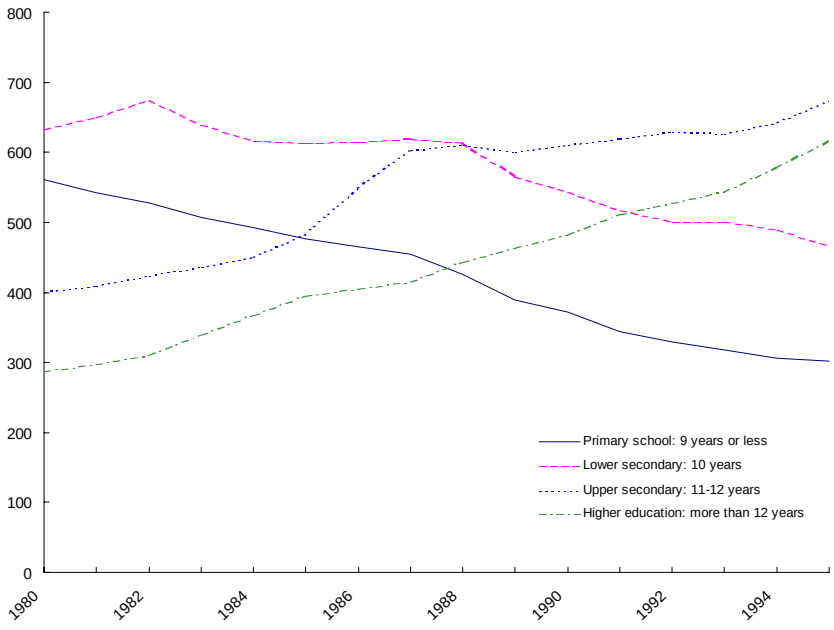
[7] Standard errors in parenthesis when available in the publications.

**Table 2. Returns to educational degrees, the omitted variable is Primary School (9 years or less). Dependent variable: log hourly wage[1]**

| | Year | | All |
|---|---|---|---|
| Asplund et al. (1996) | 1989 | Vocational | .109 (.011)[2] |
| | | Short non univ. | .269 (.015) |
| | | BA-level | .304 (.017) |
| | | Graduate | .442 (.020) |

*Notes:* [1] This is not the model referred to in Appendix Table A2.
[2] Standard errors in parenthesis.

**Figure 1. Number of employed persons (in 1000), 16 to 67 years of age, 1980 to 1997, by educational level**




*Source:* Labour Market Statistics, Statistics Norway

Both Hægeland et al. (1998) and Raaum and Aabø (1999) estimate flexible non-linear models with dummies for 9 to 18 years of schooling. Raaum and Aabø conclude that linearity can be rejected for the male population. They find that the returns to school years are specifically high at 12 and 16 years of schooling. In the female population they find specifically high returns at 13 and 16 years of schooling, but the hypothesis of linearity cannot be rejected. Hægeland et al. (1998) do not test for linearity, but find relatively high marginal returns at 12 and 16 years, as well, in their gender pooled estimations.

Tables 3 and 4 report returns to years of schooling estimated separately for the private and the public sector. The results clearly indicate higher returns to education in the private sector. Swedish and Danish studies, reporting results from the late eighties, describe the same pattern. Finnish studies from the same period report the opposite result, that is, higher returns to education in the public sector (Asplund et al., 1996).

**Table 3. Returns to years of schooling in the private and the public sector. Dependent variable: log hourly wage[1]**

| | Year | Private sector | Public sector | |
|---|---|---|---|---|
| | | | State | Local |
| Yin (1994) | 1989 | .042 (.003)[3] | .028 (.003) | .032 (.004) |
| Barth and Yin (1996) | 1987-90 | | .044[2] | |
| | 1991-94 | | .038[2] | |
| Schøne (1997) | 1991 | | .039[2] | |
| | 1992 | | .034[2] | |
| | 1993 | | .042[2] | |
| | 1994 | | .042[2] | |
| | 1995 | | .041[2] | |
| | 1996 | | .042[2] | |
| Barth (1997) | 1989 | .060 (003) | | |
| Barth and Kongsgården (1996) | 1991 | .063 | .050 | |
| | 1995 | .074 | .043 | |

*Notes:* [1] When nothing else is noted, the estimates are generated by the models described in Appendix Tables A1 and A2.

[2] The equation estimated is: $\log(w) = c+a_1S+a_2S^2+a_3SxE+Zg+u$. The value is calculated for the sample mean value of schooling (S) and experience (E), the standard errors of the estimated coefficients are available in the publications.

