# WAGE RETURNS TO TRAINING: EVIDENCE FROM FINLAND

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# Contents

# Kiitokset

”Erkki, tule heti syömään!” Se oli esikoiseni Lauri, ja vuosi oli 1984. Toinen poikani Tuomas parkui jossakin taustalla. Viimeistelin kotona kansantaloustieteen pro gradu –työtäni inhimillisen pääoman teoriasta – siitä samasta teoriasta, johon nyt käsillä oleva työ perustuu. Olisin jo silloin halunnut syventyä paremmin, mutta olosuhteet eivät sitä sallineet. Uutta hitas-asuntoamme ei vaimoni Tuulan tuloilla maksettaisi. Töihin oli päästävä ja pian. Vakituisen työpaikan myötä aikuisopintoni jatkuivat ja lisensiaattityöni koulutusasteen tulovaikutuksesta valmistui 1994. Sitä tehdessä nousi mieleeni kysymys aikuiskoulutuksen tulovaikutuksesta. Aloin mapittaa artikkeleita aiheesta.

Sitten työelämä taas vei. Vuonna 2004 tuli kuitenkin stoppi, ihan kunnon kriisin seurauksena. Oli keksittävä keino ammattitaidon ylläpitämiseksi, kun se leipätyötä tekemällä ei enää onnistunut. Ratkaisuksi tuli tämä väitöskirjahanke, ja sen luontevaksi aiheeksi aikuiskoulutuksen tulovaikutus. Otin yhteyttä Rita Asplundiin, jonka rohkaisua on kiittäminen siitä, että hanke liikkeelle nytkähti. Tutkimusohjaajaksi lupautui Markus Jäntti, jota minun on kiittäminen siitä, että materiaali ja menetelmät lopulta toisensa löysivät.
Tähtäsimme esseemuotoiseen väitöskirjaan: neljä esseetä, joista kolme teemakohtaista esseetä ja yksi johdantoessee. Ensimmäiset versiot esseistä syntyivät jaksolla 2005–2007. Ville Heinoselta ja Olli Poroputaalta saamani avun turvin kirjoitin johdantoesseeseen laajan mutta mielestäni välttämättömän kuvauksen Suomen koulutusjärjestelmästä, aikuiskoulutus osana kokonaisuutta. Toinen essee oli aika suoraa jatkoa sille, mitä lisensiaattityössäni olin tehnyt. Mutta kolmas essee oli jo niin innovatiivinen, että aikaa meni ihan eri tavalla. Neljäs essee oli menetelmällisesti hankalin, ja vei lopulta eniten aikaa. Ajatuksen matching-menetelmän käytöstä teki Rita Asplund, ja arvokkaita kommentteja sen käytöstä sain Kari Hämäläiseltä ja Petri Böckermanilta. Eri esseiden eri versioita olen esitellyt Valtion taloudellisen tutkimuskeskuksen, Elinkeinoelämän tutkimuslaitoksen, Palkansaajien tutkimuslaitoksen ja Pellervon taloudellisen tutkimuslaitoksen seminaareissa. Saamastani palautteesta kiitän laitosten tutkijoita.

Keväällä 2009 kokonaisuus alkoi hahmottua, ja esitarkastajieni – Niels Westergaard-Nielsen ja Pekka Ilmakunnas – myönteinen lausunto tuli toukokuussa 2009. Sitten ilmeni, että Åbo Akademi ei esseemuotoista väitöskirjaa tunne. Esseet oli joko julkaistava erillisinä artikkeleina tai työstettävä koko nivaska monografiaksi. Valitsimme jälkimmäisen vaihtoehdon. Se osoittautui varsin työlääksi, mutta palkitsevaksi. Neljän erillisen esseen sijasta kirjasta tuli kokonaisuus. Muuntotyön seurauksena kieli on tosin voinut hieman kärsiä, ja viime hetken lisäysten englanti on minun omaani. Muilta osin kielihuollosta kiitän Paul Dillinghamia.

Aikuiskoulutusta käsittelevä väitöskirjani on ollut aikuiskoulutusta sanan varsinaisessa merkityksessä. Se sisältää havaintoja kolmelta vuosikymmeneltä, nuoren miehen osittaisanalyyseistä keski-ikäisen miehen lähes holistisiin pohdintoihin. Kaikkien osallisten lisäksi kiitän myös terveyttäni. Yllättävän hyvin se on kestänyt pitkää työpäivää viimeisten viiden vuoden aikana. Viimeiset kiitokseni menevät Yrjö Jahnssonin säätiölle ja Työsuojelurahastolle. Niiden myöntämä tuki on mahdollistanut ne opintovapaat, jotka työn ohessa työskentelyyn olen tarvinnut.

Mäntsälässä 15.1.2010

Erkki Laukkanen

# Tiivistelmä

Kirjallisuuden mukaan ammatillisen aikuiskoulutuksen palkkavaikutus on positiivinen ja suuri, jopa yllättävän suuri, kun vertailukohtana pidetään tuottoa yhtä nuorella iällä hankittua koulutusvuotta kohti. Monissa maissa, kuten myös EU:ssa, keskustellaan mahdollisesta ali-investoinnista ammatilliseen aikuiskoulutukseen. Päätelmien tekemistä kuitenkin vaikeuttaa se, että ammatillisen aikuiskoulutuksen tuotto näyttää riippuvan käytettävissä olevasta aineistosta, tarkasteltavasta maasta ja estimoinnissa käytetystä mallista. Tässä tutkimuksessa ammatillisen aikuiskoulutuksen palkkavaikutus estimoidaan Suomen aikuiskoulutustutkimuksien 1990, 1995 ja 2000 aineistolla, joka kattaa varsin hyvin "kilpailevat" inhimillisen pääoman muodot. Tavanomaisella elinkaarimallilla estimoidut tulokset viittaavat siihen, että yksi kurssi ammatillista aikuiskoulutusta nostaa bruttotuntipalkkaa noin 1.3−1.8 prosenttia. Modifioidussa, todellisiin työkokemus- ja koulutusvuosiin perustuvassa mallissa, joka sisältää myös mitatun kyvykkyyden, tuotto on hieman pienempi, noin yhden prosentin, mutta silti yllättävän suuri yhdelle koulutusvuodelle estimoituun tuottoon verrattuna. Henkilöstökoulutuksen tuotto on estimoitu myös lyhyellä aikavälillä, noin kaksi vuotta koulutuksen hankkimisen jälkeen. Tulosten mukaan tuotto on positiivinen ja suuri, kun henkilöstökoulutus on ollut riittävän pitkäkestoista. Kaiken kaikkiaan tulokset viittaavat siihen, että ammatilliseen aikuiskoulutukseen investoidaan liian vähän. Siksi sen integrointia muodolliseen, tutkintoperusteiseen koulutusjärjestelmään pitäisi harkita.

Avainsanat: Ammatillinen aikuiskoulutus, henkilöstökoulutus, koulutuksen tuotto

# Abstract

According to the literature, wage returns to training are likely to be positive and large, even surprisingly large, compared with the return to one year of education at a young age. The possibility of underinvestment in training is discussed in many countries, as well as in the EU. The conclusions, however, are difficult to draw, since the returns to training seem to depend on the data, the country and the model used. In this study, the return to training is estimated by means of the Finnish Adult Education Surveys of 1990, 1995 and 2000, which quite extensively include the "competing" forms of human capital. The results from the basic life cycle model show positive returns to training. The coefficient estimates suggest that one course of vocational training increases the gross hourly wage by 1.3–1.8 per cent. In a modified model with actual years of work experience and education and a measure for ability, the return to training is somewhat less, around one per cent, but still surprisingly large compared with the return to one year of education. Besides, there are results for in-service training based on the estimations over two years after the training. They reveal positive and large returns for long training spells. Taking together, the results suggest that there is underinvestment in training in Finland as well. Therefore, actions for integrating training into the system of formal degree-based system of education should be considered.

Key words: Vocational adult education, in-service training, returns to training

# 1. Thesis on training and wages

This thesis is about the wage effect of training when other human capital variables, such as education and work experience, are controlled for. The theoretical framework is human capital theory. The thesis consists of discussion of the relevant literature, characterisation of the Finnish educational system and data, and three empirical research topics specified in their own chapters.

## 1.1 Theoretical framework

In human capital theory, outlined by Becker (1962, 1964 and 1975), the causality goes from education to productivity and from productivity to earnings. The level of education determines the earnings level, and on-the-job training determines the rate of concavity in the age-earnings curve, i.e. the wage increase with work experience. In a wider interpretation, such as that of Willis (1986), education is a process in which occupational qualifications for the labour market are acquired. Therefore, educational selection includes vocational selection, an investment in skills of a certain occupation.

The concept of human capital includes all investments in human beings, but most attention has been given to formal education, i.e. the years of schooling at a young age. According to Deere and Vesovic (2006), training is a close second, especially when equated with labour market experience as measured by the passage of time since leaving school. During the last 15 to 20 years, questions like flexibility and inclusion of modern technology have underlined the importance of on-the-job training and other forms of adult education, as reported, for example, by Blundell et al. (1999), Bartel and Sicherman (1998), and Autor et al. (2001).

One crucial question in the economics of education is which part of the earnings differences between individuals can be addressed to degree-based education at a young age and

which part to adult education, not necessarily based on formal degrees. There is also the question of the complementarity of education and training, as reported by Brunello (2001) and Belzil et al. (2008). After confirming the standard result that training incidence is higher among individuals with more education, Belzil (ibid) reports that the relationship between individual educational attainment and training incidence varies significantly across countries and birth cohorts. How training actually affects wages depends on many institutional factors, such as the stratification of the schooling system, union density, employment protection and the spatial distribution of labour, as suggested by Brunello and De Paola (2008).

## 1.2 The basic model

The evolution of the concept of human capital started long ago. The role of skills in economic development can be traced as far back as to Smith (1776), the concept of human capital to the 1930s, and its model-based econometric applications, "the human capital revolution", to the 1960s and 1970s, as noted by Walsh (1935), Blaug (1976) and Sahota (1978). For the development of human capital theory, it was crucial that it compiled theories and inconsistent presentations of an individual's ability, age, education, productivity and earnings. Important steps in this development are Schultz (1961), Ben-Porath (1967) and Mincer (1958, 1962, 1974) and many others.

Perhaps the best known success story in the field's applied research is the Mincerian earnings function, or Mincerian model, as presented by Mincer (1974):

$$\ln y_i = \alpha_0 + \beta_1 s_i + \beta_2 x_i + \beta_3 x_i^2 + u_i ,$$

where log-earnings *ln y* are explained by years of education *s*, years of work experience *x* and its square.[1] In the model, education and work experience years are potential and based on the assumption that all the time is used either for work or education. Therefore, it was sufficient to deduct from age the years it typically takes to pass each level of education and the school starting age, and what then remains is work experience. This sort of identity between age, education and work experience made it possible to compare different countries, even if there was no information at all about the actual years of education and work experience.

[1] S comes from the American literature, where instead of education the concept of schooling is used.

Most results all over the world support the model's assumption of a concave relationship between earnings and work experience. In some older comparative studies, such as Psacharopoulos (1994), Mincer's earnings function is applied to tens of countries at different levels of development. His results show the highest returns on one year of education for developing countries, approximately 14 per cent. In industrial countries, the return on one year of education is approximately 8 per cent. This latter was the result for Finland in the study by Lilja and Vartia (1980).

More recent research on Europe, with some model modifications and new estimation techniques, reveals a slight reduction in average returns, although the 7 to 9 per cent return range still includes many countries. Besides, as reported by Asplund (2001), Asplund and Pereira (1999), and Psacharopoulos and Patrinos (2002), the relative returns for Finland, compared with other European countries, still seem to be at a good average level. However, the results based on IV, Instrumental Variable estimation, such as Uusitalo (1999), indicate that the return to education is much higher compared with those reported above, and produced by Ordinary Least Squares, OLS. The methodological reasons for the difference are beyond the scope of this research. They are discussed by Belzil (2004, 2005) and Cunha and Heckman (2007), for example.

With certain modifications, Mincer's earnings function can also be used to estimate the return to adult education, including the training given at the workplace. One of the modifications, developed by Becker (1962, 1964 and 1975) and Ben-Porath (1967), was the conceptual division of training into general training and firm-specific training. In a perfectly competitive labour market, the costs of general training are paid for by the worker, who also reaps the benefits of the investment. Only in the case of firm-specific training, such as the training of key workers in senior positions often is, the employer is motivated to pay for the costs of training.

The evidence indicates a more complicated picture. Many writers, such as Bishop and Kang (1988), Bishop (1996), Autor (2001), Autor et al. (2003), Leuven (2005), Leuven et al. (2005), Bassanini and Brunello (2007) and Song (2008), have shown that wage returns to training are good, as compared to formal education. They also show that there are several possible reasons for employers, such as adaptation to changes in technology, to finance general training too. In the "duality hypothesis", proposed by Mincer and Jovanovic (1981), financing more training, whether general or firm-specific, brings about slower turnover, i.e. something for which employers have a motive to pay. For this, and

some other reasons, Ballot et al. (2006) suggest that the question of who reaps the benefits should perhaps be taken more as an empirical question.

What we know for certain is that, during the last generation, investments in training have opened up a new frontier in education policies. Already 20 years ago, Mincer (1989) wrote about the substitution of schooling by job training. Ten years ago, Heckman et al. (1998) estimated that in the US more than half a lifetime human capital is accumulated through post-school investments. For Finland these relations are unknown but are today under evaluation, as in many other countries as well.[2] Once again, high hopes from the viewpoint of education policies are contrasted by cool warnings, such as that by Arulampalam and Booth (2001): Groups who are already privileged disproportionately may take advantage of the new education-training mix at the expense of unprivileged.

But before policy discussions, some words of criticism of the earnings function are justified. The criticism focuses on the returns to education, but certainly it also holds regarding the returns to training, when training is included in the earnings function characterized above.

## 1.3 Restrictions of the model

According to critics, some assumptions of Mincer's (1974) earnings function are problematic. In the model, human capital is homogeneous, a quantity measurable in time. But, as pointed out by Willis (1986), for example, human capital is more likely heterogeneous, the quantity of which rises from occupational qualifications and is difficult to measure. Besides, Ghriliches (1977, 1979), for example, has shown that personal qualities, such as ability and family background, could cause bias in the estimation of the model. The point is that when these variables are constant, the return to education is less relative to that presented by Mincer (ibid) and other researchers utilizing his model.

In the signalling literature, pioneered by Spence (1973) and Stigliz (1975), higher levels of schooling signal higher innate ability. In the case of 'sheepskin effects', reported by

[2] Actually, there is an ongoing international clarification process on VET (Vocational Education and Training) known as the Copenhagen process. The basis for it was laid out in the Copenhagen Declaration which was endorsed in November 2002 by the education Ministers of 31 European countries, social partners and the European Commission. Besides, in the rhetoric of the European Union, training and education are connected to 'flexicurity', a conceptual balance between flexibility and security, as discussed by Eurofound (2007).

Belman and Heywood (1997), for example, diplomas as such matter, i.e. returns to one more year of education are higher after reaching the next level of education, and highest after college. In Arrow's (1973) screening hypothesis, schooling may have learning content, but basically education, especially higher education, works as a filter, sorting the more able into better positions irrespective of the content of education.

To avoid criticism like this, it has become necessary to control for ability either by using sibling models or by including some measure of ability, such as the IQ measured during some earlier phase in life, in the earnings function. Examples and pioneers of this line of research are Ben-Porath (1967) and Griliches (1977, 1979), as summarized and discussed by Card (1999, 2001). In Finland, this point of view was adopted by Uusitalo (1999). Other writers, such as Bowles and Gintis (1976) and Edwards (1976), emphasize the importance of acquired ability.

In labour economics, the line dividing cognitive and non-cognitive ability has been surprisingly clear until recent years. However, the recent studies, presented by Heckman (2000) and Carneiro and Heckman (2003), allow for both cognitive and non-cognitive ability. According to Heckman et al. (2006), both forms of ability have an effect on education selection, educational attainment and a whole number of other issues, such as wages. In behavioural sciences, there is also the question of job knowledge, a mediating factor between job performance and cognitive ability, which may be dependent on training, since it seems to be dependent on work experience (Palumbo et al., 2005; Schmidt et al., 1986).

A third area of criticism has been the assumption of a well-working competitive labour market, i.e. the payment for a certain qualification is about the same, independent of the industry of the economy. In reality, there may be relatively large earnings differences which cannot be explained by the workers' qualification levels. However, in Nordic countries like Sweden, earnings differences between industries are relatively small in comparison with the US, for example. This result has been interpreted by Edin and Zetterberg (1989) and Björklund et al. (2004) as an advantage of the Nordic labour markets, i.e. even though earnings differences exist, competition between industries functions quite well.

A fourth reason for criticism is focusing on private returns, returns to individuals, instead of social returns, which, in the case of human capital, have particular interest for the society. This point of view, as discussed by Stevens (1994), McMahone (1998), Ciccone and Peri

(2006) and Moretti (2004a, 2004b), underlines the non-monetary returns and the positive externalities for co-workers, organisation of work and productivity in general. Thus, if the social return exceeds the returns for employer and the employee, for which governments and rival employers have a motive to pay for. Judging only from the private returns to education and training may lead to underinvestment in both from the social point of view, i.e. from the educational policy point of view.

On these grounds, Stevens (1994) criticizes the dualism of general vs. firm-specific training, and argues that purely firm-specific non-transferable skills are hard to imagine. Instead, she suggests the concept of transferability, where some skills are more transferable than others. For more transferable skills, such as language skills and computer skill, transferability is high, but even those are not necessarily needed in manufacturing, for example. For less transferable skills, there must be at least some other firms, where the trained skill is worth of paying. Thus, there is almost always place for some sort of externality, which then suggests that there is almost always place for poaching from the side of other employers. Therefore, there is a pressure for underinvestment in training, and for the government to compensate.

The nature and quality of data also have their own effects. Some problems relating to the estimation of Mincer's model become less severe when panel data are used for estimation. In this case, questions like unobserved heterogeneity between individuals can be modelled. With multiple measurements from the same individuals, the error term can then be divided into two parts, a permanent effect and a stochastic error term. The permanent effect can be seen to represent the excluded ability, both innate as well as acquired. Therefore, Lillard and Willis (1978) reported that over half of the permanent effect was caused by unmeasured factors, such as ability and family background.

And finally, there is the question of data availability. According to Mincer (1989), alternative explanations for upward slopes of wage profiles, such as managing costs of supervision (Becker and Stigler, 1974), costs of turnover (Salop and Salop, 1976), and consequences of job sorting of newly hired staff (Jovanovic, 1979), are probably due to the absence of direct information on on-the-job training. Now that almost 20 years have passed since Mincer's statement, it is interesting to see what the results actually look like when training information is available and used.

## 1.4 Structure of the thesis

In the following chapters, the relationship between training and other human capital variables is discussed in detail. I start from a literature survey (Chapter 2 ) and then move towards an empirical approach, after analysing the role of education and training in the Finnish educational system in the 1990s (Chapter 3) and the available data, the Adult Education Surveys of 1990, 1995 and 2000 (Chapter 4). In Chapters 5, 6 and 7, I focus on three empirical study problems.

In Chapter 5, I start from the standard Mincerian earnings function, such as that characterised above, and focus on developments in the 1990s. I ask what happens when the earnings function is expanded by training. In Chapter 6, the approach is cross-sectional. I focus on the returns to education and training in 2000, comparing the wage effect of these two in a modified life sycle model, where ability and selection for training are controlled for.

In Chapter 7, the approach is longitudinal. I focus on in-service training, the Finnish parallel for on-the-job training, acquired during one year's reference period either at the workplace or in a training institution, and estimate its short-run wage effect over the following two years 2001 - 2002. Chapter 8 summarizes the key results and suggests some topics for further research.

All the way of the study, I have made my very best effort to take into account the institutional features of vocational adult education and training in Finland. To picture the relationships between the key human capital variables I have included an extensive set of graphics. All chapters end to conclusions where the key results' interpretations are discussed. The summary includes some policy recommendations too.

# 2. Literature review

## 2.1 Earlier work on the returns to training

In the first phase of research, developed by Mincer (1962, 1974, 1988, 1989), and Mincer and Jovanovic (1981), training was limited to on-the-job training, OJT, the amount of which there was typically no direct information. Therefore, its accumulation over the life cycle had to be estimated from more general sources, like age and work experience. The returns to OJT were then estimated from the shapes of age - earnings or work experience - earnings profiles, including seniority, defined as years with the present employer.

In most of those studies, the return to potential work experience is positive but at a reducing rate, as reported by Rubinstein and Weiss (2006). The results on seniority, years in the present job, are less consistent. For example, Abraham and Farber (1987), Altonji and Shakatko (1987) and Topel (1986) have reported rather modest returns to seniority. After re-examining his data, Topel (1991) estimated that 10 years of employment in the same workplace may increase the earnings of an American male by 25 per cent. In a study by Altonji and Williams (2005), the return on 10 years in the same job is estimated to be 11 per cent. Williams (2009) has reported for the UK that if seniority matters for wages it is only for union workers.

To what extent returns to work experience are due to on-the-job training is assessed by Mincer (1989) and Bartel (1995). Mincer (1989) calculates that returns to training are in the range of 32 to 48 per cent before depreciation. Allowing for depreciation substantially reduces these numbers. Mincer's range after such correction is from 4 to 26 per cent, Lillard and Tan's (1986) 15 to 20 per cent. Bartel's calculations lead to a 42 per cent return with 10 per cent depreciation and 26 per cent return with 20 per cent depreciation.

In the second phase of research, reported by Barron et al. (1997) and Bishop (1997), for example, direct measurement of on-the-job training was started. In the beginning, the return to training was found to be positive, nearly one-to-one with the assumptions of the above presented theory. However, as years have passed, suspicions that positive results may be due to the model's specification error have increased.

In the third phase, research has paid special attention to selection for training. The possibility had to be accounted for that the selection for training is a socially selective or, in some other way, non-representative process, where selection favours, for example, the better educated or some particular group, such as males. As Groot and Maassen van den Brink (2003) and Arulampalam et al. (2004) have pointed out, there are also other issues, such as the nature of the work contract and the sector of economy, to take into account in selection for training. Accordingly, data requirements have increased, and, finally, other forms of training than on-the-job training have also become research topics, as shown in Table 2.1, adapted from Leuven's (2004) tables.

In the US, the most frequently used research data are the National Longitudinal Survey of Youth (NLSY). Among others, it has been utilized by Lynch (1992), Veum (1995), Parent (1999) and Frazis and Loewenstein (2003). According to Lynch (1992), one week of on-the-job training increases wages "only" by 0.2 per cent.[3] According to Veum (1995), one hour of on-the-job training increase wages by 0.7 to 0.9 per cent. Parent's (1999) interest is a longer time span. The results show that one year of on-the-job training increases wages by 12 to 18 per cent, depending on the estimation method. Frazis and Loewenstein (2003) report that in specifications including both a participation indicator and training duration, the coefficient on participation will be upward biased and the coefficient on duration downward biased.