[3] Standard errors in parenthesis when available in the publications.

**Table 4. Returns to years of schooling in the private and the public sector, men and women. Dependent variable: log hourly wage[1]**

| | | Private sector | | Public sector | |
|---|---|---|---|---|---|
| | Year | Men | Women | Men | Women |
| Barth and Mastekaasa (1993) | 1980-82 | .0516 | .0592 | .0497 | .0545 |
| | 1983-87 | .0705 | .0677 | .0402 | .0573 |
| | 1989-91 | .0649 | ..0611 | ..0431 | .0507 |
| Asplund et al. (1996) | 1989 | .0639 (.002)[2] | .0558 (.003) | .0413 (.003) | .0456 (.002) |

*Notes:* [1] When nothing else is noted, the estimates are generated by the models described in Appendix Tables A1 and A2.

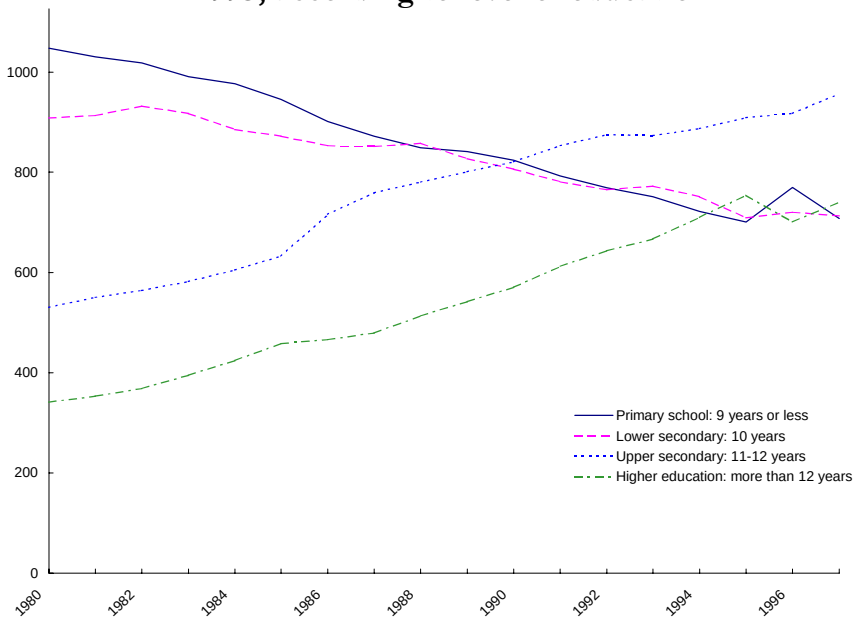
[2] Standard errors in parenthesis when available in the publications.

Table 4 reports returns to years of schooling in the private and public sectors, estimated separately for men and women. The results indicate that while males have a slightly higher return to education in the private sector the situation is the opposite in the public sector. However, the differences are not significant.

During the last decades many countries in the OECD area have experienced increasing returns to education and increasing earnings inequality. When trying to explain this development, researchers have focused on technological changes and increased trade, which have increased the relative productivity of – and thus the relative demand for – labour with a higher education.

The increased demand for education has come into force in the Norwegian labour market as well. Figure 1 shows the number of employed persons, 16 to 67 years of age, from 1980 to 1995, according to the level of education. It is apparent that a strong increase in the demand for workers with a higher education has taken place during the last two decades. This development indicates that, other things equal, structural changes on the demand side of the Norwegian labour market have increased the relative shortage of workers with a higher education. However, the strong expansion of the Norwegian educational system in the same period has worked in the opposite direction. Figure 2 shows the total number of persons in the Norwegian population according to the level of education. As pointed out in Hægeland et al. (1998), the increasing capacity of the

**Figure 2. Total number of persons (in 1000) in the Norwegian population, 16-67 years of age, 1980-1995, according to level of education**




*Source:* Labour Market Statistics, Statistics Norway

educational system may result in a downward pressure on educational premiums, not only due to the supply effect. As higher proportions of each cohort are enlisted, the selection into higher education becomes less strict with regard to previous school performance and the standard of teaching and training may decrease. Thus, the expansion may involve a reduction in the average quality of education.

The estimates reported in Table 1, from the studies of Barth and Mehlum (1993) and Barth and Kongsgården (1996), indicate that the return to education in Norway increased in the early eighties, that is, from 1980 to 1983, and then dropped again from 1983 to 1987, after which it levelled out. The study of Kahn (1998) gives a similar impression, except that the increasing trend from the early eighties lasts longer in the female population.[4]

[4] These trends must be interpreted with caution since the standard errors are not reported.

However, the overall impression given by Table 1 is stability and thus, that the Norwegian economy has not been affected by the much reported international trend of increasing rates of return to education. This impression is supported by the study of Hægeland et al. (1998), who estimate wage equations for 1980 and 1990 across sectors and different cohorts, and conclude that the return to education has been stable between 1980 and 1990.

If the return to education has been more stable in Norway than in many other OECD countries, a possible explanation may be that the expansion of the Norwegian educational system has been particularly strong (Jørgensen, 1993; OECD, 1997) and thus, that the income development of people with higher education has been influenced more strongly by a negative supply effect. Kahn (1998) examines the supply and demand conditions for high and low skilled workers in the period 1987 to 1991. He concludes that the market conditions for low skilled workers were actually less favourable in this period, compared to earlier periods in Norway and to a similar period in Sweden.

Controlling for education-specific experience effects on wages and cohort-specific selection into education, Hægeland et al. (1998) find that younger cohorts have higher returns to years of schooling than older cohorts. From this result they conclude:

*"This later result contrasts the popular belief that the quality of the educational system has declined over time. It may be due both to a persistent shift in the primary education for younger cohorts or an improvement of the quality of education above primary level."*

The study by Barth and Kongsgården (1996), reported in Table 3, shows divergent trends in the private and public sector during the nineties; while the returns to education decrease in the public sector they seem to increase in the private sector. These results suggest that the stability in the economy as a whole may be a result of different development patterns in the two sectors. However, Hægeland et al. (1998) find that this is not the case with regard to the development between 1980 and 1990.

Several of the studies, e.g. Kahn (1998), Barth and Kongsgården (1996), Barth and Yin (1996), have emphasized the role of the wage setting system, and its interaction with the business cycles, in explaining the earnings distribution and returns to educa-

tion in Norway. The discussions have focused on the degree of centralization in wage formation. By increasing the possibilities for different wage outcomes across firms, and the opportunity by individual firms to use favourable wage offers to attract human capital, a more decentralized bargaining system is hypothesized to increase wage inequality and returns to education. In Norway, the major union federation (LO) has placed great emphasis on a fair (equal) income distribution among different groups of wage earners. In periods with wage bargaining at the national level this ideal has gained higher priority from the workers' side.

In general, the Norwegian wage setting and bargaining system has been characterized as relatively centralized in comparison to that of other countries (Calmfors and Driffill, 1988; Kahn, 1998). To substantiate this description the authors point to the large proportion of the labour force covered by collective bargaining and the fact that the large unions and the employer federations often sign national agreements, involving also government participation.

The degree of centralization has changed to some extent over the period we study. Norway moved towards a more decentralized bargaining system in the beginning of the eighties. The first half of the eighties may be characterized as an economic boom period with low unemployment and increasing prices. Unemployment, however, rose quite sharply among low skilled workers (basic education only), from nearly 2 per cent of the labour force in 1980 to 4 per cent in 1983, while the unemployment of high skilled persons (educated above secondary education) remained stable at a level below 1 per cent of the labour force. Thus, the combination of a relatively decentralized system of wage setting and an increasing relative shortage of highly skilled workers may have contributed to the rise in returns to education indicated in the studies by Kahn (1998) and Barth and Mehlum (1993) for this particular period. The favourable economic conditions and the decentralized system of wage setting continued from 1983 to 1987. At the same time the studies reported in Table 1 indicate a decline in the returns to education. However, contrary to the preceding period the unemployment among low skilled decreased quite sharply from 1983 to 1987. After 1987 unemployment rose dramatically in the whole labour force and the system of wage setting re-centralized in response to the economic depression. From 1988 to 1990 the normal bargaining system in Norway was replaced by wage laws.

The wage setting system in Norway also varies between the private and the public sector. In the public sector the system has been characterized by a rigid wage structure, determined at a central level. In the private sector wage formation has been more decentralized and individual wage agreements are more common, especially in relation to workers with a college or university education. The diverging pattern with regard to returns to education between the private and public sectors in the 90s may be viewed in light of the changes in the bargaining system. In the private sector, the increased demand for skills has put a pressure on high-skills wages, and a decentralization of wage formation has allowed this to show up in relative wages. However, in the public sector, the still centralized system of wage bargaining has not allowed skills differentials to increase in the early 90s. There has, though, been some movement towards a larger degree of decentralized wage setting even in the public sector in the 90s. It remains to be seen how the public sector will react to the increasing gap between relative wages in the two sectors.