In the UK, a number of different data sources have been in use and correspondingly the results include possibly even more variation than in the US. According to Booth (1991), participation in formal, job-related training increases the annual salary by 11.2 per cent for males and by 18.1 per cent for females. According to Booth (1993), one week of formal, employer-provided training during the first year of employment increases wages

[3] Lynch (1992) is also an example of how problematic the samples can sometimes be. His research focused on the income development in 1981-1983 of those who graduated in 1980. From approximately 13 000 persons' sample information was received from 3000, of which 4 per cent had received training. For many those, the form and quality of training remained unclear, and in the wage estimation, only training courses one month or longer were included.

for both males and females by one per cent. Blundell et al. (1996), however, concluded that participation in on-the-job training organised by the employer increases males' wages by 3.6 per cent. Participation in training outside the workplace seems to be more profitable; for males the return is 7 per cent and for females 5 per cent.

Table 2.1. Estimated returns to training in selected studies.

| Study | Data* | Period | Sample | Training | Method** |
|---|---|---|---|---|---|
| US | | | | | |
| Lynch (1992) | NLSY | 1980–83 | College graduates | Weeks, OJT | OLS+SC, FE |
| Veum (1995) | NLSY | 1986–90 | Adults with low num. skills | Hours, OJT | OLS, FE |
| Parent (1999) | NLSY | 1979–91 | 14 to 21 year-olds in 1979 | Years, OJT | OLS, IV |
| Loewenstein & Spletzer (1998) | NLSY | 1988–91 | 23 to 34 year-olds in 1988 | Weeks, formal employer provided | FE |
| Frazis & Loewenstein (2003) | NLSY, EOPP | 1979–2000 | 14 to 21 year-olds in 1979 | Weeks, formal employer provided | OLS+SC, FE |
| UK | | | | | |
| Booth (1991) | BSAS | 1985–87 | Males, females | Participation, formal & job-related | OLS |
| Booth (1993) | BNSG | 1986–87 | Male and fem. graduates | Weeks, employer provided | OLS+SC, FE |
| Blundell el al. (1996) | NCDS | 1981–91 | Males, females 33 year-olds | Participation, OJT | quasi-diff. |
| Blundell el al. (1999) | NCDS | 1981–91 | Males, females 33 year-olds | Courses, employer provided | OLS, FE, IV |
| Arulampalan & Booth (2001) | NCDS | 1981–91 | 33 year-olds | Participation, work related | OLS+SC |
| France | | | | | |
| Goux & Maurin (2000) | FQP | 1988–93 | 20 to 64 year-olds | Participation, employer provided | OLS+SC |
| Fougere et al. (2001) | FQP | 1993 | Job-switchers Non-switchers | Participation, employer provided | Switching regression |
| Germany | | | | | |
| Pischke (2001) | GSOEP | 1986–89 | Private sector | Years, work related | FE |
| Kuckulenz & Zwick (2003) | BIBB/ IAB | 1998–99 | Private service | Participation, work related | OLS, SC |
| Norway | | | | | |
| Schone (2002) | NSOE | 1989–93 | All wage-earners | Participation, employer provided | OLS, FE, IV |
| Netherlands | | | | | |
| Leuven & Oosterbeek (2002) | NIPO | 2000–2001 | All wage-earners | Participation, work related | OLS+SC |

* National Longitudinal Survey of Youth (NLSY), Employer Opportunity Pilot Project, EOPP, British Social Attitudes Survey, BSAS, British National Survey of Graduates and Diplomats, BNSG, National Child Development Survey, NCDS, German Socio Economic Panel, GSOEP, "Qualification and Career Survey", BIBB/IAB, Norwegian Survey of Organisations and Employees, NSOE, Post-initial Schooling Survey, NIPO.

** Ordinary least squares, OLS, Selection correction, SC, Fixed effects, FE, Instrumental variables, IV.

From the same data, but with a larger sample, Blundell et al. (1999) estimated a 5 to 8.3 per cent return for males for each employer-provided training course. The return remains on the same level for other courses for males. For females, the returns are very method-dependent, and differ clearly from those for males. Arulampalan and Booth (2001) reported that participation in a work-related training course increased wages by approximately 40 per cent during the period 1981-1991. However, the number of training courses did not appear to have a statistically significant effect. There are also results from other countries.

The conclusion of all this is quite problematic. Firstly, the reported returns to training are surprisingly high, especially those for the US, where the return to one week of full-time training seems to be almost as high as the return to one year of full-time education for the young. Secondly, the results differ according to country, sample, method and training form, making it very difficult to build up a consensus through comparisons. But if the "American returns" are true returns to training as Leuven (2004, 2005) and Leuven et al. (2005, 2008) seem to think, we can talk about a substantial under-investment in training. According to OECD (2003a) and Bassanini et al. (2005) there are many reasons for this, such as the organisation of the labour market relations in general and, especially, the status and design of R&D policies.

In Finland, only a few results are available. Asplund (1999) reviews returns to in-service training[4], the Finnish counterpart to the American on-the-job training. Her survey, which covers numerous studies conducted between 1989 and 1993, also includes findings about the work experience variables. She reports returns of around 10 per cent to the incidence of in-service training, a 1.4 to 1.8 per cent wage effect on one year of work experience at the beginning of the work career, and a 7 to 9 per cent return to one year of education, i.e. "schooling". Exceptionally, she reported years of actual work experience and not potential as is usual.

Many studies have been published recently and, as Asplund (2004) has reported, even partial data on the acquired training have improved our understanding of the model's weak link, the amount and quality of work experience acquired. But in most of them, the study setup differs essentially from the life cycle perspective of Mincer (1974). In a

[4] In-service training is the official translation according to Statistics Finland. The concept refers to training paid at least partly by the employer and given to those with a labour contract with the employer.

typical case, training has been acquired during some period $t_i$, and its return or wage effect is then estimated in some near future period $t_{i+k}$, but not over the life cycle.

## 2.2 Selection for training

One selection issue is statistical in nature, i.e. how to identify the wage effect of training when data is usually available for a selected group, such as the employed, only? This problem of selection bias is well known from other research topics of labour economics and Heckman's (1979) two-step estimation has become the standard method for correcting for this problem. The same method is on offer for the correction of the possible selection for training bias when the estimator is Ordinary Least Squares, OLS. In the first step, probit models for positive wages and the positive number of training courses are estimated. In the second-step, the selection correction terms formed from the probit models' predicted values are used.

The problem of this method is to find good instruments that correlate with training but do not correlate with wages. Therefore, during the last ten years, selectivity issues have increasingly been tackled through the use of matching, as described by Cameron and Trivedi (2005, 871-878). The roots of matching are in the medical sciences, in testing the effects of certain medicines, usually assuming that no other effects exist. Accordingly, effects of any other treatments are to be tested by comparing the results of the treatment group to the results of the untreated. One typical treatment to be tested is the effect of training on the wages in the following year (Heckman et al., 2006b).

Another issue that is debated at length in the literature concerns the extent to which training is allocated based on observed characteristics. That is, to what extent selection for training is driven by selection, compared with self-selection specified as some sort of ability by Rosen and Willis (1979). Thus, how should we take into account non-individual factors, such as adaptation to technological change, selection process defined by the objectives set for the educational system, and the impact of trade-unions and other labour market institutions? This issue is very interesting and leads us to the basic questions of economics of education.

Basically, the demand for adult education and training is not a purely economic process. As Kodde and Rizen (1984, 1985) have shown, people can also acquire education as a form of consumption. In practice, there is all-round education or interest-based education,

with either weak or nonexistent links to work or occupation. It is also possible that this motive is emphasized in adult education, in particular compared with vocational education of the young. According to human capital theory, education is an investment in productive capacity, and consumption-based education and training certainly violates this assumption.

The second problem is the concept of vocational adult education. In Mincer's (1974) model, years of work experience are used as an instrument for on-the-job training. Other vocational adult education that is not on-the-job training is omitted from the model. But, according to human capital theory, it should be included, as should all forms of education with a positive relation to productive capacity. In the case of Finland, this points especially to self-financed voluntary adult education, where the individual's own motives play a deciding role when education decisions are made.

The third problem is the Finnish counterpart to on-the-job training. It is called in-service training and is regulated by acts and collective agreements, such as the Act on Co-operation within Undertakings (725/1978), the Act on Co-operation within Government Offices (1988/651) and the General Communal Agreement (1993). These proactive regulations enable trade unions' involvement in training decisions as suggested by ILO (2000). In the case of dismissals, unions' policy is that training to other tasks within the establishment is to be considered as a primary action, as is also stipulated by law.[5]

In these regulations, the focus is on adaptation to changes by means of proactive co-operation, including co-operation in in-service training. For example, the Act on Co-operation within Undertakings, Section 6 b point 1 stipulates that: "The undertaking shall adopt plans regarding staff and training every year prior to the beginning of the financial year." Besides, point 2 stipulates: "The training plan shall cover the general needs in training arising from the staff plan, and an annual action plan for training, by staff category." The domain of the act is establishments[6] with 30 wage-earners or more, leaving thus around 20 per cent of the wage-earners free to choose whether to co-operate in line with the act or some other way. In the public sector, these regulations are not as

[5] See Employment Contract Act (579/2006, Chapter 7, Sections 3 and 4) on: http://www.finlex.fi/fi/laki/kaannokset/2001/en20010055.pdf (October, 2009).

[6] In the following, I write about establishments with the meaning that they include both private and public employers. In the case of private sector, I also write about enterprises and firms. Independent of the sector of economy, workplace is the site where the work is done. In the data, around 70 per cent of establishments include more than one workplace with the same employer.

accurate, but in practice, as a loose but generally adopted framework, they apply to all sectors of economy.

According to these regulations, selection for in-service training is basically a consequence of firms' urge to adapt their workers to changes in technology, work organisation and production lines. Moreover, almost all of this training is financed by the employer, not the employees, as commonly supposed in the literature, based on "American" workplace bargaining between training and wages. I conclude that these differences open up a different world, where individual ambitions and capital market imperfections should not be such key questions in selection for training as they possibly are in the US, for example.

A procedure like this, as suggested by Chatterji (2008) and Dustmann and Schönberg (2004), could ease under-investment in training by making the training a social issue of which both social partners, employers and wage-earners, could benefit. It could also ease the "poaching" and "hold-up" problems discussed by Chatterji (2008). But, due to lack of evidence, it is difficult to say, what kind of workplace bargaining are we actually talking about. For example, are trade-unions and shop stewards able to separate pay issues from training issues, as questioned by Acemoglu and Pischke (1999)?

In the literature, this seems to be an open question. For Mincer (1983), in the US, trade-unions aim for seniority-related pay, and thus reduce the wage-earner's incentive to invest in general training. On the other hand, with assumed reduction in flexibility, trade-unions increase employers' investment in firm-specific training. In line with this theory, in the UK, Boot and Chatterji (1998) demonstrate that union participation in pay negotiations results in increased personnel training, through reduced likelihood for job changes. For Booth et al. (2001), male union members received more training, and for Booth et al. (2002) coordinated industry level agreements may also facilitate parallel pay and training development at the workplaces, at least in the case of general training.

In Finland, the co-operation process in assessing the need for training is based on social relations and institutions at the workplace. It includes informal relations arising from the people and tradition, and formal relations, such as meetings of co-operation bodies and documentation of the common understanding regarding the need for training. But the co-operation does not include such specialization as the use of union learning representatives like in the UK (Davies, 2008). Thus, in Finland, the direct guidance from outside the

undertakings should not much affect the selection for training and wage decisions within undertakings.

But then there is the question of indirect guidance, through collective bargaining. In Finland, collective bargaining takes place between unions, and workplace bargaining is conditional to unions' approval. Moreover, collective agreements are generally binding, i.e. they apply to employees of an unorganised employer too.[7] It follows that with around 70 per cent union density bargaining coverage is around 90 to 95 per cent. This enables a procedure that Malchow-Møller and Skaksen (2003) describe as institutional compression of wages, which, according to the writers, decreases individuals' incentives to get training, but increases firms' incentives to invest in training.

Harcourt and Wood (2003, 2007) go further, and name Finland as a coordinated market economy, CME, as contrasted to a liberal market economy, LME, such as the UK. It is typical that in the CMEs firms' resource their internal labour markets by means of employment protection, which then provides workers with incentives to stay and develop their skills in the firm (Schwab, 1993; Sousa-Poza and Henneberger, 2004). In internal labour markets, firm-specific skills are created in the long run, through a combination of on-the-job training, classroom instruction, work experience, mentoring, induction and other mainly informal processes. For employers this can be costly, but if firms are able to share the costs with workers, as compensation for employment protection, and the government, as compensation for positive externalities, co-operation can induce a superior development in productivity. Thus, in a labour market like this, there should be more training.

But, why to speak in singular, as if there was only one homogenous labour market in each country. In fact, there are many, such as the three sectors of economy, i.e. the processing industries, the private services and the public sector, with their sector-specific work organisations. Accordingly, as also discussed by as by Harcourt and Wood (2003, 2007), in the segmented labour markets, there may also be a variety of training organisations. Besides, these segments may be gender-specific, as discussed by Rubery et al. (2005), for example.

In Europe, this question is relevant in the context of the European Employment Policies, EES. Today, it includes the training sensitive concept of "flexicurity", a flexibility-

[7] See definitions and comparisons on: http://www.eurofound.europa.eu/eiro/2002/12/study/tn0212102s.htm (October, 2009).

security mix, where flexibility is for employers and security for employees. In spite of its ambiguities, discussed by Keune (2008) and Rubery et al. (2008), it challenges the values of employment protection, underlined in the concept of internal labour markets, by rhetoric like "easy fire, easy hire".

On the other hand, if governments are able to compensate the deterioration of employment protection by means of active labour market policies leading to re-employment in another establishment, as discussed by Madsen (2002) and Larsen et al. (2007) in the case of Denmark, in-service training is just substituted by public training for labour market reasons. But, even in this case, the role of in-service training in vocational adult education and training as well as the motivation for its pro-active assessment at the workplace would become undermined. Thus, in a labour market like this, there should be less employer-provided in-service training.

In my interpretation, the presence of internal labour markets is connected to the presence of workplace bargaining. But this far there is only limited evidence to picture this relationship in Finland. The only evidence of workplace bargaining on training is limited to some studies within labour law.[8] In Heikkilä and Piekkola (2005) and Pekkarinen and Alho (2005), where workplace bargaining is discussed from the economic point of view, training is not mentioned. Thus, all we know for sure is that the idea of internal labour markets is written in the introduction of the Co-operation Act within Undertakings (725/1978) and in other corresponding regulations, but only with a loose connection to workplace bargaining. Thus, by means of empirical data, identification of internal labour markets in Finland is problematic.

## 2.3 Conclusions

In the literature, estimated returns to training are typically positive, but depend on the data, the country and the model used. At first "the American returns" to training were found surprisingly high as compared with the returns to other human capital variables, such as years of schooling and work experience. Then the problem of "too high" returns was found from many other countries. Meanwhile the variation of results increased, depending, for example, on how selection for training was taken into account. Most of the results are based on short-run returns to training. So far the research regarding the rate of return to

[8] See the summary in: http://www.tsr.fi/files/TietokantaTutkittu/2008/108191eng.pdf (October, 2009).

training over the life cycle is very limited. The only estimates that I have found are from Mincer (1989) and colleagues, and are based on the slopes of aggregate wage profiles.

Thus, two points of view look interesting. If the research problem is the rate of return over the life cycle, in comparison to other human capital variables, the earnings function of Mincer (1974) looks like a natural starting point. For life-long learning a life sycle model is needed. But in the case of short-run returns to training, other models and methods, such as matching, need to be assessed. In both cases the processes behind the selection for training must be clarified. Since training in general, and in-service training especially, differs from its American counterpart, there are reasons to assume that selection for training depends on factors that are typical for Finland, but not necessarily for the US.

According to the literature, in Finland, there are signs of internal labour markets, where workers' skill-levels are raised in the long run by all available means of training, but primarily in the form of in-service training. To some extent, the idea of internal labour markets is present in the co-operation regulations when assessing the need for training at workplaces. But, the workings of the internal labour markets must also be connected to the procedures of enterprise bargaining, as decisions of training easily affect wages as well. Therefore, a proper modelling of the causes of training in Finland remains a very challenging task.

# 3. Education and training in Finland

It appears likely that the returns to training vary across countries depending on education and labour market institutions. Therefore, in the following, the Finnish educational system (see Figure 3.1) is discussed in some detail. Special attention is given to the years of education, the key control variable when modelling the return to training. Through the discussion of the above characteristics, I depict the key challenges of the Finnish educational system. For thematic evaluations of the whole educational system, a good source is Jakku-Sihvonen (2002). Unfortunately, some other sources that I refer to are available in Finnish only.

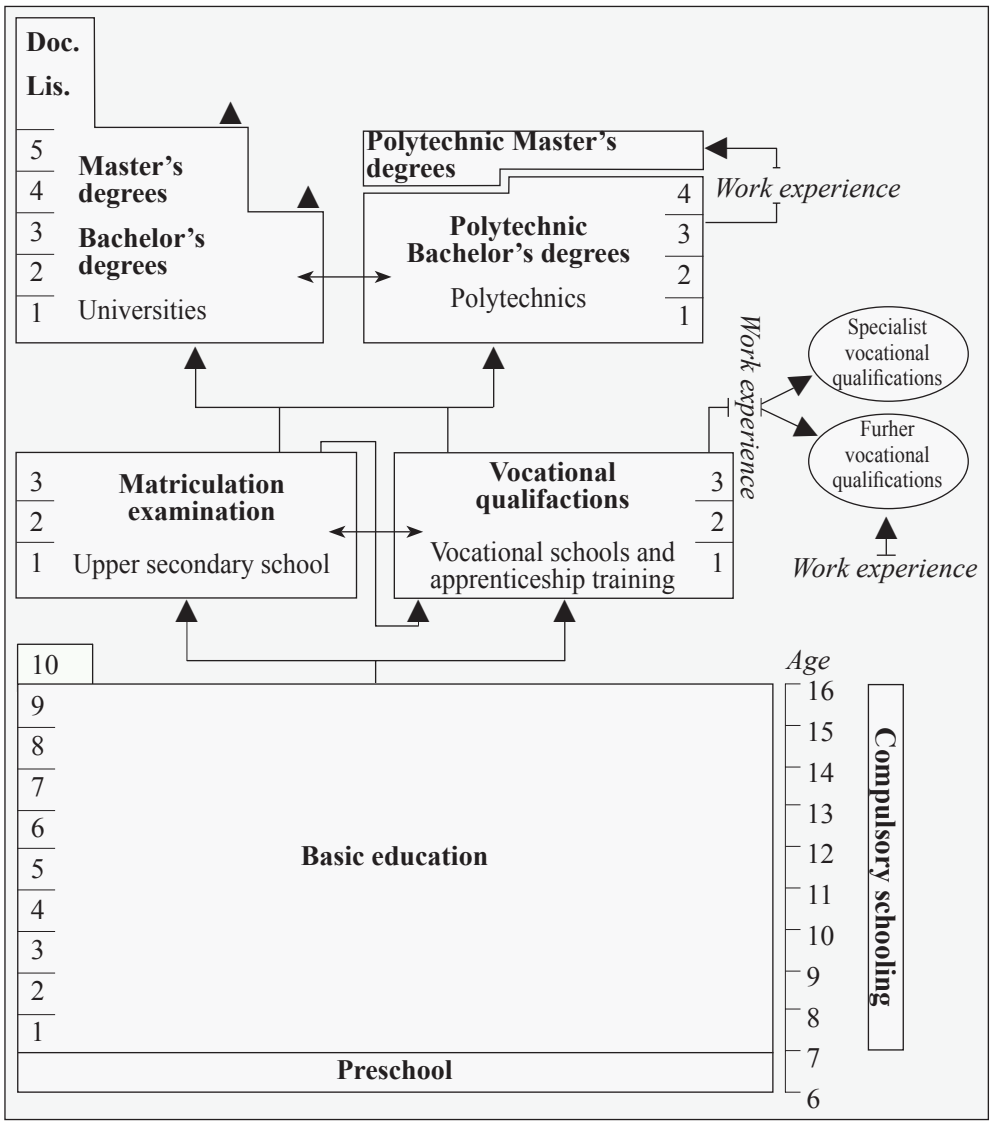
To the question, why such an extensive overview to the Finnish educational system, I refer to Heckman (2000), Cunha et al. (2006) and Wößmann (2008): Good results at one phase of education, like in adult education, are connected to what has happened before in basic vocational education, and even before that, in primary education. For example, without skill equalising activity at school-age, it is very difficult to decrease skill differences later by means of adult education.

## 3.1 Education of the young

In Finland, school starts at the age of seven depending, however, on the observed school maturity of the children. The one-year long pre-school prior to compulsory basic education does not include a curriculum for cognitive disciplines. As a general rule, compulsory basic education lasts nine years. Should the pupil wish to improve his or her grades, this can be done by taking an additional tenth year. The typical exit age from compulsory basic education is 16. But already at this point of education, the differences in actual years of education can be a few years.

After compulsory basic education, the following education for 16–19 olds can take place at an upper secondary school, a vocational school or a combination of the two. For the first two, the length is typically three years, but the combination usually takes at least four years. The upper secondary school, ending in the matriculation examination, does not give any vocational qualification but coaches the student for further education.

Figure 3.1 Educational system in Finland.



For many reasons, the drop-out rates from secondary level education have increased over a long period, starting long before the 1990s.[9] Dropping out does not necessarily mean dropping out of education completely, but can entail changing the course of studies. However, the effects of this on actual years of education are real, and deviations from the normal 3 to 4 years may accordingly have increased in frequency.

The tertiary level of education is given either at a university or at a polytechnic high school. The normal length of a basic degree course at university (for a Master's degree) should be five years. In reality, the variation is considerable and even in the1980's the graduation usually took 6–9 years (Laukkanen, 1987). The normal length for degree courses at a polytechnic high school is 3.5–4 years and the realization of the norm is far better than at universities. A term of compulsory work experience is included as part of the studies at a polytechnic high school. Its length can vary from half a year to one year.[10] Therefore, the normal length of a Polytechnic Bachelor's degree is 4 to 5 years.

In the 1990s, the focus of this thesis, two major changes in the educational system took place. Firstly, there was the introduction of the above mentioned polytechnic high school system at the beginning of the 1990s. Along with this change, the former higher secondary level of education became the lower and lowest tertiary-level of education, and a corresponding amendment was made to the education code representing the level of education. According to Böckerman et al. (2009), this reform had some positive effects on the employment and earnings of the polytechnic graduates. However, these effects are only present in the field of business and administration.

Secondly, in the mid-1990s, it became possible to pass a vocational examination with the help of a so-called competence test, as described by Rinne and Vanttaja (1999). In addition to years of education, the competence test has some further importance for this research. The opportunity that vocational proficiency can also be acquired outside an educational institution is something that has not previously existed in the Finnish education system, a system favouring classroom arrangements also in the case of work-oriented degrees,

[9] From 2000 onwards, the time series for drop-out rates according to the level of education are available at www.tilastokeskus.fi

[10] In autumn 2009, there has been discussion of the wages of those who do their compulsory work experience period without pay on with e.g. food compensation, with special attention on those periods organised by employment offices. According to some estimates there are tens of thousands of such trainees. However, so far there is no research on this topic. In the data of this study, during the 1990s, the average starting wages have decreased some but not much.

such as apprenticeships. In the 1990s, the competence tests have become an essential part in the expansion of adult education and thus strengthened the link between adult education centres and establishments of all kind, public and private. This arrangement has also helped establishments in a more general problem of the 1990s, i.e. in matching their needs with the broader vocational qualifications produced by the educational system. Those qualifications do not normally qualify to any job in any establishment. Thus, they need to be tailored by means of training.

Apart from these changes, the basic features of the Finnish educational system have remained stable during the period to be studied. As pointed out by Heinonen (2006), passing a lower level of education gives the right to study at the next level of education, regardless of age. In principle, this objective has certainly existed since the 1960s. But this far, according to statistics, the "productivity" of the Finnish educational system has been based on the education of the young, as depicted in Figure 3.2.[11]

In the figure, four important issues can be seen. First, a large part of Finland's degree-based human capital has accumulated since the1960s. In 1960, only one fifth of the most educated generation (25–29 olds) had passed the examination of the following level after the basic education, i.e. had acquired a vocational qualification. Second, the proportion of people with a vocational qualification has increased almost entirely as a consequence of the young generation's education. In 2000, a good 80 per cent of the most educated generation (20–40 olds) possessed vocational qualifications.

The third issue is very relevant with respect to adult education. Over-45-year-olds have a persistent "education deficit" compared with younger generations. For the Finnish educational system this deficit has become a key problem, as concluded by Rinne and Vanttaja (1999). One possible solution to it is adult education. Unfortunately, this well-known problem did not, at least not essentially, ease during the 1990s, and in the end of the 1990s it still was one of the worst among the OECD countries (Rahikainen, 1999).[12]

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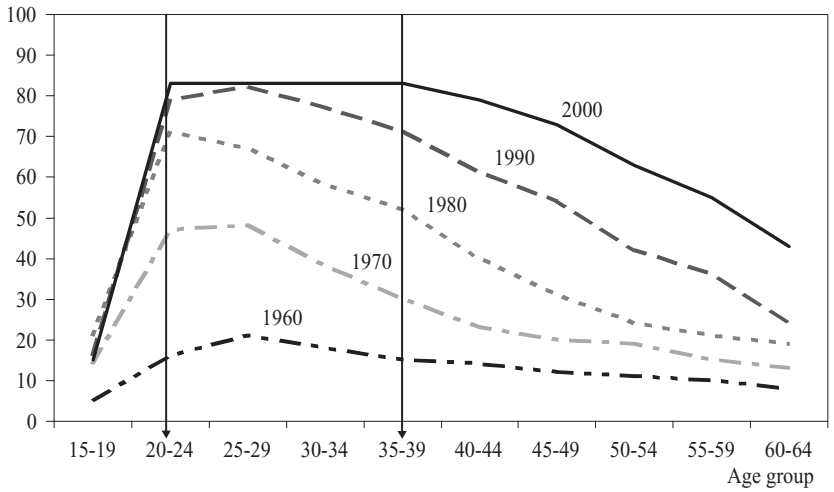
[11] The "productivity" of the Finnish educational system is assessed by the share of the population who completed basic vocational education. It is a rough assessment but, by means of this assessment, it is possible to avoid the chaining problems caused by numerous changes in the education classification codes.

[12] Another issue, connected to the "education deficit" and training, is early retirement. In my opinion, it is such a demanding issue that I decided to leave it here. Introduction to the issue and its determinants is given by Ebbinghaus (2006) and Lund and Villadsen (2005).

Figure 3.2. Occupationally educated 1960–2000, % of population.




The fourth issue is the fact that the proportion of the vocationally uneducated young people did not decrease in the 1990s. In 2000, it was still the same fifth that it was in 1990. This problem of the 1990s can partly be due to a lengthening of graduation years because of educational upgrading. But other reasons must exist because the lengthening of graduation years has been a trend since the expansion of secondary and tertiary level education in the 1970s, without a slowing-down effect in the proportion of occupationally uneducated young before the 1990s. Something is wrong, but from the literature it is difficult to judge what it is.

## 3.2 Adult education

The existing situation is challenging for the Finnish adult education policy. The older generations are less educated than the younger, whose educational attainment is among the highest in the world. Today, in 2009, the demarcation line is rather close to 50 years of age (Opetusministeriö, 2002). This dichotomy is a consequence of the decisions made in the 1960s and 1970s, when the supply of the secondary and tertiary level education was substantially increased. Therefore, the educational attainment of people who were educated in the 1970s is considerably better than the educational attainment of people who were educated earlier. From the policy point of view, it is favourable that this challenge is also recognised among the Finnish population, with rather small differences in assessment between the young and the old, as depicted by Aro et al. (2005). In the data, more than 90 per cent responded affirmatively to several statements concerning the importance of

education. It is such a high proportion that the question, where is it actually arising from, is relevant.

According to the OECD's country examinations,[13] the history of adult education in Finland can be roughly divided into three phases: integration policies until the 1960s, educational planning policies until the late 1980's and, from the 1990s onwards, policies based on labour market demand (Allardt, 1997; Lampinen, 1998; Ministry of Education, 2002). The third phase has also been called by other names, such as the phase of continuous adult education. It includes the idea that adult education directs people to higher levels of education than their own (Alanen, 1992; Rinne and Vanttaja, 1999).

Even though the descriptions of the phases may be interesting in their own right, for the purpose of this study it is essential to determine the relationship between non-vocational adult education and vocational adult education. The starting point for this is the 1925 law on community colleges, which was based on the idea of "population civilization", the so-called open civilization procedure, which had only a weak or at most an indirect link to the labour market.[14] On the other hand, the law made the state the financer of adult education and therefore also made way for labour-market-oriented adult education. Additional justification for this orientation was given by the increased unemployment of the 1970s. Courses for unemployed adults became more commonplace, and in the 1980's the supply of vocational adult education was included in the supply of other vocational education (Komiteamietintö, 1988).

After the 1980's the idea of educational planning ran into difficulties, partly because of the deep recession of the early 1990s and partly for political reasons, and the supply of education by industry was replaced by industry-related plans by the Ministry of Education and the National Board of Education. In 1991, the law on vocational adult education centres was passed, which made it possible to focus on a demand-based supply of education, including in-service training.[15] In practice, the dominating paying customers of the adult education centres were the local offices for the Ministry of Labour, determining the amount

[13] Unfortunately, this report is available only in Finnish. However, two summary reports are in English (OECD, 2003b, 2005). Moreover, there is Heinonen (2006) in German, and the earlier committee report, Ministry of Education (1997), is in English.

[14] See updated: Act on Liberal Adult Education (632/1998) and Decree (805/1998)

[15] See updated: Act on Vocational Adult Education Centres (631/1998).

of education supplied. However, the contents and the production of education remained for the adult education centres (Rinne and Vanttaja, 1999).

The country comparisons of the OECD (2003b, 2005) suggest that the1980's was a decade of a break-through, since then large parts of adult education were included in the developing plans of the whole educational system, i.e. in the formal degree-based educational system, as if coordination like this would bring about the best social returns to tax-financed investments in education. Accordingly, in the 1990s, the number of adults in formal education rose to almost one million persons in the nearly one thousand institutions of the formal educational system. Another positive statement from the OECD underlines the role of paid study leaves, like paid educational leave[16] and job alternation leave, targeted at older age groups in need of education.

Unfortunately, as pointed out by Bishop (1996), in the country comparisons, there is very little about the role of on-the-job training, i.e. in-service training, which is the typical means of vocational adult education in Finland, as it probably is in many other countries as well. Thus, in the case of Finland, it can be argued that in-service training is still outside the formal degree-based educational system, in spite of the formal procedures to produce in-service training at workplaces and educational institutions.

The steps that have been taken to lower the borderline between in-service training and other vocational adult education have been practical steps and authorised by administrative rationality, not by research based on observed spillovers and externalities or estimated social returns. If such estimations exist they are not to be found in scientific libraries that I have used.[17] To the best of my knowledge, for example, there is no economic evaluation on the effects, social or private, of the above descriped competence tests.

## 3.3 Training vs. education

In Finland, the borderline between adult education and training is complicated, as it must be in many other countries as well. But certainly one line goes between employer-provided training and other vocational adult education. There the relevant questions are: Who pays

[16] See about the study aid of Education Fund in address http://www.koulutusrahasto.fi/?3

[17] My primary source has been Nelli Portal, a net library for tens of Finnish Universities and polytechnics.

the costs of training? And does the training aim to an acknowledged qualification of the formal educational system, measured, for example, by a change of education code?

Let us start from the costs. In Finland, investment in training is made in a different way than in the US, where the relevant empirical literature mainly comes from. In the US, an individual himself is typically assumed to pay for the training in the form of indirect costs, i.e. during the training course the worker receives a lower wage than those who do not participate. And what it comes to in-service training in Finland, both direct and indirect costs are typically covered by the employer.

This tradition started by means of collective agreements. Since 1968, the Central Organisation of Finnish Trade Unions (SAK), for example, has had an agreement with the employers on covering the costs of in-service training. And later, in the 1970s and after, the rules for in-service training were stipulated by acts and agreements, sector by sector, as described in section 2.2, creating some differences in the co-operation procedures. But still the costs of in-service training remained for the employer.

In the 1990s, however, some forms of active labour market policies, such as training of unemployed, and some forms of degree-based education, such as apprenticeships, became possible contents for in-service training. And then also tax-payers money became available for in-service training. It follows that today the nature and contents of in-service training is diverse. In a typical case training spells are short, only a few days, but also longer "educational" training spells are possible.

It should also be noted that the collective co-operation procedures are not the only drivers for in-service training. On the internet there are a variety of firms selling all kind of management programs for the key personnel groups, such as chief executive officers, department heads, superintendents and foremen. In these programmes, training is very much like education, a curriculum consisting of several modules to be studied over a long period of time, and leading to a decree of the formal education system. Moreover, there are drivers like self-selection, where individuals select themselves for training, because of their personnel characteristics. This driver brings us to voluntary adult education.

In voluntary adult education, the individual is more responsible for the training costs. But also there, the costs are often subsidised by governments, and not only in Finland, as pointed out by Bishop (1996). Also in the case of in-service training, government subsidies

are possible when there is a joint decision of the goals of training, such as increased employability or opportunities for further vocational education or training, which, in the end, may also be measured by a change of education code. Thus, it is possible to conclude that the borderline between (formal) education and (informal) training is often difficult to draw and empirically observe, at least in advance.

My last note here applies to learning-by-doing. It is present in all working and refers to workers' capability to improve their productivity by repeating the same type of action in the work of their own, as well as learning from co-workers and colleagues by, for example, copying someone's acts. According to human capital theorists like Mincer (1974) and Becker (1975), investment in training does not completely encompass learning-by-doing, but is to be measured by years of work experience and its by-products tenure and seniority. On the other hand, Killingsworth (1982) argues that training and learning-by-doing are two rival models of life sycle behaviour, and a synthesis is suggested. Destre et al. (2008) provide a new distinction between imitation jobs and experience jobs, and argue that workers in imitation jobs, who learn most from others, tend to have considerably longer tenure than workers in experience jobs. According to their estimations, workers on average can catch half of their learning from others' potential in just 2 years.

Without going to details of this discussion, I conclude that learning-by-doing is informal in all meanings of the word. Therefore, it is also difficult to evaluate with other measures but by years of work experience including tenure and seniority. Besides this, learning-by-doing has one feature worth of mentioning: It is a typical way of organising training in small establishments, where opportunities for formal training, measured by training incidents separable from work, are limited, as discussed by Barron et al. (1997). And hardly is it unproblematic in bigger establishments either, particularly in the case of firm-specific training.

## 3.4 Conclusions

The proportion of occupationally educated labour in the 1990s increased at around the same pace as it had increased in the 1980s. Basically, the increase took place by means of the formal education of the young. However, in 2000, almost 20 per cent of the 20 to 39 -year-old population had no vocational degree, in spite of the increased flexibility of the educational system, which allowed people to deviate from the normal lengths of study

at each level of education, depending on personal reasons or other reasons, such as the training needed for qualifying a degree.

In the 1990s, the main issue of Finnish vocational adult education and training was the "education deficit" of the over-45-year-olds, a persistent kind of a problem, which was created by expansions of the secondary and tertiary level of education in the 1970s. This well-known problem did not essentially ease during the 1990s, in spite of efforts to expand adult education and training by means of formal, degree-based education, and informal training, such as in-service training.

Today, as in the 1990s, the borderline between adult education and training is complicated. Basically, in-service training is informal in that it does not normally lead to a qualified degree within the formal educational system. On the other hand, in-service training may include elements of formal education, such as training for apprenticeships. In addition, when government authorities and establishment's management make joint decisions regarding the goals of training, such as to increase employability of the people of the target group, also other types of vocational adult education can take the form of in-service training. But in this transformation, the role of economics has limited to some partial analysis only. Therefore, I conclude that the economic evaluation of the Finnish educational system is still in its early stages.

# 4. Data

## 4.1 Data collection

For studies like this, there are three primary data sources. First, there is the Adult Education Survey, AES, where sample persons' experiences are examined according to an extensive questionnaire form and a face-to-face interview. In a situation like this, interviewees may feel some social pressure to report at least some training, but, on the other hand, all relevant activity is reported accurately. Second, there is the Labour Force Survey, LFS, which Statistics Finland carries out on a continuous basis and where in-service training is just one issue amongst tens of others. The survey is done by telephone, without separate definitions of education types and contents. There are no questions about other adult education forms, indicating the relative position of in-service training. For these differences in data collection, AES reports some higher participation rates for in-service training than LFS.

A third source, the companies' in-service training statistics, where the training data are obtained from companies, produces almost the same results as the AES of 2000. The information about companies' in-service training is based on a Europe-wide research project (Continuing Vocational Training Survey - CVT). In 1999, the study was carried out simultaneously with the same arrangement and uniform means of data collection in all 15 European Union member countries, the 9 candidate countries as well as Norway. This source is thus interesting when the use of register data and country comparisons are discussed. But so far, register data are available for big companies and formal education and training only, making it a problematic source for studies like this, where the focus is on the wage effect of all adult education and training for all wage-earners.

The data used in this thesis consist of Adult Education Surveys (AES) in 1990, 1995 and 2000, carried out by Statistics Finland, and income data from the tax authority's register. The survey information is gathered by means of questionnaires for interviews, the interview method being interview visits. The questionnaires have changed over time, but the objective has remained the same: to get information on education, adult education in particular, for planning and research, for decision-making and for public debate. Therefore, in the questionnaires, the emphasis has always been on issues such as participation in all forms of education, the learning and development opportunities provided by employers, and the needs for and obstacles to adult education.

According to the quality report on the AES of 2000, the survey is comparable to the 1990 and 1995 surveys and corresponding surveys in other countries. But of course there are also some problems in comparisons. The questionnaire used in 1990 was considerably shorter than those used in the later surveys, and therefore the comparison of cross-section data sets must be based on the 1990 questionnaire. If a certain question was asked in 1990, it is very likely it was also asked again later, and also the ways of questioning have remained very much the same.

All three survey years have been quite different, and "the spirit of the age" is, for some parts, to be seen in the questionnaires. 1990 was the end of a long-lasting growth period. The unemployment rate was 3.5 per cent and there were fears of a shortage of labour. In the questionnaire, adult education was seen as one answer to ensuring labour availability. The background for the 1995 survey was a new social situation, a deep economic recession with mass unemployment. Therefore, the relationship between education and unemployment was a focus of attention in the questionnaire. In 2000, the country had already recovered from the recession rather well, but the unemployment rate was still around 10 per cent. Because of the country's EU membership, and probably for other reasons as well, the questionnaire took into account the development of adult education statistics which then was taking place within the OECD, UNESCO and the EU.

A new emphasis in the AES of 2000 was informal education, i.e. education and training that are difficult to observe. Therefore, in the 2000 interviews, any courses lasting for at least 6 hours were counted as adult education. However, it is important to notice that this concept of the informal differs from the informal of this thesis, i.e. activity outside the degree-based educational system. In 2000, vocational and non-vocational adult education was also separated in detail by asking the interviewee to state the purpose of their studies. In

addition, information on whether the education was provided by an employer or otherwise was produced by the interviewer, Statistics Finland. A more detailed discussion about this is in the interview report by Blomqvist and Nyyssönen (2000).

The response rates of the three different surveys are shown in Table 4.1 (Blomqvist et al., 2002). Although the sample sizes and target populations by age differ slightly in the 18–64-year-old population, the number of respondents in each survey is around 3500–4000. In 1990 and 1995, the response rate was 82 per cent, but in 2000 only 74 per cent, i.e. 8 percentage points less. However, the response rates have decreased relatively smoothly over all the background variables of Table 4.1, i.e. equally for both males and females,

Table 4.1. Response rates according to certain background variables, % .

| *Year of survey* | *1990* | *1995* | *2000* |
|---|---|---|---|
| Males | 82 | 82 | 74 |
| Females | 82 | 83 | 75 |
| Age groups | | | |
| 18–24 years | 85 | 87 | 79 |
| 25–34 years | 81 | 84 | 76 |
| 35–44 years | 81 | 80 | 73 |
| 45–54 years | 80 | 80 | 73 |
| 55–64 years | 83 | 80 | 73 |
| Level of education* | | | |
| Primary or lower secondary (ISCED 0–2) | 79 | 76 | 68 |
| Upper secondary (ISCED 3–4) | 84 | 84 | 76 |
| Tertiary (ISCED 5–7) | 84 | 88 | 78 |
| Type of municipality | | | |
| Urban | 78 | 80 | 70 |
| Semi-urban | 82 | 85 | 79 |
| Rural | 89 | 87 | 83 |
| ALL | 82 | 82 | 74 |
| Number of responses | 3602 | 4107 | 3990 |
| Number of sample persons | 4888 | 5005 | 4891 |
| Age limits, years | 18–79 | 18–64 | 18–74 |

* Since 1997 there has been no division into lower and upper within the secondary level of education. In this research primary equals ISCED-class 0–2, secondary ISCED-class 3, and tertiary ISCED 5 and more. In the following tertiary is still split into four parts according to the first number of ISCED: 5 is the lowest third, 6 is the lower third, 7 the upper third, and 8 researchers.

for all age groups and for all levels of education. Thus, it may be that the increase in non-response was not selective.

In Blomqvist and Nyyssönen's (2000) interview report, the increase of non-response with respect to age is found unproblematic. It coincides with the increase of average non-response. The two other suspicious groups, respondents with less than upper secondary education and respondents living in urban municipalities, were also found unproblematic, in general. The only problem, according to the interview report, was the 35–44-year-old age group with less than upper secondary education. Their proportion of the increased non-response was higher than in the total sample. But according to the authors, it may be that all the deviations fit within the 95 per cent confidence interval. Accordingly, the deviations should not pose any problems for statistical analysis as such.

Blomqvist et al. (2002) report: "It is evident that the higher non-response observed here relative to earlier surveys is attributable to an increase in refusals by 7 percentage points. This rise was evenly distributed over all the groups representing background variables while the proportions of respondents who could not be traced remained virtually unchanged." But the reason why people refused to be interviewed so often in 2000 is not reported by Blomqvist et al. (ibid). However, looking at some other surveys, we can see that response rates came down in the 1990s quite generally in surveys for employees. In the Working Conditions Survey of 1990, for instance, the response rate was 85 per cent. In the same survey of 2003 the response rate was 78 per cent, 7 percentage points less.

## 4.2 Key human capital variables

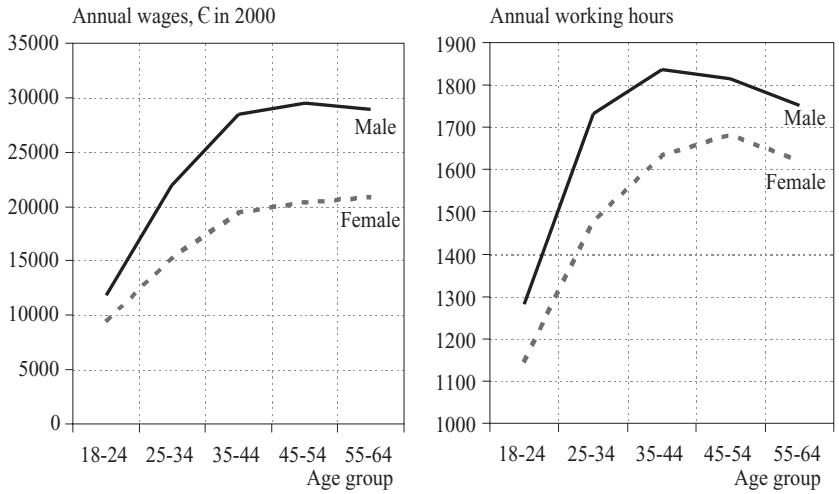
In the following, I shall show key descriptive information from the data, such as annual wages and working hours, educational attainment, vocational adult education over the life cycle and the division of one year's adult education into in-service training and other adult education.

Other variables of the thesis are presented in their own context of each following chapters. All the following results are for wage-earners only, according to the spirit of the earnings function. Pooled data are unweighted averages for the all three surveys.

The age-wage profiles for males and females, see Figure 4.1, are concave as is typically the case in the literature discussed above. And typically as well, the concavity is stronger for males than for females, but after the ages of 35-44, curving is very modest for both sexes. Females' wages are roughly 70 per cent of males' wages, i.e. ten percentage points less than the 80 per cent reported by Eurostat[18]. Thus, using annual wages as an endogenous variable for census data, as advised by Heckman et al. (2006, Appendix B), might cause problems if no information on working hours is available.