## 3.2 Returns to other forms of human capital

The reviewed studies on returns to education all include controls for experience and seniority if available. Only Asplund et al. (1996), Arai et al. (1998), Barth (1997), Barth and Schøne (1999) and Schøne (1996) focus specifically on the returns to these other aspects of human capital. Barth (1997) and Schøne (1996) also include the returns to job specific on-the-job training. Table 5 reports the coefficients for experience, age, seniority and on-the-job training from these five studies.

We find a concave age-earnings profile in Norway as in most other places in the world. The experience-earnings profile is concave as well. Panel data is required to sort out the difference between potential cohort effects involved in the interpretation of these earnings profiles. The earnings profile is slightly steeper in Sweden and Norway than in the other Nordic countries (Asplund et al., 1996).

Arai et al. (1996) find that particular low-wage occupations are characterized by flat age-earnings profiles, while the rest of the labour market displays the usual concave relationship. They conclude that low wages are largely a matter of occupation and not only of age,

**Table 5. Returns to on-the-job training in Norway. Dependent variable: log hourly wage[1]**

| | Age | Age²x100 | Experience | Experience² x100 | Seniority | Specific OJT |
|---|---|---|---|---|---|---|
| Arai et al. (1998) | .22 | -.05 | | | | |
| Asplund et al. (1996)[2] | | | .021 (.002) | -.004 (.000) | .003 (.001) | |
| Barth (1997)[3] | .017 | -.010 | .010 (.003) | -.017 (.001) | .005 (..002) | .046 (.012) |
| Barth and Schone (1999): | | | | | | |
| NFS | | | .028 (.001) | -.05 (.001) | .012 (.000) | .036 (.002) |
| NSOE | | | .017 (.001) | -.03 (.002) | .003 (.001) | .032 (.004) |
| Schone (1996) | .016 (.005) | -0.02 (.000) | .008 (.003) | -.01 (.000) | .001 (.000) | .033[4] |

*Notes:* [1] When nothing else is noted, the estimates are generated by the models described in Appendix Tables A1 and A2.

[2] Separate estimates for women are reported. The separate estimates for men are nearly similar.

[3] The within firm estimate is used. Barth (1997) also includes two interaction terms between firm specific OJT and seniority (-0.0016) and experience (0.0005).

[4] The equation estimated is: $\log(w_{93}) = c+c_1OJT_{89}+c_2JS_{89\text{-}93}+c_3OJT_{89}xJS_{89\text{-}93}+bZ$. $OJT_{89}=1$ if formal on-the-job training in 1989, JS=1 if job stability from 1989 to 1993. The value in the table is calculated as: $c_1+c_3$ , where $c_1=.073$ (.024), $c_3=-.040$ (.026).

and that certain occupations may be characterized as low-wage 'traps' in the labour market.

The returns to seniority are smaller than the returns to experience, and if interpreted in terms of returns to specific and general human capital (Becker, 1964) most of the on-the-job training is general. However, an upward sloping seniority profile may be interpreted in terms of turnover models and as an incentive device as well (Lazear, 1995). The figure reported in Barth (1997) is a within-firm estimate of the seniority profile, which assures us that the returns to seniority actually arise within firms and not only as a statistical artefact from job-to-job mobility.

Ranging from 4.6 per cent within firms in the private sector to 3.2–3.6 per cent for the whole economy, the returns to on-the-job training requirements are actually not very far from the range of returns to education in Norway. Barth and Schøne (1999) show that the level of on-the-job training requirements may be negatively related to the level of turnover in the establishment, indi-

cating that a regime with large job-to-job movements may be detrimental to firm-specific investments in training.

Schøne (1996) uses different measures for training at work. His study suggests that having participated in formal training during the last 12 months adds approximately 3 per cent to the wage level. The results also show that the return to training depends on the point in time when the training took place. Training activities back in time had a larger impact on wages than recent training activities, indicating that training affects both the level and the growth rate of wages. His study is particularly concerned with the distinction between general and specific training. A main conclusion is that in Norway training financed by the firm seems to contain a large portion of general and transferable skills.

Barth and Yin (1996) decompose the seniority-wage profile within large public-sector firms into wage growth arising from promotions versus within-position wage growth. They find, among other things, that job promotions are necessary for keeping up with the wage growth of newcomers. Within-firm wage growth is thus mainly a question of promotions and career development between job titles.