But here, there is also information on annual working hours, as shown in the right-hand part of Figure 4.1. After asking, Statistics Finland was able to deliver information on months worked and hours of a normal working week. Multiplying these two by the average number of weeks per month, i.e. 4.2 weeks, results in 1720 hours per year, which is practically the same as found in the Labour Force Survey of 2000.[19] On average, females' hours are roughly 90 per cent of males' hours, and the shapes of the age – working-hour curves look even more concave than the age-wage curves. It follows that age – hourly wages profiles cannot be as concave as age – annual wages profiles.[20] Another implication is that females' hourly wages are roughly 80 per cent of males' hourly wages, as they should be according to the wage

Figure 4.1. Annual wages and working hours in the 1990s. Pooled 1990, 1995 and 2000.




[18] Unadjusted figure published in http://epp.eurostat.ec.europa.eu (January, 2008). The European Commission (2006) has reported gender pay cap of about the same size for the private sector.

[19] See also Tilastokeskus (2004), especially the article by Laura Hulkko and Table 1.2 on page 20.

[20] Dividing concave annual wages by concave working hours may result in a curve not far from linear. This matter is discussed in more detail in the following chapter.

statistics of Eurostat. Thus, the hourly wage variable seems satisfactory. It certainly gives a more accurate picture of work compensation than the typically used annual wage.

Some words about the explanatory variables need to be added. The most commonly used human capital variables are years of education and work experience. As discussed above, returns to education are usually estimated from potential years of education, i.e. those that are typical of the given level of education. Accordingly, years of work experience are potential: years of age less potential years of education, defined by Statistics Finland,[21] less 7, i.e. the school starting age. However, this relationship between potential years of education and work experience is possible only in a world where all time after the age of 7 is used for education and work.

But for the proper estimation this may be too potential. Even at the primary level of education, schooling years differ between individuals, as depicted in Figure 4.2, where potential years are plotted against actual years plus and minus its standard deviation at each class of potential measurement. And so is the case with work experience as well, where the way of measurement is also relevant from the gender point of view, since potential working years could lead to substantial measurement errors in the male-female difference. In both cases, along with higher levels of potential education and work experience, standard deviations in actual years are bigger. Unfortunately, actual years are asked only in 1995 and 2000.

The third human capital variable is the stock of training courses over the life cycle, shown in Figure 4.3. They were asked of all those who had at least some work experience. The stock of training courses increases nearly linearly up to 35 years of age, and then the increase moderates gradually until the pension age. The size of the stock[22] depends on the level of education, suggesting a positive correlation between training and education. For the tertiary level of education, the number of training courses is almost twice that of those with primary level of education, i.e. people with no vocational degree.

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[21] According to the norm lengths of Statistics Finland's 1997 classification the education length for the primary level is 9 years, the secondary level 12 years, the lowest tertiary level 14 years, the lower tertiary level 16 years and the upper tertiary level 18 years. The norm lengths are based on ISCED, International Standard Classification of education, and utilised in other countries as well.

[22] The stock is calculative, imputed through the use of class-midpoints of original training indicator, just like with levels of education. More closely this procedure is discussed in section 5.2.

Another part of Figure 4.3 shows minor differences between males and females. The average number of training courses is 7.8 for both genders. The only significant difference between males and females is in the age group of 55 – 64, the difference being one course more for males. Thus, for males the number of training courses increases till the pension age. But, for females the life-time maximum takes place in the age group of 45–54. Then, probably for reasons of selection, the figure for next age group is a bit smaller.

Figure 4.2. Potential and actual years of education and work experience. Data from 2000.

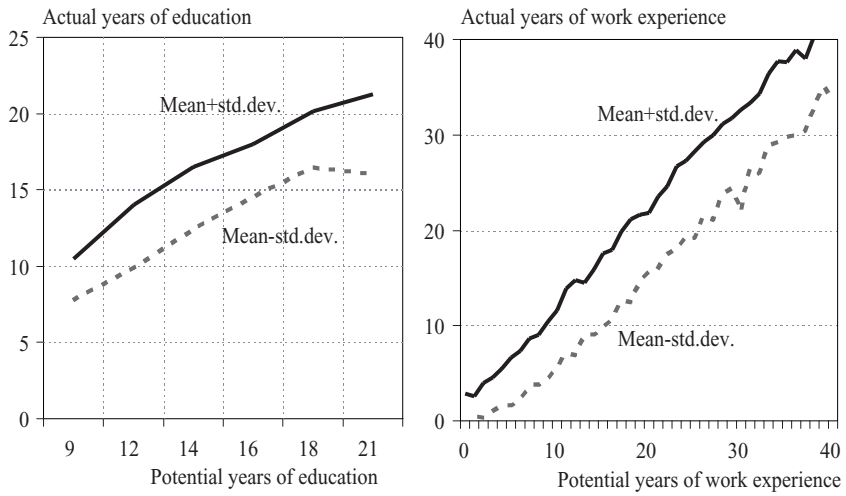
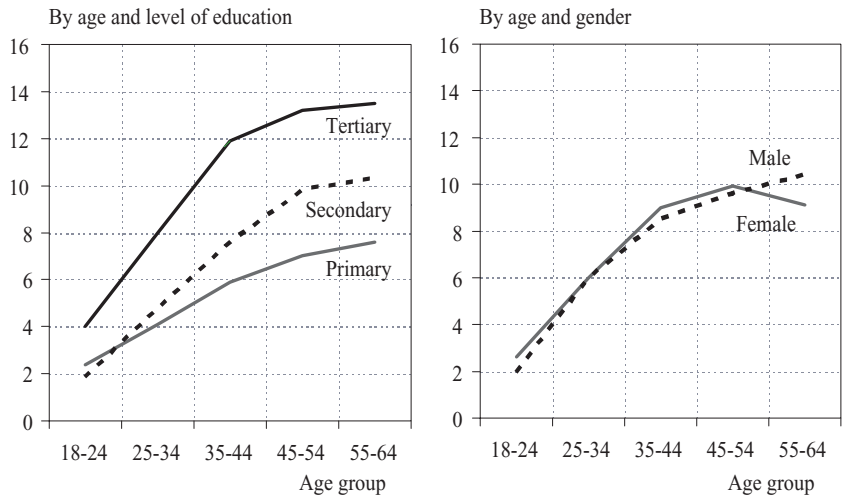



Figure 4.3. The stock of vocational training courses. Pooled 1990, 1995 and 2000.



The fourth human capital variable is participation in adult education and training in the 12-month period preceding the interview in the survey year. According to Figure 4.4, in-service training dominates adult education. It constitutes 84 per cent of all adult education and training instances, and 56 per cent of all adult education and training days.[23] Thus, 16 per cent of all instances and 44 per cent of all days are something other than in-service training.[24] When non-vocational education and training is excluded the corresponding figures are 5 and 27. Actually, between 1995 and 2000, the latter proportion has decreased from 33 to 27 per cent, i.e. the proportion of in-service training of all days in vocational education and training has increased from 67 to 73 per cent.

Participation rates by age are concave, peaking at the age of 44–54 years, and then decreasing to the pension age. The concavity is due to in-service training, i.e. other forms of education and training, such as voluntary vocational education and non-vocational education, the curve is quite flat with respect to age. The age profiles of days in all adult education and training look different. Most days are spent at a young age, and then days decrease quite linearly until the pension age. Along with ageing, the relative differences between in-service training and other forms of adult education and training decrease. Thus, at a young age the days in voluntary vocational education and non-vocational education are a typical part of adult education, but not so much after the prime working age of 35–44 years.

Figure 4.5 presents some subjective assessments regarding selection for training and wage returns.[25] As can be seen, females feel much more often that they have selected the given course by themselves. In the prime working ages, this accounts for the majority of females. The rest of the females (and males) are directed to the given course by employers. For males, the share of voluntary selection is 16 percentage points less, and, at both ends of the age range, clearly less than average. From the data it is impossible to judge to which extent the difference between males and females is a real one, and to which extent it reflects differences in subjective judgements.

[23] Besides, in the 1990s, the proportion of in-service training of all days in adult education and training has been rather stable: 55 % in 1990, 48 % in 1995 and 56 % in 2000. For 1990, figures for other types of education and training are not available. But from 1995 to 2000, the proportion of other vocational education and training decreased from 23 to 21 per cent. Meanwhile, the proportion of non-vocational education and training decreased from 28 to 23 per cent.

[24] For clarification, in the AES the participation rate for in-service training is higher than in the Labour Force Survey, LFS. In the two surveys for 2000, the difference was more than 10 percentage points. The main reason for the difference seems to be the method of asking the questions.

[25] The results for selection for training are grounded on one randomly selected course in one year's time, and the results for wage returns to previous vocational training in general.

Figure 4.4. Adult education and training in one years time. Participation rate and days by age in 2000.

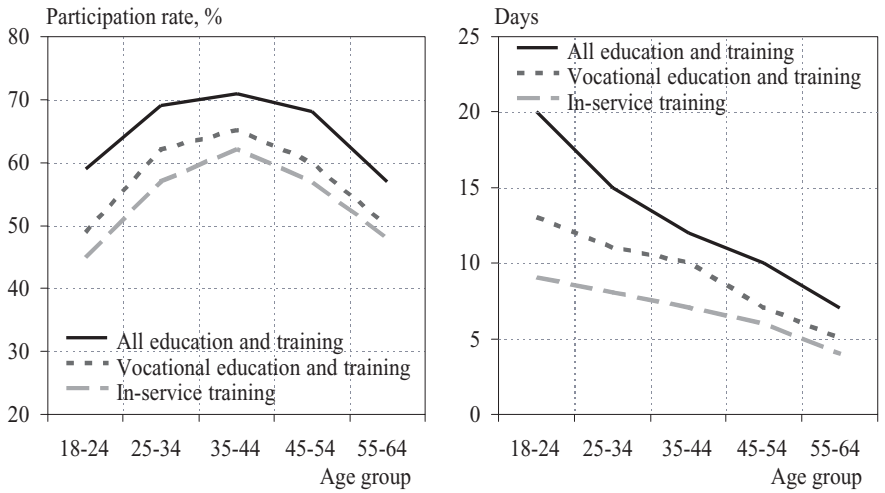
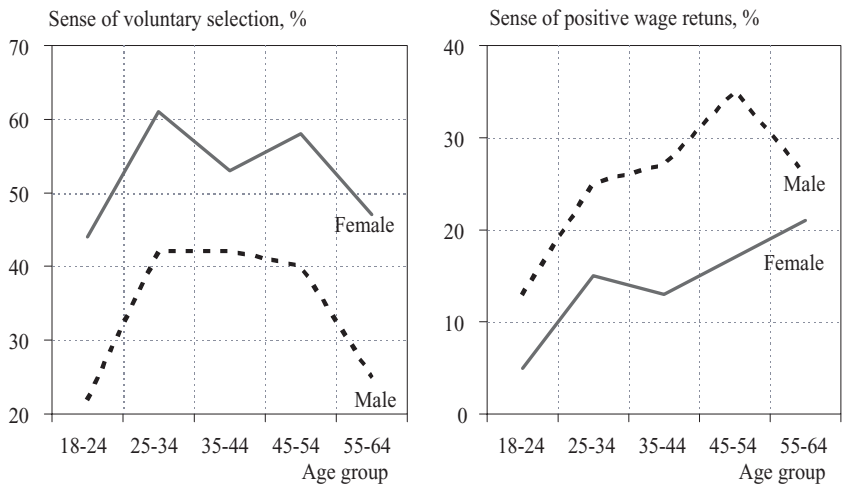



Figure 4.5. Subjective assessment of trainign selection and wage returns. % by gender in 2000.




The other part of Figure 4.5 shows that males more often feel that acquired courses, in general, have brought about some positive wage returns. This feeling increases with age going from 9 to 23 per cent from the youngest to oldest age group. For males, the peak comes in the age group of the 45–54 old, and then decreases. For females there is no decrease. But, once again, it is very difficult to say to which extent this feeling accords with reality. It can also be that males' and females' assessments of wage returns are different in scale. In the data, there is some evidence that males concentrate more on wage returns and females concentrate on some other "qualitative" returns.

From the subjective statements, I conclude that wage returns are not the most typical returns to the training acquired. The most acknowledged returns to training are improved chances for better or more demanding tasks, and in surprisingly many cases without reported changes in wages. The share of sample persons giving feedback like this is twice that of those who say they got positive wage returns. Besides, "defensive" effects, like keeping one's job, or "securing" effects, like switching a temporary contract to a permanent one, were mentioned almost as often as positive wage returns.

Unfortunately, the typology for selection for training, the nature of training and the possible outcomes of training do not allow any operational division into general and firm-specific training. It is possible to argue that most of the vocational adult education acquired during working life is in-service training and possibly rather close to firm-specific training, because it is mostly employer financed. But actually we do not know, and it even could be the other way around. When one sub-sample of trained was asked directly whether it was general or firm specific, 67 per cent named the training general in nature.[26] Another problem is that the data do not include information about institutional features of the labour markets and about the internal labour markets particularly.

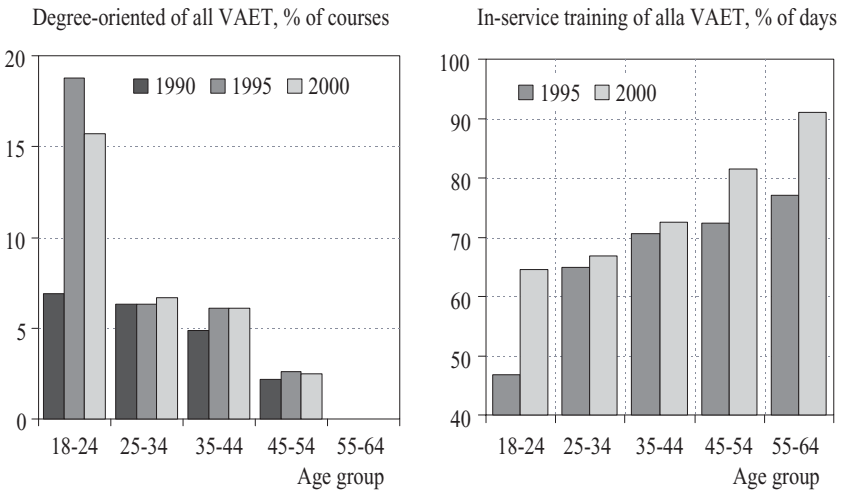
What we know from the data is the skew distribution of training over occupational groups. In highly professional groups, such as legislators, senior officials and managers and other professionals, the average number of accumulated training courses is more than 10. Then there is the middle group of clerks and service workers with 8–10 courses. And finally, there are other skilled and unskilled workers with an average of 5–7 courses.

## 4.3 Formal vs. informal over time

Finally, I return to Mincer (1989), who wrote about the substitution of schooling for on-the-job training. In the case of VAET, Vocational Adult Education and Training, I assess this possibility in Finland by two comparisons. First, I compare the proportion of degree-oriented studies of all VAET. Second, I compare the proportion of in-service training of all VAET. Through the use of the data from the AES, the first comparison is possible for the whole 1990s, since it is based on one randomly chosen course in VAET. The second is possible for 1995 and 2000 only, as it is based on days in VAET. In other words, defined earlier in this study, this is a comparison between formal and informal VAET over time. The results of this comparison are in Figure 4.6.

[26] Source: SAK's working conditions survey 2008. It is available only in Finnish.

Figure 4.6. Degree-oriented education and in-service training over time. Per cent of VAET, Vocational Adult Education and Training.




According to right-hand part of the figure, the proportion of degree-based VAET has increased some, but only between 1990 and 1995. In 1990, the proportion was 4.6 per cent, on the average. Among the young it was some higher than in the prime working age of 35 to 54, but the difference was only some percentage points. The deep economic recession of 1991 to 1994 increased the volume of formal education for labour market reasons. Therefore, by 1995, the proportion of degree–oriented education almost tripled among those who were younger than 25. Besides, there was some improvement in the prime working age. In 2000, the distribution of degree-oriented education is about the same as it was in 1995. The figure for the youngest age group has slightly decreased, but otherwise the proportions have retained. And when it comes to degree-oriented education for 55 to 64-olds, in the 1990s, there have been no cases at all.

According to the left-hand part of the figure, the proportion of in-service training has increased too.[27] In 1995, the proportion was 67 per cent, and in 2000, the proportion was 73 per cent, 6 percentage points more. The increase had taken place in both ends of the working life. Among the youngest, less than 25 years of age, it had increased most, from 47 to 65 per cent. Moreover, among those who were 45 and older, i.e. the original target group of the adult education policies, the increase is substantial too. However, after

[27] For 1990, these figures are unknown, i.e. Statistics Finland did not deliver with the data in a comparable way with the data of 1995 and 2000.

looking more closely at the data, it is possible to argue that these increases are not due to increased investment by the employers. On the contrary, their investments among the younger than 25 and among the older than 54 has decreased.

In these age-groups, employer-provided in-service training is substituted by system-provided in-service training, and for tax-payers money. This statement is based on comparison between days totally and partially paid by the employer. Days totally paid favour people in prime working age, days partially paid favour both ends of age distribution. As a word of warning, however, days totally paid is not an accurate figure, since they had to be estimated from the data with some assumptions.[28] With this reservation, in 1995 and 2000, around 69 and 65 per cent of all days in in-service training were totally paid for by the employer. But even after this minor decrease, the proportion of totally employer-paid days of VAET has remained at the level of 1995, i.e. at the level of around 50 per cent. Meanwhile, the proportion of voluntary, self-financed, adult education has remained at the level of 20 per cent. And, the proportion of voluntary in-service training has remained at the level of 10 per cent.

From the education policy point of view, these results are problematic. In spite of the official goal-setting of the1990s, according which adult education should be aimed towards the next higher level of education the proportion of degree-based education has remained limited and has not increased since 1995. Informal forms of vocational adult education, such as in-service training, have remained dominant and even increased in both ends of working life. These increases are due to tax-financed demand through the system of formal education in the form of apprenticeships, competence tests and training for labour market reasons. Through this involvement, in-service training is also institutionalised in a way that during 1995 to 2000 the proportion of in-service training given in specific training institutions outside the workplace has increased from 27 to 32 percent.

Other possible reasons for these changes, such as changes in workers' preferences, are not to be clarified in a reliable way by the given data. Besides, as a general reservation, the degree of accuracy in asking the days in training has developed over time. In the interview of AES 2000, the accuracy must have been better than in the previous two interviews, since the focus of that survey was informal training.

[28] For example, assuming that all training days are either totally or partially employer-provided training.

## 4.4 Conclusions

The data, three Adult Education Surveys from the 1990s, consist of representative samples of the Finnish wage-earners. The data include all relevant human capital variables that are needed for a proper estimation of the wage effect of training. There are two training contents. The first training content, i.e. courses in vocational adult education and training during the working life, is the same for each cross-section of 1990, 1995 and 2000. The questions that are asked are always asked in the same way. Therefore, this training content is suitable for assessing the developments of the 1990s.

The other training content, i.e. days in vocational adult education and training during the last 12 months, may vary a little over time, since the accuracy of asking has also changed. This training content suits best for the cross-section of 2000, since it seems to be the most accurate in measuring days in training. In both cases, the estimation of the wage effect of training should be based on hourly wages, since it takes into account the hours worked. Correspondingly, the years of education and work experience should be based on actual years, since they allow for individual differences in the pace of studies and years out of work and education.

The accumulation of training over the life sycle is occupation-sensitive. In professional groups, the number of life-time training courses is around double those of unskilled workers. Of training days we know that they decrease in a linear way over the life sycle, that most of the training days are in-service training, that the number of training days is around the same for men and women, and that the distribution of training days is skewed to the right. And from the subjective assessments we know that males focus more on wage returns and females on some other “qualitative” returns.

Unfortunately, the data do not allow operational division into general and firm-specific training. Besides, the question of internal labour markets remains open. The data do not allow the identification of the collective co-operation procedures within establishments in assessing the need of training. Indicator variables for the incidence of enterprise bargaining, annual action plans for training and for collective lay-offs during the last 12 months, for example, had been welcome to catch some features of the internal labour markets.

# 5. Returns to training in a standard life cycle model

In this chapter, I focus on the 1990s. I ask, what happens when Mincer's (1974) basic model is expanded by training, as other variables of the model are measured and in a customary way? In the model, all the time of adulthood is used for either studies or work, measured as potential years of education and work experience. I start by clarifying the structure of the model, and its weak link, indirect measurement of training. Then, through a short literature survey, I discuss the need of a direct measurement of training, such as that included in the Adult Education Survey, AES. Finally, by means of data from 1990, 1995 and 2000, I estimate the wage effect of training for the mean hourly wage as well as for nine wage deciles, including the median wage-earner.

## 5.1 Model and discussion

### *5.1.1 Statistical earnings function*

According to Berndt (1991), the econometric literature on wage formation has usually been based on regression equations like

$$\ln y_i = f(s_i, x_i, z_i) + u_i, \tag{1}$$

where $ln\, y_i$ is the natural log of earnings or wages for the i*th* individual, $s_i$ is a measure of schooling or educational attainment, $x_i$ is the human capital stock of work experience, $z_i$ are other factors affecting wages, and $u_i$ is a random disturbance term reflecting unobserved ability and the inherent randomness of earning statistics.

But what is the functional form of equation (1)? According to Willis (1986), the analytical function form should be considered as an approximation of intertemporal choice problems, which, according to the author, does not have a simple and practical solution. But, by means of human capital framework with some assumptions, it is possible to give some guidelines for the analytical functional form of equation (1).

If we assume that the return to education is the same $r$ for all levels of schooling, and if we approximate (1+r) by $e^r$, the rate of return to s years of education is

$$y_s = y_0 e^{rs}, \tag{2}$$

This can be rewritten in logarithmic form as

$$\ln y_s = \ln y_0 + u, \tag{3}$$

where $r$ is the estimated private return to one year of education, and $\ln y_0$ is the intercept, indicating the predicted level of log earnings in the absence of schooling. In the model, it is assumed that schooling is uncorrelated with the error term $u$.[29]

But if schooling is endogenous or there are omitted variables, such as ability, that are correlated with both $y$ and $s$, OLS provides inconsistent estimates, as Taubman (1976a, 1976b), Griliches (1977, 1979) and Card (1995, 1999, 2001) have pointed out and discussed. For the dataset used in this chapter, these critical notes are very difficult to deal with, as is discussed in the next chapter. In order to proceed with the given research problem, a more general form of equation (3) is needed. One such is given by Mincer (1974), by writing

$$\ln y_s = \ln y_0 + \beta_1 s_i + \beta_2 k_i x_i + u_i, \tag{4}$$

where $\beta_1$ is the rate of return to schooling, $\beta_2$ the rate of return to on-the-job training, $k_i$ is the proportion of the i*th* worker's time devoted to the training investment, and $x_i$ is the i*th* worker's years of work experience. This formula does not refute the above criticism, but it mitigates the question of omitted variables relative to one, i.e. training. The problem

[29] Usually it is assumed that $u$ is normally distributed with mean zero and a constant variance. When testing this assumption, Wagner and Lorenz (1988) found little support for it, but Heckman and Polachek (1974) found the semi logarithmic form (1) consistent with their data.

for Mincer (1974) was that data on *k* was not generally available, and he had to estimate the return to on-the-job training indirectly, by judging the presence of training from the concavity of age-experience profiles. To help this work he rewrote equation (4) as

$$\ln y_s = \ln y_0 + \beta_1 s_i + \beta_2 x_i + \beta_3 x_i^2 + \beta_4 s_i x_i + u_i , \quad (5)$$

where $x^2$ is the square of work experience and *sx* is the interaction for schooling and experience. The square of work experience tests the concavity of the experience-wage curve. The interaction term tests whether better educated workers get more on-the-job training. Both tests arise from human capital theory, according to which on-the-job training is mostly used at the beginning of the work career, and that more educated are more trained, as Becker (1964, 1975) and Pen-Porath (1967), for example, have pointed out.

Estimation of the parameters of equation (5) by means of OLS yields the mean wage effect of the key human capital variables. But, as presented by Gould (1992) and Koenker and Hallock (2001), estimation could also be done by means of Quantile Regression for each wage quantile, making it possible to test whether wage effects vary across the wage distribution, as suggested by Ahlstrand et al. (2003). It is also possible to compare whether the returns to training by wage level differ from returns to education by wage level, of which Martins and Pereira (2004) have reported for 16 countries, including Finland.

### *5.1.2 The reference literature*

In the past forty years, the Mincer models, such as model (5) above, have been widely used throughout the world. Almost all results, for example those reported by Schultz (1975), Blaug (1976), Willis (1986), Psacharopoulos (1994), Psacharopoulos and Patrinos (2002) and Belzil (2005), support the assumption of a concave relationship between earnings and work experience, indicating the scale of investments made in on-the-job training and the depreciation of acquired professional skills. In the basic model, work experience includes on-the-job training, assuming that most investment in on-the-job training is made at the beginning of a career, and that the concavity of the life cycle earnings shows how much these investments yield.

According to Psacharopoulos (1994), the individual return to one year of formal degree-based education is highest in the developing countries, at approximately 14 per cent. In

industrial countries, one additional year of education yields 8 to 10 per cent on average. The later research in Europe indicates of a slight reduction in the average returns, although many estimates are still in the range of 7-9 per cent, as are the returns in Finland (Asplund and Pereira, 1999; Asplund, 2001).

These results justify the interest in the relationship between education and income distribution. In principle, both education and training could be used as a means for decreasing wage inequalities by affecting the distribution of skills. Evidence on this possibility is Hamil-Luker (2005), regarding women with and without on-the-job training. However, the results reported by Asplund and Barth (2005) for Europe and Heckman et al. (2003) for the US, are still quite ambiguous, and depend on many other factors difficult to control.

The role of on-the-job training, typically paid for by the wage-earner, has also been a popular research problem. But, as one can see from the assessment of Barron et al. (1997), its focus has been on the first years of the work career. However, with certain modifications, the model has also been used to estimate the wage effect of training in its natural context, in a spirit of life-long learning over the life sycle. Mincer (1989) and Asplund (2004), and many others in between, have reported that even partial data on acquired training has improved our view of the model's weak point, the amount and quality of acquired work experience.

Mincer (1989) was optimistic for the access to direct measurement of training and evaluated that the lack of such measurement had led to competing theories to upward slopes of wage profiles, such as the costs of supervision, turnover, job sorting and job matching. But still the literature regarding returns to training over the working life is quite limited. One probable reason for this has been inadequate data about the number of training courses acquired during the working life. It is a restriction that could be overcome by using data from the Finnish Adult Education Survey, AES.

In this chapter, I expand Mincer's model by including training acquired during the working life, and compare the model specified in this way with one without training. I believe that this is what Mincer would also have done at the beginning of the 1970s when writing his equations such as (4). But, due to data restrictions, it was not possible. And later on his work focused on outlining the model's theoretical implications, as one can see from Mincer and Jovanovic (1981), Mincer (1988) and Mincer (1994). They help in specifying the model, but are of less help in interpreting the results and comparing them with those presented in this chapter.

## 5.2 Data

The data used in this chapter have been collected from the Adult Education Surveys of 1990, 1995 and 2000. The sample sizes of the full surveys were in the region of four thousand and the number of wage-earners half of that. In 1995 and 2000, the questionnaires were almost the same. The questionnaire in 1990 was more compact and it also differed from the other two in the framing of its questions. Therefore, the choice of key variables for all three surveys had to be based on the more restrictive 1990 survey.

In addition to the information acquired from the questionnaires, the data include information from other registers. The most important of these concern formal degree-based education and incomes. The sample persons' education codes, which identify their degrees and the level of education, were taken from the examination register using the 1997 education classification of Statistics Finland. The income data, wages and salaries in a calendar year, were taken from the tax authority's register.

The tax authority's register also included information on entrepreneurial and taxable income, i.e. all incomes less deductions. However, it is possibly most fitting for the earnings function to focus on wages only.[30] By dividing annual wages by the number of working weeks and then again by standard weekly hours[31], I get an estimate for gross hourly wages. The gross hourly wages, assessed in this way, differ somewhat from the statutory wages in collective agreements. But in order to standardize the work contribution in the model estimation this assessment is surely called for.

The average gross hourly wages were 11.9 € in 1990, as measured by the money of the year 2000.[32] Due to the depression of the early 1990s, hourly wages were still almost at the same level in 1995, but in 2000 the hourly wages were already 13.8 €. The average annual increase in real hourly wages during the entire decade was therefore 1.6 per cent, i.e. around the same as according to Statistics Finland should have been.

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[30] There may be some reasons to include some parts of entrepreneurial income in earnings, as noted by Chiswick 2003), but it would be much more problematic to substitute earnings by taxable income, as taxable income also includes capital incomes and all deductions from taxable income.

[31] Standard, customary weekly hours were not defined for all the wage-earners. The imputed value of 37 hours was given to wage-earners working "full time". The rest, 20–30 wage-earners per year, were abolished from the data.

[32] Finnish marks have been converted into euros and deflated by the consumer price index to the 2000 level.

Table 5.1. Descriptive statistics.

| *Variables* | *1990* | | *1995* | | *2000* | | *Pooled* | |
|---|---|---|---|---|---|---|---|---|
| | *Mean* | *Std.D.* | *Mean* | *Std.D.* | *Mean* | *Std.D.* | *Mean* | *Std.D.* |
| *Continuous variables* | | | | | | | | |
| Gross hourly wage, € in 2000* | 11.9 | 9.2 | 11.9 | 10.9 | 13.8 | 12.5 | 12.3 | 11.0 |
| Years of age | 37.9 | 10.8 | 39.8 | 10.2 | 40.6 | 10.4 | 39.4 | 10.5 |
| Years of education* | 11.9 | 2.5 | 12.4 | 2.7 | 12.7 | 2.7 | 12.3 | 2.7 |
| Years of work experience* | 19.0 | 11.5 | 20.4 | 10.8 | 20.9 | 11.0 | 20.1 | 11.1 |
| Number of training courses* | 6.6 | 6.0 | 8.1 | 6.1 | 8.9 | 6.0 | 7.8 | 6.1 |
| *Indicator variables* | | | | | | | | |
| Male | 0.51 | | 0.50 | | 0.51 | | 0.51 | |
| Uusimaa area | 0.23 | | 0.29 | | 0.30 | | 0.27 | |
| Sector of economy | | | | | | | | |
| Agriculture | 0.02 | | 0.04 | | 0.04 | | 0.03 | |
| Processing industries | 0.35 | | 0.29 | | 0.27 | | 0.31 | |
| Private services | 0.33 | | 0.37 | | 0.35 | | 0.35 | |
| Public services | 0.29 | | 0.30 | | 0.35 | | 0.31 | |
| *Level of education* | | | | | | | | |
| Primary | 0.32 | | 0.26 | | 0.20 | | 0.26 | |
| Secondary | 0.42 | | 0.40 | | 0.43 | | 0.41 | |
| Lowest tertiary | 0.16 | | 0.19 | | 0.20 | | 0.18 | |
| Lower tertiary | 0.05 | | 0.07 | | 0.08 | | 0.07 | |
| Upper tertiary | 0.05 | | 0.09 | | 0.09 | | 0.08 | |
| *Incidence of lifetime training* | | | | | | | | |
| None | 0.21 | | 0.16 | | 0.11 | | 0.16 | |
| One course | 0.11 | | 0.08 | | 0.07 | | 0.09 | |
| 2–3 courses | 0.16 | | 0.13 | | 0.14 | | 0.14 | |
| 4–10 courses | 0.21 | | 0.24 | | 0.23 | | 0.23 | |
| More than 10 courses | 0.30 | | 0.40 | | 0.45 | | 0.38 | |
| Number of observations | 2069 | | 2008 | | 1875 | | 5952 | |

* Calculative or potential measurement, as explained in the text.

One important point regarding the measurement of wages is demonstrated in Figure 5.1. As described above, human capital theory predicts concave experience-wage curves and uses on-the-job training as an explanation for them. In the figure, there are two age-wage curves, which accordingly should be concave. But only one is. It is the age-gross annual wage curve, typically used as the dependent variable in the literature. But the other, the age-gross hourly wage curve, is almost linear, at least after 35 years of age. Thus, the change in concavity is not only due to on-the-job training, as normally assumed in the literature, but to changes in working hours. For the young and the old workers, the hours are fewer than during their most active working lives, peaking at the age of 40–45.

Figure 5.1. Age-wage profiles of pooled data. % of mean wage.

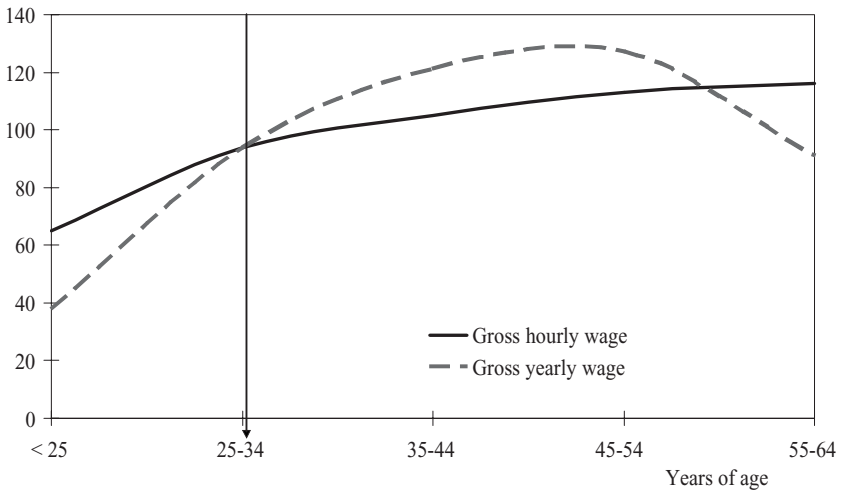
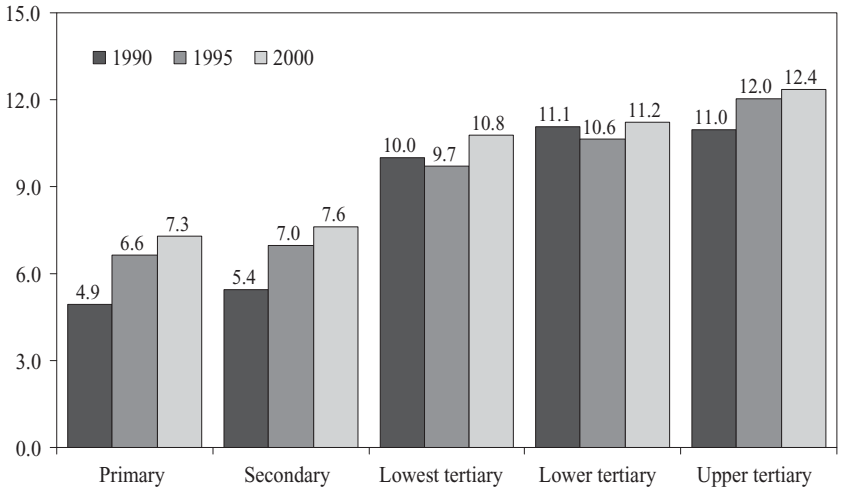



Figure 5.2. Training courses by level of education in the 1990s. Number of courses during working life.




The average potential years of education, i.e. the typical length of education at each level of education, defined by Statistics Finland,[33] increased during the decade from 11.9 years to 12.7 years. Accordingly, the potential years of work experience, i.e. age – years of education – school age, increased from 19 years to 21 years. However, part of the increase in potential years of work and education is due to an increase in the average age of the

[33] See Section 4.2 Key human capital variables.

sample persons. Other possible reasons, such as unemployment and absence from work, are excluded, as they are not noted in the estimation used here. This problem in studied in the next chapter.

During the decade, the average age of employed wage-earners increased from 38 years to 40.6 years. There was no corresponding increase in the population.[34] Therefore, the reason for the increase in the sample persons' average ages is presumably the increase in the average ages of those being selected for paid employment during the decade. Why this has happened and how this selection process may have affected the results is not examined in this chapter, as would be possible using the selection correction procedure presented by Heckman (1979). The reason for this is the lack of variables that explain job offer decisions especially in the 1990 data, as discussed in the next chapter.

The sample persons' educational attainment has improved quite a lot during the 1990s. In particular, the proportion of those without vocational education, i.e. people with only primary level education, has decreased from 32 per cent to 20 per cent. In 2000, 43 per cent had completed secondary level education and 37 per cent had a tertiary level degree. Here, the upper tertiary level degrees also include post-graduate education[35], the proportion of which in the samples was only a few per cent.

All the persons who had any work experience were asked about adult education received during their careers: "As an estimate, how many times have you had work- or occupation-related training or education after moving into the labour market?" The choices were never, once, 2–3 times, 4–10 times, over 10 times and "I can't say". The question was successful in that "I can't say" answers were given by very few. In 1990, they were 1.3 per cent, in 1995 0.9 per cent and in 2000 1.4 per cent.[36] Unfortunately the length and timing of these courses we do not know.

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[34] The sample persons were 18 or older. The lower age limit has not been interfered with here, but the sample persons older than 64 years were dropped from the 1990 and 2000 samples. In the 1995 sample, all the sample persons were in the range of 18–64 years.

[35] It is class 8 of ISCED, the International Standard Classification of Education.

[36] From the way asked, one can judge that in the case of "I can't say" the number of courses was greater than zero. From other sources I found out that age was relevant for the process of imputation. Accordingly, a value of 2–3 courses was imputed if the sample person was younger than 40 and 4-10 courses if the sample person was older than 40.

In the following, the above-defined adult education is called training, as opposed to education at a young age. By cross-examining the data, I found out that more 90 per cent of "work- or occupation-related training or education" is in-service training courses paid by the employer. The rest is voluntary adult education, aiming at some vocational qualification. It is paid for by the employee and is typically taken before the prime working age. Thus, training here also includes some elements of education in educational institutions. But its share is so small and its nature so near to training that the overall concept of training is justified.

In the data of 1990, 79 per cent of sample persons had participated in at least one training course during their working lives. In 1995, the corresponding proportion was 84 per cent and 89 per cent in 2000. However, along with the expansion of training and adult education, the accumulation of the participation has also increased. In 1990, less than one third of the sample persons had participated more than 10 times during their working lives: In 2000, their share was 45 per cent.

From the indicator variables for training intensities it is possible to create a continuous training variable in the same way as levels of education are typically converted into years of education. Zero times and once in training got exact values; 2–3 times was marked as 2.5, 4-10 times as seven, and more than 10 times as 15.[37] Proceeding in this way, we get an estimate for every sample person and every sample year. The average number of estimated training courses was 6.6 times in 1990, 8.3 times in 1995 and 8.9 times in 2000.

Figure 5.2 depicts how the number of training courses increases with the level of education, as is the typical case according to Brunello (2001), for example. In 1990, those with a primary level of education had, on average, 4.5 training courses, which is less than half of those 11 courses that graduates from the upper tertiary level had. In 1995, the corresponding figures were 6.6 courses for the primary level and 12 courses for the upper tertiary level. Thus, the differences became narrower, and so it also happened in the latter part of the 1990s.

[37] The last class, more than ten, was open and therefore problematic. In estimations presented later the use of alternatives 13 and 17 brought out some higher (in the case of 13) or lower (in the case of 17) returns, but the changes in estimates were in the 95 per cent confidence level for the chosen solution.

In 2000, the course "stock" for those with the primary or secondary level of education was already around 60 per cent of the courses for those with upper tertiary level degrees, i.e. 15 percentage points more than at the beginning of the 1990s. In addition, for the lowest and lower tertiary level degrees there was no increase at all. On the contrary, for these levels of education, the year 1995, the first growth year after the long-lasting recession, was worse than the year 1990.

Lastly, some words about the other explanatory variables, used to capture differences and changes in the socio-economic background. Usually, the means of these variables are rather close to each other in all three cross-sections, suggesting small or slow changes in socio-economic background. But because of the recession of the first half of the 1990s and the very strong growth on the second half, the relative sizes of the economic sectors have changed. The size of the processing industries dropped from 35 to 29 per cent by 1995 and then on to 27 by 2000. Private services grew from 33 to 37 in the first half and then dropped back to 35 in the second half. Public services grew in the second half from 30 to 35 per cent.

An essential part of the structural change in Finland has also been the growth of the capital city and its neighbouring areas, i.e. the Uusimaa area consisting of two counties, Uusimaa and Eastern Uusimaa. During the first half of the decade, the Uusimaa area grew from 23 to 29 per cent of the sample and then to 30 per cent in the next half. According to the Labour Cost Survey 2000, collected by Statistics Finland, hourly wages for the growing Uusimaa area were about 10 per cent higher than the average for Finland.

## 5.3 Returns to education and training

### *5.3.1 Earnings functions for cross-sections*

I first estimate the returns to education and training in a model where both the education level and the number of training courses are present as indicator variables. Thus, controlling for all other explanatory variables, the coefficient estimates of each education level show how many percentage points higher gross hourly wages these people receive compared with those with a primary level of education. Correspondingly, the coefficient estimate for each number of training courses shows the return to training compared with those who did not receive any training.

The results, estimated separately for each year, are presented in Table 5.2.[38] They show that during the decade returns to different levels of education, compared to the primary level, have changed quite a bit. Returns to the secondary level were 13 per cent in 1990, but since then returns have dropped to almost zero and were statistically insignificant. Also, the returns for the lowest and lower tertiary level education have decreased from 1990 to 1995, but not since then. In 1990, the returns were in the range of 18–31 per cent. However, returns to the upper tertiary level have been almost constant in the 1990s, i.e. close to 60 per cent higher compared to the primary level of education.

In addition to education, returns to training have been positive in all three years. But, for a statistically significant positive return, many courses were needed, especially in 1990 as the return to training was positive only in the case of 10 training courses or more during the working life. In 1995 and in 2000, fewer lifetime courses produced a statistically significant positive return too. In 1995, which was the first real growth year after a long recession, even 2–3 adult training courses were associated with a positive average return. The period 1990–1995 seems to have been kind of a breakthrough for training, as measured by the increase in wage returns. Since 1995 changes have been small.

The size of the return is also worth a comment. Ten training courses or more are associated with a positive return of 22–27 per cent, depending on the year, compared with those with no training. In 1995 and 2000, 4–10 courses had a return of 12–13 per cent, and in 1995, 2–3 courses had a return of 11 per cent. The coefficient estimates for the other key variables of the earnings function are as expected. The return to higher levels of education is tens of percentage points compared to the primary level, but decreasing, in general. The return to one year of work experience holds in a range of 2–3 per cent and declines over the life cycle.

From the viewpoint of the research problem, the indirect effects of expanding the earnings function with training are certainly interesting. Those effects on key human capital variables are depicted in Figure 5.3, based on comparisons of regressions with and without training. The results of regressions without training are shown in Appendix 5.1 and the

[38] The models explain "only" 17–24 per cent of the variation in gross hourly wages, the least in 1990 and the most in 2000. By testing, I noticed that the models' explanatory power had been around 7 per cent higher when the dependent variable had been the log of the annual wage. The difference rises mainly from work experience and its square.

Table 5.2. Regression results, OLS for earnings function with training.

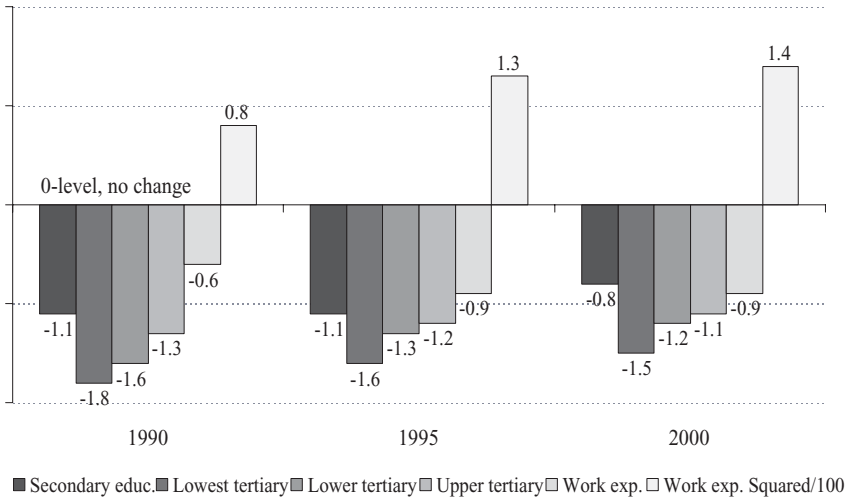
| *Dep.: log hourly wage* | *1990* | | *1995* | | *2000* | |
|---|---|---|---|---|---|---|
| | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| *Independent:* | | | | | | |
| Male | 0.232** | 0.030 | 0.194** | 0.024 | 0.176** | 0.023 |
| Uusimaa area | 0.149** | 0.033 | 0.097** | 0.026 | 0.089** | 0.027 |
| *Sector, cf. to agriculture* | | | | | | |
| Processing industries | 0.371** | 0.130 | 0.215* | 0.096 | 0.218** | 0.056 |
| Private services | 0.280* | 0.130 | 0.161 | 0.096 | 0.160** | 0.056 |
| Public services | 0.389** | 0.130 | 0.214* | 0.096 | 0.120* | 0.055 |
| Work experience | 0.024** | 0.005 | 0.030** | 0.004 | 0.020** | 0.005 |
| Work exp.squared/100 | -0.028* | 0.011 | -0.045** | 0.009 | -0.031** | 0.010 |
| *Education, cf. to primary* | | | | | | |
| Secondary level | 0.130** | 0.037 | 0.062 | 0.034 | 0.011 | 0.031 |
| Lowest tertiary level | 0.278** | 0.048 | 0.148** | 0.044 | 0.184** | 0.037 |
| Lower tertiary level | 0.452** | 0.057 | 0.370** | 0.055 | 0.307** | 0.042 |
| Upper tertiary level | 0.637** | 0.073 | 0.581** | 0.057 | 0.574** | 0.071 |
| *Training, cf. to nothing* | | | | | | |
| One course | -0.027 | 0.059 | 0.067 | 0.051 | 0.109 | 0.065 |
| 2-3 courses | 0.057 | 0.048 | 0.115* | 0.046 | 0.067 | 0.047 |
| 4-10 courses | 0.025 | 0.053 | 0.132** | 0.044 | 0.125** | 0.042 |
| More than 10 courses | 0.221** | 0.048 | 0.258** | 0.039 | 0.268** | 0.041 |
| Constant | 1.224** | 0.135 | 1.345** | 0.120 | 1.659** | 0.080 |
| Number of observations | 2069 | | 2008 | | 1875 | |
| F( k, n-k) | 31.73 | | 39.51 | | 30.01 | |
| Prob > F | 0.0000 | | 0.000 | | 0.000 | |
| R-squared | 0.1721 | | 0.214 | | 0.243 | |

Robust standard errors, * and ** are statistically significant coefficients at the level of 0.05 and 0.01.

results of regressions with training are based on Table 5.2. Figure 5.3 shows differences in coefficient estimates per one year of education and work experience. Thus, in the case of education, the coefficient estimates are first divided by the norm number of years that each successive level of education requires, starting from the primary level of education. According to Statistics Finland the norm numbers are 3, 5, 7 and 9 years for the secondary, lowest third, lower third and upper tertiary levels of education.