# 4 Conclusions

Wages are more compressed in Norway than in most other industrialized countries. This shows up in comparisons of returns to human capital as well. The studies reviewed here indicate a private return to education between 3.5 and 7 per cent. Most of the studies using standard OLS procedures on some measure of hourly wages indicate returns to education in the neighbourhood of 5 per cent. In the OECD area, these estimates place Norway in the lower half, but within the range of other countries with regard to private returns to school years.

The studies we review give no clear conclusion concerning the gender gap in returns to education in Norway. Depending on the data set and the statistical technique used, women seem to have lower, equal, or higher returns to education than men. However, the different studies seem to agree that the return to education in Norway is lower in the public than in the private sector.

The studies we review put different emphasis on the role of demand shifts, supply shifts and changes in the bargaining system for explaining the development of relative wages over the last two decades. The interaction of these forces has, however, produced a relatively stable situation with respect to the overall return to education. In other countries increasing returns to education during the last decades, have been interpreted as the result of demand shifts resulting from technological development and changing trade patterns. In the early nineties there may be some indications – in the private sector – that this underlying demand shift is working in Norway as well. However, the general impression is that wage differentials have been kept in place by both a considerable increase in the supply of more educated people and a recentralization of wage bargaining in the late 80s and early 90s, both of which may be regarded as a response to the recent recession. As the economy booms and the bargaining system is being decentralized, we may expect these demand forces to play out more freely also in Norway.

What should be on the research agenda? First of all, it would be very useful to understand the causes and consequences of a relatively compressed wage structure. It may be that we have a relatively low return to education in Norway, measured in this way, simply because education is inexpensive for the students in Norway. Education is more or less free in Norway. However, the relatively high unskilled wages make it costly to stay out of work for one year. It may also be noted that the lower unemployment risk is not included as a part of the return to education, as measured in the studies reviewed here. The supply boom of education, in recent decades, suggests that low returns have not prevented young people from study longer, which is after all the real concern with low returns to education. Down to very recently the capacity of universities and colleges seems to have been the main impediment with regard to the growth in the level of education in the Norwegian population. However, in the last year there have been signs that the queue to higher education has been shorter and that some fields of studies do not utilize their total capacity.

The relatively low return to education in Norway, compared to other countries, indicates that the highly educated Norwegian citizens might receive an income premium if moving abroad. However, studies of labour migration from Norway suggest that migration out

is low and that return migration is high among those who move. Thus, from this point of view, a low relative return to education seems to pose a very small threat to the stock of highly educated workers in Norway (Røed, 1996a; Schröder, 1996). Studies of the international migration from Norway also show that temporary migrants may gain an income premium from working abroad after returning to their home country (Røed, 1996b). This suggests that some level of migration – stimulated by low relative wages – may actually be productive for the Norwegian economy.

Another important question is in what manner private returns to education affect the overall income distribution in the population.

While analysis of the development of the return to education over time within a country requires a focus on *changes* in labour market conditions and the market for education, the comparison of returns to human capital between countries needs to focus on *differences in the levels* of different features of the labour market and the educational structure. The continuation of the PURE project will hopefully give us a better understanding of the causes of the different returns to education across the nations of Europe.

Next we have the issue of identifying the causal effects of schooling. Are we really measuring the returns to education, and do we do it right? A number of specification tests should be made. Hægeland et al. (1998) conclude that controlling for endogeneity does not improve much on the estimates and, furthermore, that the lack of such a control does not impair comparisons over time to any significant degree. That is comforting. However, the results from the twins' study of Raaum and Aabø (1999) suggest that the OLS estimates are upward biased and that this bias may matter significantly, at least for men. Obtaining clear-cut results with respect to the direction and magnitude of the bias in the measurement of the causal effect of education still seems to be far off into the future.

The human capital literature is dominated by supply side considerations. Of course, the demand side is equally important. It must be the case that more educated workers are more productive in performing certain tasks compared to unskilled workers, otherwise employers would not hire them at the higher price. Still, studies of the relationship between productivity and human capital are in high need. Does a low private return to education in Nor-

way imply that education adds less to productivity in our country than in other countries? The results from Hægeland et al. (1997) seem to suggest this, since they find a close correspondence between relative productivity and relative pay in Norway.

Recent literature on productivity and growth, on the other hand, suggests that education may have positive external effects, which are not picked up by the estimated private returns to education. Further study of the productivity effects of education is clearly warranted.

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