The results indicate substantial changes in coefficient estimates for the key human capital variables. After training is included in the earnings function, the returns to education and work experience decrease. The return to one more year of education decreases by one percentage point or more, most at the lowest tertiary level and least at the secondary level. In the case of the lowest tertiary level of education, i.e. the level for technicians, business services, marketing, and grammar school personnel, the

Figure 5.3. Change in the key variables' coefficients, % points per year. Coefficients with training – coefficients without training.




change is nearly -2 percentage points. Indirectly, this change reveals a substantial role for training in the wage setting at this specific level of education. At the lower tertiary level of education, i.e. the level of bachelor degrees and such, the role of training is almost as important.

Changes in the coefficient estimates for education have been small over the 1990s. But, in the case of work experience, some changes have taken place. In 1990, the difference for one year of work experience was -0.6 percentage points, but nearly -1 percentage point in 1995 and 2000. Accordingly, one could argue that the role of training with respect to work experience has increased. Also, the difference in work experience squared has increased, i.e. coefficient estimate with training is less negative than without. Accordingly, one could argue that the inclusion of training has made experience-wage curves flatter.

These differences are so big that some words of caution are needed. Certainly not all of the differences reported in Figure 5.3 are necessarily related to training, but some other factors may be driving them. One should remember that during the period 1990–1995, Finland suffered the worst depression of its economic history, and that depression may have contributed to the process of wage formation. "Creative destruction" as Maliranta (2003, 2004) calls the productivity-strengthening selection between firms

and positions, was at its strongest just before and during the depression and settled in the mid-1990s.[39]

"Creative destruction" may not necessarily have a direct link to the change in the earnings curve, but it is good to note the similar timing of the changes. The problem is that if the data are used as basis, it is difficult to name the causal process behind this development. In principle, the process may have started by the wage-earners' need to improve their position in relation to other wage-earners by means of adult education and training. On the other hand, the reason may also have been firms' and other work organisations' attempts to improve their adaptability in the more competitive work environment of the 1990s.

However, the effects of the model's expansion on the coefficients of education and work experience can be regarded as true to the assumptions of human capital theory. Because training correlates positively with both the level of education and work experience, the inclusion of training decreases the "effect" of other human capital variables. This is obvious but, because of data availability problems, seldom done.

### *5.3.2 Estimations with pooled data*

The results above suggest that 1) training has a positive return on lifetime gross hourly wages, independent of education and work experience, and 2) the role of training in the earnings function is rather stable over time. This allows me to go further, and switch to pooled data for the whole decade of the 1990s. Pooling the data facilitates tests across time and allows for more detailed breakdown into small groups.

In Table 5.3, there are three unweighted OLS specifications for the pooled data. Model 1 is without training, Model 2 with training as a set of indicator variables, and Model 3 with training as a number of training courses. When one compares Models 1 and 2, the results are about the same as in Table 5.2 above. By expanding the earnings function with training indicator variables, the return to training proves to be positive and, because of training, the coefficient estimates of other key human capital variables decrease substantially. The returns to higher levels of education decrease 8–12 percentage points

[39] With respect to training content, Song (2008) underlines the two-edged nature of firm-specific training. It favours older workers, and leads to better wages if production continues normally. But in case of lay-offs, these workers face bigger earnings losses, and possibly bigger difficulties in re-employment.

compared with the primary level of education. Accordingly, the returns to one year of work experience decrease from 3.2 to 2.4 per cent. And finally, the change in the coefficient on the squared form of work experience indicates a flatter experience-wage profile than training excluded.

There are two time indicator variables in each model, picking up wage changes since 1990. The indicator variable of the year 1995 does not deviate from zero in any of the three models. But the indicator variable for the year 2000 does, i.e. the wage level in 2000 is 11 per cent higher than in 1990 when training is excluded, and 9 per cent higher when training is included. It follows that when the variables of the earnings function are controlled for, the real hourly wages in the 1990s increased by about one per cent per year on average and all of that took place in the latter half of the decade. The deep recession at the beginning of the decade led to zero growth in real wages, and the compensation, in the face of rapid productivity growth, took then place in the latter half of the decade.

Model 3 with estimated number of training courses produces the same results as Model 2. The coefficient estimates and their standard errors for the key human capital variables are almost exactly the same, as are the normal goodness of fit test statistics as well. This is good news for the number of training courses, formed as explained above. There seems to be no information loss when one switches from indicator variables for different amounts of training to the approximate continuous number of training courses. The return to one training course turns out to be 1.6 per cent, and the result is clearly statistically significant.

However, when these point estimates for training indicators are divided by the average number of courses, i.e.1, 2.5, 7 and 15, there is a statistically significant decrease from 3.2 (2-3 courses) to 1.3 (4-10 courses) per cent and then a statistically insignificant increase to 1.6 (more than 10 courses) per cent per course. The decrease may be due to longer courses for those who enter employment at a young age. The other possible explanation is that the decrease is driven by the exceptional year of 1995, the first year of recovery after the long-lasting recession. In Table 5.2, this decrease occurs in the model for 1995 only.

Table 5.3. Three OLS models for earnings function with pooled data.

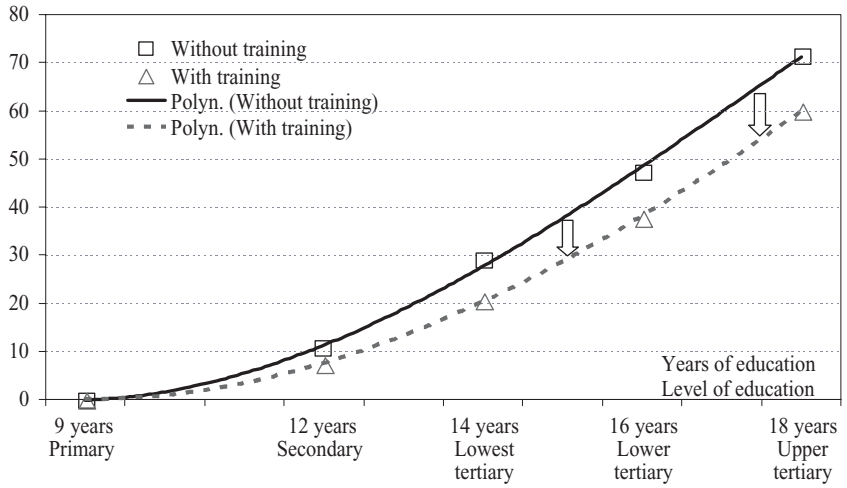
| *Dep.: log hourly wage* | *Model 1* | | *Model 2* | | *Model 3* | |
|---|---|---|---|---|---|---|
| | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| *Independent:* | | | | | | |
| Male | 0.215** | 0.015 | 0.207** | 0.015 | 0.207** | 0.015 |
| Uusimaa area | 0.121** | 0.017 | 0.111** | 0.017 | 0.111** | 0.017 |
| Processing industries | 0.255** | 0.054 | 0.261** | 0.054 | 0.260** | 0.054 |
| Private services | 0.209** | 0.054 | 0.193** | 0.054 | 0.193** | 0.054 |
| Public services | 0.258** | 0.054 | 0.234** | 0.053 | 0.233** | 0.053 |
| Work experience | 0.032** | 0.003 | 0.024** | 0.003 | 0.024** | 0.003 |
| Work exp.squared/100 | -0.045** | 0.006 | -0.034** | 0.006 | -0.034** | 0.006 |
| *Education, cf. primary* | | | | | | |
| Secondary level | 0.105** | 0.020 | 0.073** | 0.020 | 0.074** | 0.020 |
| Lowest tertiary level | 0.291** | 0.024 | 0.207** | 0.025 | 0.207** | 0.025 |
| Lower tertiary level | 0.474** | 0.029 | 0.378** | 0.030 | 0.376** | 0.030 |
| Upper tertiary level | 0.715** | 0.037 | 0.601** | 0.039 | 0.601** | 0.039 |
| *Training, cf. none* | | | | | | |
| One course | | | 0.037 | 0.035 | | |
| 2-3 courses | | | 0.081** | 0.028 | | |
| 4-10 courses | | | 0.092** | 0.028 | | |
| More than 10 courses | | | 0.245** | 0.025 | | |
| No. of training courses | | | | | 0.016** | 0.001 |
| Year, cf. 1990 | | | | | | |
| 1995 | -0.025 | 0.019 | -0.032 | 0.019 | -0.034 | 0.019 |
| 2000 | 0.108** | 0.018 | 0.093** | 0.018 | 0.093** | 0.018 |
| Constant | 1.351** | 0.064 | 1.390 | 0.065 | 1.398** | 0.064 |
| Number of observations | 5952 | | 5952 | | 5952 | |
| F( k, n-k) | 87.75 | | 81.52 | | 97.16 | |
| Prob > F | 0.000 | | 0.000 | | 0.000 | |
| R-squared | 0.193 | | 0.210 | | 0.209 | |

Robust standard errors, * and ** are statistically significant coefficients at the level of 0.05 and 0.01.

In models 2 and 3, where training is included, males receive a 20.7 per cent wage premium compared with females. Compared with Model 1, where training is not included, this average premium is 0.8 percentage points less, but the difference is statistically insignificant. It follows that training is not likely to be the explanation behind wage differences between males and females in the 1990s. The wage cap between males and females remains after training has been included in the model.

Figure 5.4 illustrates the effect of including training in the earnings function, based on the above results. The X-axis is defined according to the idea of a linear wage effect of education, i.e. the distance from the primary level of education is set according to the difference in years of education given by Statistics Finland. The y-axis depicts the return

Figure 5.4. The return to education with and without training, %. Compared with primary level of education.




to each successive level of education compared with the primary level of education in models 1 and 3.

The figure clearly shows two outcomes. One outcome is that the returns to successive levels of education decrease, as already explained. And the higher the level of education, the bigger the decrease is. Another outcome is that the assumption of a linear relationship between the years of education and the wage return does not hold. The relationship is a 3rd degrees polynomial. So, one more year of education does not bring the same return at all levels of education, but the return increases along the level of education.

Therefore, I re-estimated Model 3 by replacing the indicator variables for levels of education with potential (or norm) years of education, as in the most used specification of the Mincer model. The coefficient and standard error were 0.074 (0.0032), i.e. very near to what Asplund (2001) has reported for Finland. But then again, in the model, the square of potential years had been needed, as obvious from the shapes of curves in Figure 5.4.

The return to the secondary level of education is especially problematic. Three more years of education after the primary level of education bring a 10 per cent return without training (Model 1 above) and a 7 per cent return with training (Model 2 and 3 above). Why is the return so small? From the angle of human capital theory, the interpretation could be that wages at the primary level of education are too high compared with successive levels

of education. But in the same way, one could also argue that the returns for the upper tertiary level are too high. The inclusion of training in the earnings function alleviates the problem of nonlinear education-wage relationship, but does not abolish it. On the other hand, this problem may simply be due to the measurement error regarding the years of actual education. This matter is discussed more closely in the next chapter.

I also re-estimated Model 3 by replacing the number of training courses with a time-specific training variable for each year, with the following results for coefficients and standard errors (in parenthesis): 0.017 (0.002) for 1990, 0.016 (0.002) for 1995 and 0 013 (0.002) for 2000. Thus, the point estimates to one training course decreased a little in time, but according to the F-statistics, the differences were not statistically significant. And neither were the differences between the sectors of economy, after a similar estimation. The point estimate for public sector was lower than for others, but the difference was statistically insignificant.

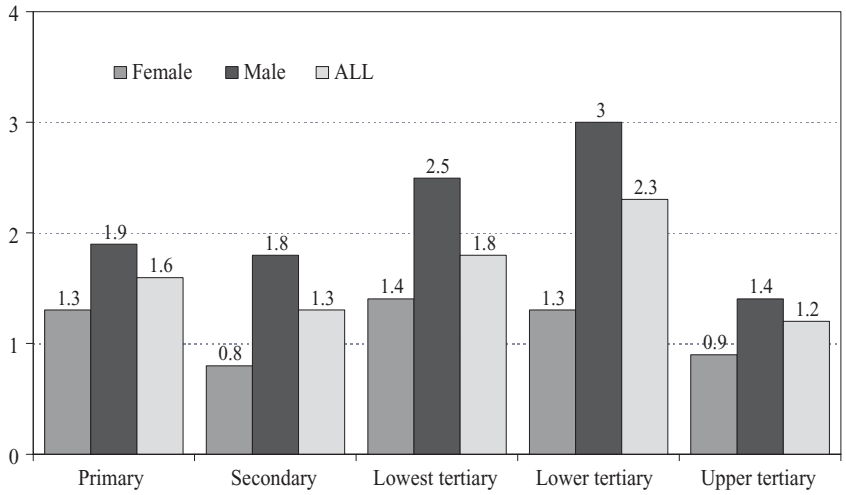
### *5.3.3 Returns to training in selected subsets*

With pooled data, it was possible to split the whole sample of 5952 wage-earners into subsets of a reasonable size. In the following, the earnings function is estimated by gender, level of education and wage. The returns to training by gender and level of education are summarized in Figure 5.5, based on wider reporting in Appendix 5.2.

When one compares returns to training at different levels of education, the first impression is that males benefit more than females. But this is not quite true. Statistically significant differences between men and women were found only for the two tertiary levels of education. The biggest differences, i.e. 3 per cent for men and 1.3 per cent for women, were found at the lower tertiary level of education. But, because of large standard errors, statistically significant differences between levels of education exist only between lower tertiary level and secondary level of education. These results hold both for all and for men, but not for women.[40] Thus, complementarity between education and training, as discussed by Brunello (2001), for example, is a relevant topic in the case of men, as measured by returns to training in a basic Mincerian model.

[40] From Appendix 5.2 it is possible to notice that also returns to different levels of education may differ by gender. But because this is not the focus of the thesis, I leave this topic here.

Figure 5.5. Returns to training by gender and level of education. Precentage to one course.



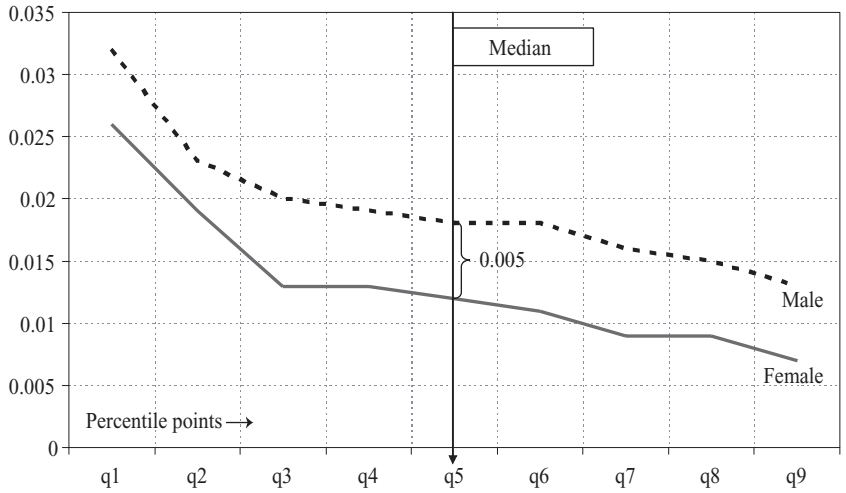

And finally, there is the question about the returns to training according to the wage level. But instead of return I call this the wage effect. It is because when modelling the relation of training on wages in subsets, where the life cycle perspective is questionable, it is better to talk about a wage effect in the subset than about returns over the life cycle. Basically, this interpretation of the concept of return also holds regarding all non-representative life cycle data sets, such as focusing on only the private sector. But my assessment from the literature is that this interpretation is not generally taken as a common rule.

The following estimates are based on pooled data, the size of which made it possible to create nine groups of equal size for both males and females. By means of the Simultaneous Quantile Regression, wage effects are estimated for each nine percentile points separately, allowing thus comparisons of wage effects between different points of wage distribution.[41] The results are shown in Figure 5.6, and the full set of results in Appendix 5.3.[42]

[41] Card (1994) asked, 'Is the labour force reasonably well described by a constant return to education for all workers?' The answers to this, such as Card (1999) and Martins and Pereira (2004), are critical or negative. But in the context of training, the answer is more ambiguous and model-dependent, as discussed by Chernozhukov and Hansen (2001).

[42] The software used is module SQREG in STATA 9.0.

Figure 5.6. Returns to training by gender and wage level. Coefficient estimates of Quantile regression.




The results indicate two differences in the wage effects. Firstly, there seems to be a difference between males and females at percentile points q3, q6 and q7. But at other points, including the difference of 0.5 per cent for the median wage-earner, the differences are statistically insignificant. This outcome is because of big standard errors, estimated using bootstrapping.[43] Second, there seems to be a difference between the high and low wage levels. The point estimates show three times higher wage effects for the lowest decile compared to the highest. The differences are statistically significant between the two lowest and the three highest deciles. This result holds for both sexes.

These results raise the question of training as a policy instrument for lowering wage inequalities. Wage-earners with low wages seem to benefit more from training. Thus, if more training is allocated to the low wage-earners, their wages might increase and the wage inequalities among wage-earners might decrease.

After looking at the data more closely, to discover what kind of people the low wage-earners actually were, I found wage-earners in uncertain labour market positions. Their working hours are less than average, their labour contracts are often fixed term, and they are very often young workers entering the labour force or workers returning to the labour force. Thus, among low wage-earners training could also bring other benefits than just

[43] It is by means of re-sampling observations with replacement. Here the number of replications is 100.

increases in hourly wages. Training could lead to more working hours, to more work experience, and, finally, to permanent work contracts. So it may be that part of the wage return reported to training is due to other factors, such as seniority in the present workplace and tenure in the present job.

I did not find any directly comparable results from the literature regarding the wage effect of training. But Arias et al. (2001) and Martins and Pereira (2004) have done comparable research regarding the wage effect of education. Martins and Pereira (ibid) have studied 16 countries, including Finland. Their results suggest that there is a positive correlation between returns to education and wages at each level of education, i.e. within-group wage inequality increases as education in that group increases, especially in tertiary education. Partly this might be due to unobservable characteristics, such as ability, but even in the absence of ability differences "this finding rings some alarm bells" from the wage ineqaulity point of view (Martins and Pereira, 2004, 367).

Contrary to this, the results of this chapter suggest that there is a negative correlation between returns to training and wages. Thus, if this result is to be verified in further research, policies designed to cut wage inequality should rather be based on training than education. But, as Chernozhukov and Hansen (2001), for example, have pointed out, this result is sensitive to the question how people are selected for training. This matter is discussed more in the next chapter.

## 5.4 Conclusions

In the literature, increasing learning opportunities across the life-course is frequently heralded as a means of reducing the gap between rich and poor. However, the proliferation of adult-education and training programs may also contribute to its increase, depending on the way of delivery. Therefore, schooling activity in the beginning of life cycle is a prerequisite for good results among adults. Without skill equalising activity at school age, it is difficult to decrease skill differences later. But, even if this prerequisite is fulfilled, there is the question of how to organise the allocation of training among wage-earners.

In Finland it is done through an education - training mix, where education is organised in institutions of the formal, degree-based system of adult education, and training as in-service training at workplaces or institutions of all kind, including institutions of the formal system of adult education. A rough rule of thumb is that degree-based adult education is

voluntary and paid for by the individual with the help of tax-financed subsidies. In-service training is paid for by the employers, either full or in co-operation with employment offices, for example.

The data show that in the 1990s a shift in the allocation of training took place, i.e. it was allocated more to those with low educational qualifications. I conclude that this change in training allocation is mainly due to changes within the "old" institutions, i.e. the system of formal, degree-based adult education and the informal, in-service training. But part of the change may also be due to the new institutions for training delivery, such as training for competence tests that became available in the middle of the 1990s. The data, however, do not allow division into two exact proportions, according which I could conclude which of the two has contributed more.

On these grounds, I constructed my study problem: What happens when the earnings function for the 1990s is expanded to include the lifetime stock of vocational training courses? The results show that 1) the return to training is positive and 2) the inclusion of training in the earnings function leads to substantial decreases in coefficient estimates for other human capital variables such as educational attainment and work experience. One or more training courses do not necessarily have any effect on the wage level, but more than 3 courses usually do, and more than 10 courses lead to returns that are far from marginal. After inclusion of training in the earnings function, the returns to formal education and work experience substantially decrease. In the lowest tertiary level of education the change is nearly -2 percentage points for each year of education. I conclude that this change reveals a substantial role for training in the wage setting at this specific level of education. Moreover, the inclusion of training decreases the returns to work experience as well, as it should, according to the human capital theory.

Next, by utilizing the class midpoints of the aggregated training indicators, I constructed a continuous training variable, making it possible to talk about returns to training in a that is comparable way with educational attainment. After replacing the training indicator variables by the number of training courses, the coefficient estimates for other human capital variables remained the same. Then I pooled the data and estimated the return to training for the whole decade. The results of this estimation form the main finding of this chapter: In the 1990s, the average return to one training course was 1.6 per cent, for which the 95 per cent confidence interval was 1.3 to 1.8 per cent.

Some support was also found for differences in returns to training across different dimensions. For example, the return to training at the secondary level of education was less than that at the lower tertiary level of education. Besides, at lower tertiary level, the returns for men exceed the returns for women. But because of large standard errors, most differences were statistically insignificant, in spite of considerable differences between point estimates. I conclude that the big standard errors are the price I had to pay for the approximate way of constructing the number of training courses by means of the class midpoints of the original information. But, on the other hand, big standard errors also hold without this approximation, i.e. when indicator variables are used.

Quantile Regressions by income deciles show that the wage effects of training were higher for the two lowest deciles than for the three highest deciles. Thus, focusing the training on the low wage-earners, holding other factors constant, wage inequalities might decrease. This is a theoretical possibility, the realization of which may depend, for example, on success in basic vocational education and even before that. It is a question of further research to verify these results. But if this really is the true correlation between returns to training and wage-levels, the prospects of training as an policy variable for decreasing wage inequalities look interesting.

These results arise from the models used, basically from Mincer's (1974) statistical earnings function. The models are consistent with the theory of human capital, but open to certain criticism, such as selection for training. As this chapter concerned the period 1990 – 2000, and the 1990 data were more limited, it was impossible to control selection for training. But, potentially even larger problem is the due specification of the relationship between formal education, informal training and work experience. More and better data about these three key human capital variables is needed for the proper estimation of the earnings function. This claim also holds regarding the workings of the labour markets institutions, especially when the delivery of learning opportunities is discussed, i.e. when the selection for training modelled.

# 6. Returns to training in a modified life cycle model

In this chapter, the standard Mincerian earnings function is modified in three ways. Firstly, potential years used for education and work experience are replaced by self-reported years in education and at work, allowing for individual differences in years of education and work experience. Secondly, the question of ability bias is tackled by measuring an individual's ability by how fast he or she has reached his or her level of education compared to others. Thirdly, two selection processes are taken into account, namely selection for work and selection for training. The model specified in this way is then used to estimate the wage return to education and training over the life cycle. Attention is given to returns to training by gender and the sector of economy, which, according to the literature, may differ.

## 6.1 Model modification

The theoretical framework of the work holds. It is the human capital theory of wage growth over the life cycle, as developed by Mincer (1958, 1962, 1974), Ben-Porath (1967) and Becker (1964, 1975). It forms the basis for economic returns to education, emphasizing the role of human capital acquired in formal education and training on the job. However, the question of "true" returns, as discussed by Griliches (1977, 1979), Rosen (1977), Jovanovic (1979a, 1979b, 1984), Mincer and Jovanovic (1981), Mortenson (1986), Mincer (1988, 1994), Card (1995, 1999, 2001), and Wolpin (2003), has led to criticism and competing specifications of wage growth. But instead of more complicated models, Asplund (2000), for example, suggests return back to the basics.

In the surveys by Belzil (2004, 2005), Rubinstein and Weiss (2006), and Heckman et al. (2006), these "specification issues" are discussed in detail. From the viewpoint of this chapter, three issues are relevant, i.e. separability, linearity and heterogeneity. Separability between the wage effects of education and other human capital variables is my starting

point and includes a new identity for lifetime activity. On these grounds, I challenge non-linearity, where wage returns increase with the level of education, as was the case in the previous chapter of this thesis. Then, I focus on heterogeneity, where wage returns may vary by gender and the sector of economy, when ability is controlled for.

Including individual differences in the earnings function is a conceptual, econometric and a data availability issue. But, there have certainly been many efforts to do so. Specifying Mincer's equation in a way that takes into account the differences between individuals has been one of the most popular research subjects of applied economics. The state of the art is surveyed in papers by Heckman et al. (2003), Lemieux (2003) and Belzil (2004). But still the question of separability, defined as above, has seldom been used as a way to take into account aspects of individual differences.

The purpose of this chapter is not to solve the problem of "true" returns, but to update Mincer's (1974) earnings function in a way that addresses some of the criticism of the standard approach, and allows for a more appropriate estimation of the returns to education and training, as compared to all other human capital variables included in the model. In the model, education is treated as exogenous. This is because I want to proceed in the spirit of Mincer's earnings function, which, even according to its critics, such as Card (1999, 1809), is "a natural starting point for building more complex models of earnings determination".

### *6.1.1 Modifying the identity of lifetime activity*

The starting point for the examination is Mincer's (1974) statistical earnings function

$$\ln y_i = \beta_0 + \beta_1 s_i + \beta_2 x_i + \beta_3 x_i^2 + u\,, \qquad (1)$$

where $s$ is years of education, $x$ and $x^2$ are years of work experience and its square, and $i$ refers to individuals. In the earnings function, years of education measures the amount of schooling acquired at a young age, and years of work experience is a measure of the amount of on-the-job training acquired after moving to working life.

Years of education and work experience form an identity according to which *years of work = age – years of education – 7*, where 7 is the school starting age. This identity is also

known as multiplicative separability proposed by Mincer (1958). In Mincer's identity, we only need data on potential years of education, and the rest is subtraction. Years of education are typically determined rather roughly and equally for everyone depending on his or her level of education. For example, in Finland for every person with upper tertiary level education, the years of education are 18 years, with no deviations from the norm. Years of work experience are also counted as potential years, i.e. absences from work are not allowed for.

In assessing Mincer's earnings function, Chiswick (2003) presents its formal and straightforward application as a problem, leaving aside the origins of the earnings function. He mentions potential years of education and work experience, and refers to the possibility of replacing them with actual or otherwise altered data. But, so far this idea has been poorly utilized in the empirical literature, although the idea of using self-reported data is not a new one. As a measurement error it is noted by Griliches (1977, 1979) and discussed by Card (1999). According to Card (ibid), research over the past decades has generally found that the reliability of self-reported schooling is about 90 per cent.

The data in this chapter contains self-reported years of education and work, making it possible to define a new term, *years of leisure = age – years of work – years of education - 7*, the school starting age. It is also possible to allow for differences between individuals with respect to the pace of studies. If someone has reached his or her level of education faster than others, that someone is assessed as being more able. Thus, instead of two quite average factors, potential years of education and work experience, we get four individual factors, actual years of education and work experience, years of leisure and ability.

### *6.1.2 Measuring the ability bias*

The question of ability bias is a severe econometric problem. According to Griliches (1977), let us assume that the earnings function to be estimated is of the form

$$\ln y_i = \alpha + \beta S_i + \varepsilon \,, \tag{2}$$

where $S_i$ stands for the education an individual $i$ has acquired. On the other hand we know that the "real equation" is

$$\ln y_i = \alpha + \beta S_i + \gamma A_i + \varepsilon_i \tag{3}$$

where $A_i$ refers to the individual's unobserved ability. Then the probability limit for the OLS estimate of β using (2) is

$$p \lim \hat{\beta} = \beta + \gamma \frac{Cov(S_i, A_i)}{Var(S_i)}, \quad (4)$$

If ability has a positive effect on wages independent of education ($\gamma > 0$), and if the correlation of education and ability is positive, then the coefficient for education $\hat{\beta}$ is overestimated in the ordinary least squares regression.

Card (1999) has summarised numerous methods – instrument variables, control functions, family background variables and models based on twin pairs – that can mitigate the "ability bias". Unfortunately, the data of this study does not include such variables that would allow us to model education separately, i.e. endogenously, by means of instrumental variables, IV estimation. However, another set of possibilities is provided through the modification of Mincer's identity of lifetime activity, as described above.

Thus, if somebody completes his or her upper tertiary level education in 16 years, while the mean is 18, he or she is more able at least at studying, and the deviation from mean study years could be used as an instrument for ability, as Groot and Oosterbeek (1994) and Skalli (2001) have used.[44] But in contrast to Skalli (ibid), the source of ability is seen more widely. Studying faster than others does not necessarily signify the presence of greater innate ability, but can also be a learned quality such as perseverance, time preference or[45] self-control, as emphasized by Bowles and Gintis (1976) and Edwards (1976).

When taking this position, I admit that the question of innate or acquired abilities and their relation is difficult. And so is the question about the nature of ability, i.e. is it verbal, numeric, spatial or some other kind of ability? Addressing such questions is usually not part of economists' education, and pretending to be a specialist is to be avoided. Therefore, I conclude that the ability in this chapter is general in nature, including innate and acquired aspects of ability.

[44] Their focus, however, is elsewhere, i.e. in testing Arrow's (1973) screening hypothesis.

[45] According to Fuchs (1982), those with high time preference are future orientated and get a lot of education. Their discount rate for the future is therefore smaller than for others.

*6.1.3 Including the selection correction*

The question of selection bias is another widely discussed problem. One solution to this problem is the two-step estimator presented by Heckman (1979). Using matrix notation, we write that the latent variable $L^* = G\tau + e$ , for which $L^* > 0$ when the respondent is employed. Then, in the first step, the probability of working is

$$P = \Pr(D = 1 \mid G) = \Pr(e > -G\tau) = F(G\tau) , \tag{6}$$

where D indicates employment ($D = 1$ if the respondent is employed and $D = 0$ otherwise), $G$ is a vector of explanatory variables, $\tau$ is a vector of unknown parameters, $F$ is the cumulative distribution function of the standard normal distribution and $e$ is the error tem to which $E(e) = 0$ . Estimation of the model yields results that can be used to predict this probability for each individual. The goodness of prediction depends on the data, namely on the available explanatory variables $G$.

In the second-step, the researcher corrects for selection for positive wages by incorporating a transformation of these predicted individual probabilities as an additional explanatory variable in the wage equation, such as

$$\ln y^* = X\beta + u . \tag{7}$$

Here $y^*$ denotes an underlying wage offer, which is not observed if the respondent does not work. The conditional expectation of wages, given the person works, is then

$$E(\ln y^* \mid L^* > 0) = X\beta + E(u \mid e > -G\tau) . \tag{8}$$

Under the assumption that the error terms $e$ and $u$ are jointly normal, we can write

$$E(u \mid e > -G\tau) = \sigma_{ue} f(G\tau)/\mathrm{F}(G\tau) = \sigma_{ue} M . \tag{9}$$

where $M$ is the necessary correction term, the inverse Mills' ratio, the relation between density and cumulative density function of fitted values of the probit model. $\sigma_{ue}$ is the correlation for the two error terms $e$ and $u$.

Heckman (1979) has showed that if one includes this correction term in the final wage model (7), i.e. in the second-step, the parameters of the model can then be consistently estimated by OLS. And in spite of criticism, such as that from Puhani (2000), Goldberger (1984) and Newey et al. (1990), this selection correction procedure has since been almost like a standard procedure in labour economics, as Heckman et al. (2003, 2006) have reported.

My aim is to apply this correction procedure to two selection processes, selection for the positive wages and the positive number of training courses. The first mentioned is just the same procedure above, applied widely in labour economics. According to the literature, selection for positive wages depends basically on a set of socio-economic background variables, other financial resources but wages, and educational attainment. Selection for positive wages follows the same principle, but is another matter, and needs some further clarification.

In the literature, there are also good reasons for degree-based education to be treated as endogenous, a good example being Uusitalo's (1999) study with Finnish data. But, in addition to theoretical reasoning, there are also other reasons for drawing a line regarding endogeneity somewhere, and in this study it is between training and degree-based education. Here it is assumed that training is endogenous, i.e. training is the part of education, with which an individual can complement his or her exogenous, degree-based education, and to become fully qualified in his or her job. In my interpretation, this is a very truthful description of the reality, depicted in section 3.2.

The final argument for this division arises from the data. To model more than two selection processes from the available data brings severe modelling problems, such as multicollinearity, which could easily distort the given research problem. Hence degree-based education is here taken as exogenous, but selection for a positive number of training courses basically depends on the person's educational attainment and labour market position.

According to human capital theorists like Becker (1964, 1975), "capital depreciation" is the faster the more time schooling takes. Therefore, the need for training should be higher for those with tertiary level education than for those with primary level education. This conclusion stands, regardless of whether the training is the individual's own choice or determined by changes in production lines or choices made by the employer. In addition, the modelling should include variables that reflect wage-earners' labour market position, such as occupational groups, as suggested, for example, by Willis (1986). Thus, when

modelling selection for training courses, all these factors should be included in the explanation, but in the limits of the available data.

The fact that in-service training in Finland is paid for by the employer makes it very different compared to the Anglo-American on-the-job training, which is paid for by the worker, as assumed in Mincer's (1974) earnings function. In Finland, the supply of in-service training is also a question of co-operation, as described in Section 2.2. According to regulations, the need of in-service training for the next year is to be clarified in co-operation between employers and employees, and the training measures needed should be recorded in a training plan. Unfortunately, the data do not reveal to what extent this co-operation actually takes place. But from other sources we know that establishment size matters.[46]

Moreover, the role of training in wage formation may depend on the organisation of work. The above characterised co-operation procedure was started in processing industries, reflecting the needs of Taylorist work organisation with detailed task specialisation and hierarchic organisation structures, as defined by Friesen (2005). But basically the needs of production may vary between the three sectors of economy, i.e. processing industries, private services and public services. In the literature, the public sector is often seen as incompatible with the assumption of a competitive market. But, the quasi-market orientation of the public sector, as defined by Le Grand (2003), for example, justifies estimation for public sector as well. Also Friesen (ibid) underlines the tendency of diminishing differences between sectors of economy.

## 6.2 Data

Table 6.1 reports the sample persons' characteristics by their labour market position and gender. The whole data set with 3110 observations is needed for the first step, i.e. for modelling the selection processes for positive wages and training courses. The set of wage-earners, consisting of 1755 observations, is needed for the second-step, i.e. for modelling the wage returns. In addition, wage-earners are divided into females and males with 874 and 881 observations. All those who were not defined as wage-earners were dropped from the wage estimation, including persons whose labour market position was close to

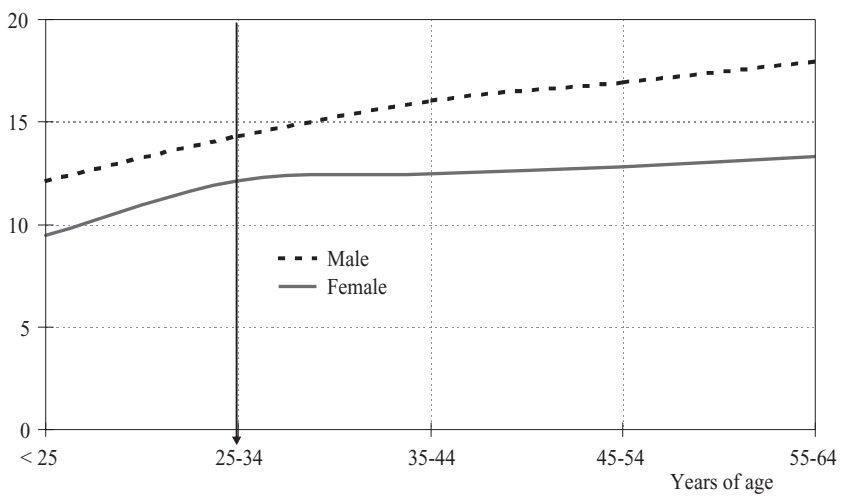
[46] In establishments with at least 30 workers, the actual domain of the Co-operation Act within Undertakings (725/1978), co-operation applies to around 60 per cent of establishments. For all establishments, the share is less than 50 per cent. The estimates come from the shop steward inquiries that I have made for SAK, The Central Organisation of Finnish Trade Unions. In English, see: http://netti.sak.fi/sak/englanti/articles/archive/future.htm (December 2008).

being a wage-earner, such as some groups of self-employed persons who, according to Chiswick (2003), should possibly be included.[47]

From the original data set of 3422 sample persons, I had to drop 312 persons. This is because training was asked only of those who had at least some work experience and those 312 persons had none, either because they were still being educated or because of other reasons, such as restrictions in working ability. On these grounds it was possible to determine a large part of the variables for both of the groups, 18–64 -year-old sample persons and its subset of wage-earners. Some variables, such as the form of employment and establishment size, were only asked of the wage-earners.

The dependent variable, gross hourly wages, was induced from annual wage earnings in the year 2000. They were given in Finnish marks, but then converted to euros. In Figure 6.1, age – wage profiles are shown by gender. According to the figure, the age – wage relation is nearly linear for both males and females. The only clear deviation from linearity takes places when women cross the age of 25–34 years. At that point, in the end of prolonged labour market transition and family formation, the age – wage curve bends a bit. For

Figure 6.1. Age-gross hourly wages by gender, €.




[47] In my interpretation, even the wage-earners might be a too general class, since they may include trainers ending their degrees. They may have a status of a wage-earner, but actually they work without pay or with a nominal compensation not comparable with that of a wage-earner. This possibility came in public through a TV-program in October of 2009. My attempts to verify the extent of this problem failed. However, this possibility was not denied by the authorities.

men's curve a similar kind but smaller bending takes place ten years later, at the age of 35–44 years. It is also worth of noticing that the wage difference between men and women increases with age. At the age of 35–44 years, "a woman's euro" is 85 cents, at the age of 55–64 years it is 74 cents. Thus, it is also possible to argue that wage discrimination between men and women increases with age.

The linearity of age – wage curves is not quite exceptional compared with some other datasets examined by Rubinstein and Weiss (2006). In their datasets, most of them from the US, the age-wage profile is quite linear after about 10 years of potential work experience, after the age of 30 plus. Before that, at least for annual wages, the relationship is concave. But in the case of gross hourly wages, linearity is also quite often to be seen among the young as well.

In Table 6.1, full-time education and work experience years are measured in terms of actual years, obtained by asking the sample persons directly. Stated in this way, the wage-earners' average actual years of education are 12.9 years for all, 13.1 for females and 12.6 for males. Correspondingly, the actual work experience years for all wage-earners are 19.6 years, 19.3 for females and 19.9 for males. Finally, by subtracting years of education and work from age (less the school starting age), we get a new term, namely leisure. It is the remainder years out of education and work. For females, the average of leisure is 1.6 and for males 0.5 years.

From these data it was also possible to build an instrument for ability, namely a measure of how much faster or slower than the average the sample persons passed their level of education. These ability differences are calculated from the whole sample, including those who are not wage-earners. Therefore, the mean ability for wage-earners is not exactly zero, but very close to it. Differences, however, can exist between individuals and between different subsets, as one can see from the standard deviations. For example, some minor differences in ability measurement exist between age groups.[48]

[48] Older sample persons have usually taken their degree courses faster than younger persons at least for two reasons. One is the scope of the degrees taken, for instance, 20 years ago and now. The second is the increased occupational uncertainty, which makes students change their curriculum more often than 20 years ago.

Table 6.1. Data.

| *Variables* | *Statistic* | *ALL* | *Wage earners* | *Females* | *Males* |
|---|---|---|---|---|---|
| *Continuous variables* | | | | | |
| Hourly wages, € in 2000 | Mean | - | 14.1 | 12.4 | 15.8 |
| | Std. Dev. | - | 8.5 | 6.8 | 9.7 |
| Other annual income, 1000 € | Mean | 0.9 | 0.4 | 0.3 | 0.5 |
| | Std. Dev. | 6.3 | 4.1 | 1.0 | 5.7 |
| Years of age | Mean | 42.5 | 40.5 | 41.1 | 40.0 |
| | Std. Dev. | 11.9 | 10.4 | 10.3 | 10.4 |
| Years of education | Mean | 12.3 | 12.9 | 13.1 | 12.6 |
| | Std. Dev. | 3.4 | 3.3 | 3.3 | 3.4 |
| Establishment size/100 | Mean | - | 1.7 | 1.6 | 1.8 |
| | Std. Dev. | - | 3.1 | 3.1 | 3.1 |
| Years with other employers | Mean | - | 9.2 | 8.7 | 9.6 |
| | Std. Dev. | - | 8.9 | 8.2 | 9.6 |
| Years in other tasks with the present employer | Mean | - | 3.5 | 3.4 | 3.5 |
| | Std. Dev. | - | 6.5 | 6.4 | 6.5 |
| Years in present tasks with the present employer | Mean | - | 7.0 | 7.2 | 6.8 |
| | Std. Dev. | - | 7.6 | 7.6 | 7.7 |
| Years of leisure | Mean | 2.7 | 1.0 | 1.6 | 0.5 |
| | Std. Dev. | 5.8 | 3.8 | 4.5 | 2.9 |
| Ability | Mean | 0.0 | -0.1 | -0.2 | 0.1 |
| | Std. Dev. | 2.0 | 1.9 | 2.0 | 1.9 |
| Number of training courses | Mean | 8.1 | 9.4 | 9.8 | 8.9 |
| | Std. Dev. | 6.1 | 5.8 | 5.7 | 5.9 |
| Number of children | Mean | 0.7 | 0.8 | 0.8 | 0.8 |
| | Std. Dev. | 1.1 | 1.0 | 1.1 | 1.0 |
| *Indicator variables* | | | | | |
| Hourly wages > 0 | | 0.68 | 1.00 | 1.00 | 1.00 |
| Training courses > 0 | | 0.85 | 0.92 | 0.93 | 0.90 |
| Male | | 0.51 | 0.50 | 0.00 | 1.00 |
| Spouse | | 0.71 | 0.74 | 0.73 | 0.75 |
| Uusimaa area | | 0.26 | 0.32 | 0.33 | 0.30 |
| Processing industries | | - | 0.26 | 0.12 | 0.40 |
| Private services | | - | 0.34 | 0.36 | 0.33 |
| Public services | | - | 0.35 | 0.50 | 0.20 |
| Secondary level education | | 0.42 | 0.42 | 0.40 | 0.43 |
| Tertiary level education | | 0.32 | 0.39 | 0.43 | 0.35 |
| *Occupational groups** | | | | | |
| 1. Legislators, senior officials and managers | | 0.08 | 0.08 | 0.04 | 0.11 |
| 2. Professionals | | 0.16 | 0.23 | 0.27 | 0.20 |
| 3. Technicians and associate professionals | | 0.12 | 0.18 | 0.21 | 0.14 |
| 4. Clerks | | 0.06 | 0.09 | 0.15 | 0.03 |
| 5. Service and care workers | | 0.08 | 0.11 | 0.17 | 0.05 |
| 6. Skilled agricultural and fishery workers | | 0.05 | 0.01 | 0.01 | 0.02 |
| 7. Craft and related trades workers | | 0.11 | 0.13 | 0.03 | 0.24 |
| 8. Plant and machine operators and assemblers | | 0.07 | 0.09 | 0.04 | 0.15 |
| 9. Elementary occupations | | 0.06 | 0.07 | 0.08 | 0.07 |
| Number of observations | | 3110 | 1755 | 874 | 881 |

* See the principles of ISCO88, International Standard Classification of Occupations (ILO, 1990). The classification includes 1) skill level and 2) skill specialisation, where skill level is closely connected to the levels of ISCED, International Standard Classification of Education (UNESCO, 1976).

Figure 6.2. Distribution of ability in studies by gender. Smoothed fit to relative frequency.

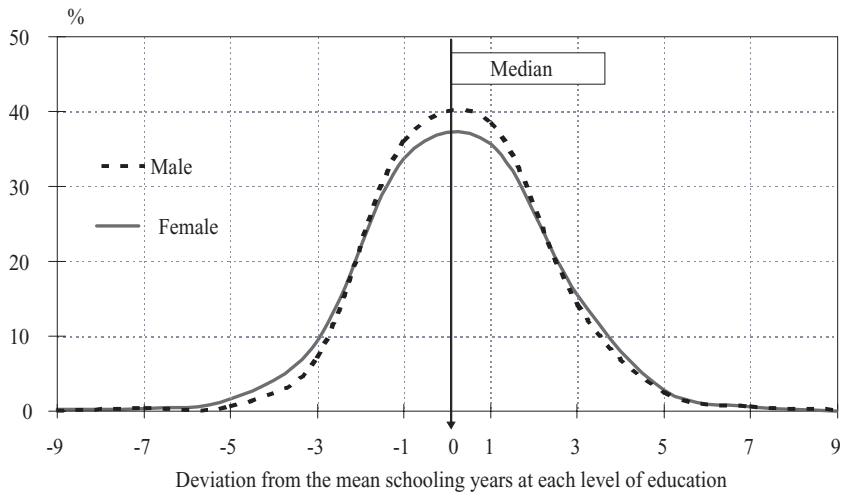
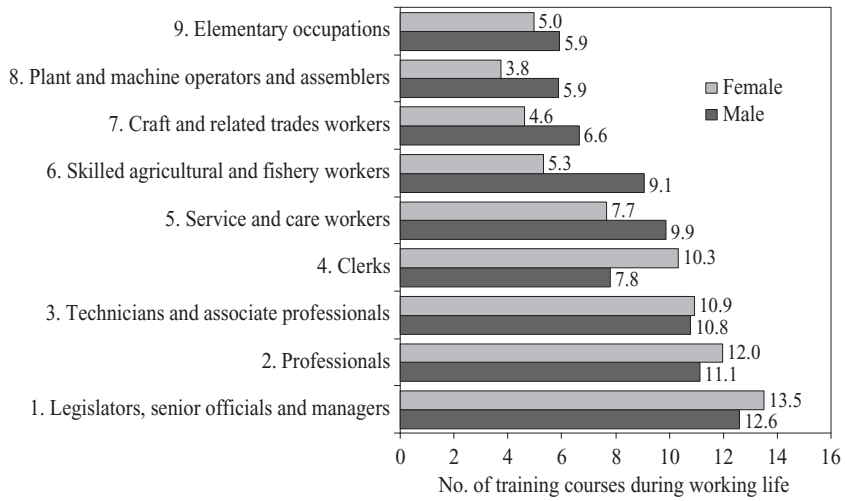



Figure 6.3. Number of training courses by gender and occupation.




As depicted in Figure 6.2, for around 40 per cent of wage-earners, the deviation from the mean study years at the given level of education is within the interval [-1, 1]. Thus, for around 60 per cent of wage-earners, the deviation from the mean is more than one year. For around 25 per cent it is at least 3 years in either direction, and even bigger deviations exist, as we can see from the figure, and as we all know from our own experience and observations. What is interesting, though not necessarily scientific by measurement, is

that the curves look very similar to the normal Bell curves for intelligence, i.e. for two thirds the ability is in the range of [-2, 2], where 2 is the standard deviation.[49] Thus, the ability measurement of this study produces the same statistical features as the generally used intelligence measurements. In addition, this ability measurement really makes a difference to the typically made assumption in human capital literature that all degrees are obtained in the norm time independent of students' abilities.

The data also include a set of indicator variables that are needed for modelling the selection for positive wages and the positive number of training courses, i.e. for those 68 per cent who had reported some earnings in year 2000 and those 85 per cent who had received training during their working history. An important subset indicates different occupational groups. This is because the training intensity is related to occupations, i.e. where the share of occupation-related human capital is large, there the need for training is large, and the other way round. In the first-step estimations, these occupational groups are compared to the 22 per cent control group with no established occupation, which consists of those with precarious or temporary work.[50]

The distribution of training over occupational groups is depicted in Figure 6.3, from which it is easy to see that some occupations are more training intensive than others. In highly professional groups, such as legislators, senior officials and managers, and other professionals, the average number of accumulated training courses is more than 10. Then there is the middle group of clerks and service workers with 8–10 courses. And finally, there are other skilled and unskilled workers with 5–7 courses on average. By participation rate, a very similar distribution for Sweden is presented by Ericson (2005).

The position of females compared to that of males is better in the professional groups and worse in the less skilled groups. Other background variables can affect these differences too. One such is the geographic area, since training-intensive professional groups are over-represented in the Uusimaa area, around the capital, Helsinki. But most important is to see that this classification of occupations correlates with educational attainment, i.e. occupational classification includes 4 skill-levels quite comparable with levels of educational attainment. Thus, in modelling the selection for training, one has

[49] A set of Bell curves at the address http://images.google.fi/images?q=bell+curve (June, 2009).

[50] According to data, with certain reservations, most of these people were non-unionised wage-earners.

to choose between educational attainment and occupational structure in order to avoid multicollinearity.

Finally, the data depicts years of work experience divided into three successive segments: years with other employers, years in other tasks with the present employer, and years in present tasks with the present employer. This division of work experience reflects the discussion of seniority, measured as years with the present employer, and tenure, measured as years in the present job with the present employer. And for reasons of comparison, the years with other employers are included. If wage premiums for seniority or tenure exist, those premiums should be seen in coefficient estimates of the earnings function. Unfortunately, the data do not include information on the number of jobs over the life cycle, which, according to Bingley and Westergaard-Nielsen (2006), could significantly affect wages, independent of the years in the jobs.

In Figures 6.4a and 6.4b, the key human capital variables are presented by gender and age. The figures show that years of education are more numerous for females and younger age groups. The education of those less than 25 years of age is still partly unfinished, and therefore their educational attainment is not fully comparable with the other groups. In contrast to education, work experience increases almost linearly with age, depending, however, to some extent on the nature of the work experience.

Work experience with other employers increases linearly up to 45 years of age, and then almost stops. The difference between sexes starts to grow in the prime working age, after 35 years of age. In the highest age group before pension age, the difference is 3.1 years, 16.4 years for males and 13.3 years for females. In other work experience, the differences between men and women are smaller. In the highest age group, the average experience in other tasks with the present employer is 7.1 years for males and 6 years for females. The corresponding average experience in present tasks with the present employer is 14.7 years for males and 15.2 years for females. The biggest difference between men and women, 3 years in the highest age group, is in years of leisure.[51] One probable reason for this is the use of parental leaves, which are still allocated mainly for women.

[51] For 35 to 44 year-old-males, leisure is almost zero. According to this, men born between 1956 and 65 had almost totally dedicated their time to education and work. This may be partly estimative, but on the other hand, the 1980s, when this age cohort entered the labour force, was the era of steady-state growth with exceptionally low unemployment.

Figure 6.4a. Human capital over the life cycles, males. Years and training periods.

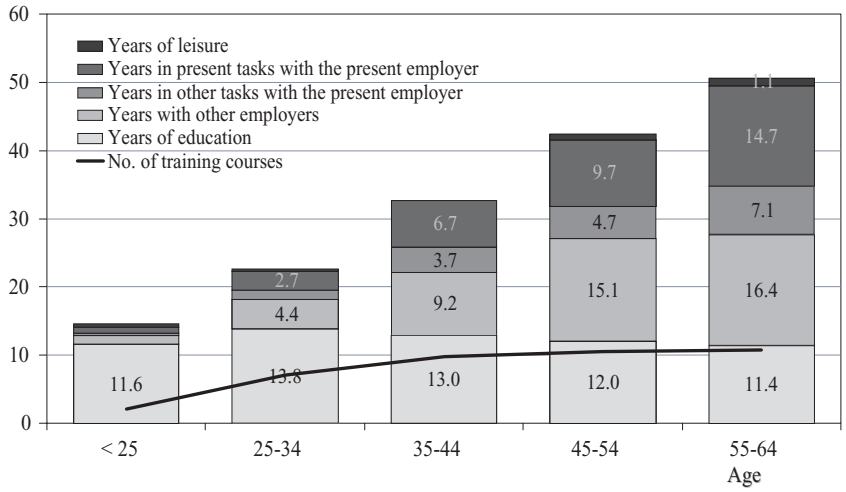
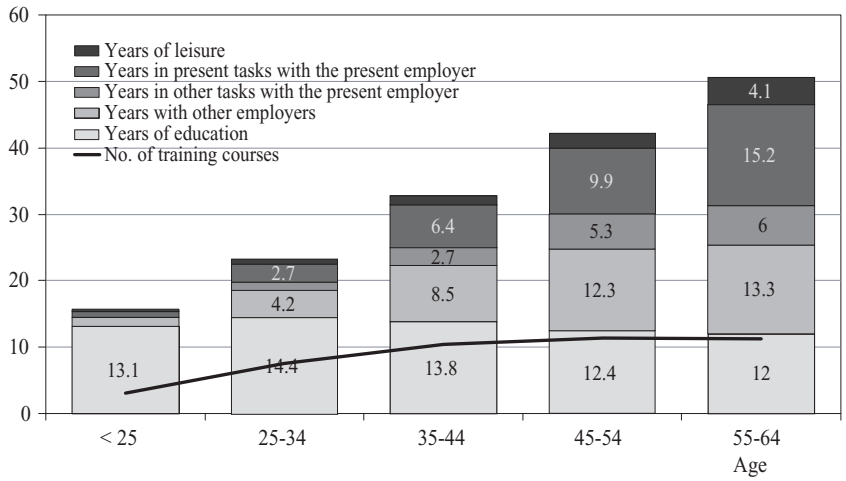



Figure 6.4b. Human capital over the life cycles, females. Years and training periods.




The number of training courses was refined from the classified data by replacing class ranges with the class midpoints. This kind of estimation is far from exact, but very similar to the method used by Mincer (1974) when transforming levels of education to years of education. The number of training courses approximated in this way is 9.8 courses for women and 8.9 courses for men.[52] The cumulative number of training courses increases

[52] Zero times and once had their own groups in the questionnaire, and hence did not need to be estimated. 2–3 times was replaced by the value of 2.5, 4-10 by the value of 7 and over 10 times by the value of 15.

steadily up to the age group 35–44, but not much after that. The focus is on the young before prime working age.

Unfortunately, the exact content of the training courses remains unknown, i.e. the exact division into in-service training and other forms of training is not possible. But from the Adult Education Surveys of the 1990s it can be estimated that around 90 per cent of the training instances and around two thirds of the training days are in-service training, paid for by the employer. The rest is mainly voluntary vocational education in educational institutions, paid for by the worker. Thus, training in this chapter also includes some parts of formal education, i.e. degree-based education. But its share is so small that the concept of training, in general, is justified.

## 6.3 Selection for positive wages and training

For my first step I modelled the two selection processes characterized above, namely selection for positive hourly wages and selection for a positive number of training courses. Selection for the two states is allowed to be correlated in a way that the processes are estimated using a seemingly unrelated bivariate probit model.[53] The results, for men and women separately and jointly, are shown in Table 6.2, according to which the two selection processes produce around the same results for men and women.

In model 1, selection for positive wages, all independent variables have at least some effect. Surprisingly, in this sample, the probability of males' working is less than that of females'.[54] The other effects are more in line with expectations, and those by Kuismanen (2000) for hours worked. As age increases, the probability for positive wages increases, but a decreasing rate. In the Uusimaa area, working is much more probable than elsewhere. The number of children and other yearly income decrease the probability of working, especially in the case of women. Having a spouse seems to favour working for men, but

[53] See module BIPROBIT in the STATA 9.0 user's manual. BIPROBIT fits maximum-likelihood two-equation probit models, either a bivariate probit or a seemingly unrelated probit.

[54] In the data, the proportion of positive wages was 68.5 % for both men and women, estimated of the annual wages of 2000. In 2000, the employment rate for men was 4 percentage points higher, including the self-employed.

not for women. Years of leisure decrease working probability for both men and women.[55] The effect of educational attainment on working is somewhat complicated. In the whole sample, the effect of tertiary level education is positive compared with the primary level of education. But for females this effect is statistically insignificant. Moreover, secondary level compared with primary level is insignificant for both sexes.

In model 2, selection for training, all other variables but occupational status and age were excluded. This was for two reasons. First, because occupations include information about the level of education, the role of which is underlined by Brunello (2001), as well as some other information, such as gender and living in the Uusimaa area.[56] Second, occupations, i.e. the nature of the work, and age are the two key factors underlined in the co-operation regulations within establishments when assessing the need for training. Therefore, in my interpretation, occupational groups are also to be used as a proxy for the unobserved co-operation procedures, underlining adaptation to changes by personnel groups, in assessing the need for training.

And when it comes to results in Table 6.2, the nature of work matters when age is controlled for. Wage-earners in the first 5 occupational groups, i.e. legislators, senior officers, managers, professionals, technicians, associate professionals and clerks, are much more likely to be trained than people with no established occupational status. To some extent training is also more likely for service and care workers, but not for other workers used, for example, in processing industries. These results hold for both males and females.

[55] One possible reason for this is state-dependency, i.e. being long out of work and having long left school makes it difficult to return to work, as in the case of unemployment analyzed, for example, by Darity and Goldsmith (1993).

[56] Occupational segregation by gender is a problem for Finland often reported by the EU Commission's employment report. But, one could as well report the problem for occupational segregation by area, since the Uusimaa area absorbs around half of the professional work of Finland.

Table 6.2. Bivariate probit models for positive wages and training.

| *Models / variables* | *ALL* | | *FEMALES* | | *MALES* | |
|---|---|---|---|---|---|---|
| | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| *Model 1: Hourly wages > 0* | | | | | | |
| Male | -0,136** | 0,053 | | | | |
| Spouse | 0,216** | 0,061 | 0,027 | 0,090 | 0,301** | 0,091 |
| Uusimaa area | 0,355** | 0,063 | 0,403** | 0,093 | 0,297** | 0,089 |
| Age | 0,145** | 0,016 | 0,165** | 0,025 | 0,109** | 0,023 |
| Age squared/100 | -0,207** | 0,019 | -0,219** | 0,030 | -0,171** | 0,028 |
| Number of children | -0,136** | 0,029 | -0,164** | 0,040 | -0,100* | 0,043 |
| Other yearly income, 1000 € | -0,009 | 0,006 | -0,208** | 0,063 | -0,007 | 0,005 |
| Secondary level education | 0,080 | 0,066 | 0,098 | 0,099 | 0,023 | 0,091 |
| Higher level education | 0,228** | 0,073 | 0,179 | 0,110 | 0,324** | 0,104 |
| Years of leisure | -0,059** | 0,006 | -0,047** | 0,007 | -0,083** | 0,010 |
| Constant | -1,561** | 0,314 | -1,905** | 0,469 | -0,882 | 0,457 |
| *Model 2: Training courses > 0* | | | | | | |
| Male | 0,054 | 0,065 | | | | |
| Age | 0,124** | 0,018 | 0,146** | 0,025 | 0,101** | 0,025 |
| Age squared/100 | -0,126** | 0,021 | -0,150** | 0,030 | -0,099** | 0,030 |
| 1. Legislators, senior off. & manag. | 0,694** | 0,143 | 0,444* | 0,222 | 0,862** | 0,185 |
| 2. Professionals | 0,948** | 0,122 | 1,013** | 0,161 | 0,911** | 0,184 |
| 3. Technicians & ass. professionals | 0,830** | 0,125 | 0,825** | 0,162 | 0,873** | 0,194 |
| 4. Clerks | 0,827** | 0,176 | 0,838** | 0,203 | 0,802* | 0,377 |
| 5. Service & care workers | 0,460** | 0,128 | 0,436** | 0,147 | 0,592* | 0,271 |
| 6. Skilled agricult. & fishery wkers | 0,133 | 0,137 | -0,082 | 0,224 | 0,297 | 0,179 |
| 7. Craft & related trades workers | 0,183 | 0,114 | 0,408 | 0,292 | 0,194 | 0,140 |
| 8. Plant & mach. operat.& assem. | 0,053 | 0,126 | 0,097 | 0,235 | 0,060 | 0,159 |
| 9. Elementary occupations | -0,057 | 0,128 | -0,118 | 0,174 | 0,039 | 0,188 |
| Constant | -2,107** | 0,326 | -2,533** | 0,473 | -1,625** | 0,446 |
| Number of observations | 3110 | | 1529 | | 1581 | |
| Wald chi2(k) | 823,6 | | 451,3 | | 421,6 | |
| Prob > chi2 | 0,000 | | 0,000 | | 0,000 | |

Robust standard errors, * and ** are statistically significant coefficients at the level of 0.05 and 0.01

## 6.4 Wage returns to education and training

### *6.4.1 Some specifications of the standard model*

Before the second-step, the estimation of the selection-corrected wage model, I investigate four different specifications of Mincer's earnings function, where workers' gross hourly wages are explained through the use of education and work experience years (see Table 6.3). The idea is to examine how the coefficients of education and work experience years, the key variables of Mincer's earnings function, change as the specification changes. In

Model 1, education and work experience years are defined as Mincer (1974) did, as years of education, years of work experience and its square. Model 2 includes the number of training courses over the working life. Model 3 includes the measure of ability, defined as above. Model 4 is with ability but without training.

In Model 1, the return to one year of education is 5.2 per cent and to one year of work experience 1.7 per cent. But, "surprisingly", the coefficient of the squared work experience is statistically insignificant, which is not typical in the literature on Mincerian earnings functions. In the typical case the squared work experience is negative, reflecting the concave profile of the typical age – yearly earnings profile. But as Figure 6.1 depicts, the age – gross hourly wage profile is almost linear. Thus, it follows that the coefficient of squared work experience should be close to zero, as it is.

In Model 2 with training, the coefficients for years of education and work experience decrease, and especially so in the case of work experience. This is in part because of a positive correlation between the above-mentioned variables, and especially between the number of training courses and years of work experience. Thus, when the number of training courses is included, the return to one working year is 0.8 per cent, i.e. around half of the size of Model 1. Moreover, the return to a year of education decreases from 5.2 per cent to 4.2 per cent.

Table 6.3. Four OLS specifications of Mincer's earnings function.

| *Dep.:* *log hourly wage* | *Model 1* *Coef.* | *Std.Er.* | *Model 2* *Coef.* | *Std. Er.* | *Model 3* *Coef.* | *Std. Er.* | *Model 4* *Coef.* | *Std. Er.* |
|---|---|---|---|---|---|---|---|---|
| *Independent:* | | | | | | | | |
| Male | 0.235** | 0.020 | 0.243** | 0.020 | 0.235** | 0.020 | 0.227** | 0.020 |
| Years of education | 0.052** | 0.004 | 0.042** | 0.004 | 0.054** | 0.005 | 0.064** | 0.004 |
| Years of work | 0.017* | 0.004 | 0.008* | 0.004 | 0.007 | 0.004 | 0.015** | 0.004 |
| Previous squared | -0.002 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | -0.001 | 0.001 |
| Training courses | | | 0.015** | 0.002 | 0.014** | 0.002 | | |
| Ability | | | | | 0.038** | 0.006 | 0.042** | 0.007 |
| Constant | 1.488** | 0.065 | 1.587** | 0.064 | 1.464** | 0.069 | 1.361** | 0.069 |
| Number of obs. | 1755 | | 1755 | | 1755 | | 1755 | |
| F(k, n-k) | 81.46 | | 75.93 | | 69.67 | | 74.40 | |
| R-squared | 0.187 | | 0.213 | | 0.230 | | 0.208 | |

Robust standard errors, * and ** are statistically significant coefficients at the level of 0.05 and 0.01

Model 3 adds ability, which is negatively correlated with years of education. It follows that in Model 3, the return to one year of education is around the same size as in Model 1 but the coefficient for one year of work is statistically insignificant, as is its square as well. Finally, there is Model 4 with ability but without training. There the returns to education and ability are highest catching a part of the impact that otherwise would go to training.

In all four models, the return to one year of education is far from those reported by Asplund and Pereira (1999) for several European countries as well as for Finland. Most of their results for one year of education are in the range of 7–9 per cent, based on potential years of education, not actual years as above. But as pointed out in the previous chapter, the returns to potential years of education may not be linear as assumed in Mincer's earnings function. This observation has led some researchers, such as Murphy and Welch (1990), to include quadratic education terms in the earnings function. But, according to the above results, actual years of education open up an alternative way, which also eases interpretation of the results.[57]

What is even more important for the purposes of this study is that the above specifications suggest that work experience is to be divided into its constituent parts, and to be modelled additively without squared experience terms. These parts are, as explained above, years with other employers, years in other tasks with the present employer, and years in present tasks with the present employer. This division into three types of work experience is important from the seniority and tenure point of view, as seniority is defined as the years with the present employer and tenure as the years in present tasks with the present employer. But the third part, years with other employers, is also noteworthy, summing up the work experience as total work experience.[58]

[57] By testing, I found that the coefficients for interactions between training courses, years of education and ability were statistically insignificant, and so was the coefficient for squared years of education. The return to one potential year of education, as defined by Mincer (1974), was 6.6 per cent and statistically significant, and so was its square too.

[58] Moreover, according to the Shapiro-Wilk statistic, the residual of the model is normal, as assumed.

### *6.4.2 Wage returns from selection corrected OLS*

Now, leaving the other background variables as they are, I focus on the key human capital variables of this research, i.e. training, education and work experience.[59] I start from selection corrected results by gender and then continue to selection corrected results by the sector of economy, i.e. processing industries, private services and public services.

The results of selection-corrected OLS by gender are presented in Table 6.4.[60] They suggest that when education, ability and other background variables are controlled for, the return to one training course is 1.1 per cent for both sexes. This result is statistically significant at the level of one per cent. The return to ability and years of education as such produce the same return as in the reduced models above. But for women the estimation produces a better average return at least when ability is considered.

The return to different types of work experience years varies between 0.5 to 1 per cent. For women the point estimate to one year with other employers is some higher than one year in the present tasks with the present employer, and the difference is statistically significant at the level of 7 per cent. When compared to Topel (1991), Altonji and Williams (1997, 1998) and Dustmann and Meghir (2005), the results here give a return which is close to the lower limit of their results for tenure and seniority, but roughly a third of that reported for Finland by Asplund (1999).[61]

[59] However, a note of the size of personnel is needed. In the model, it is in logarithmic form, i.e. log of personnel /100, since the classification, where each class range is replaced by its midpoint, is very near to exponential. Alternatively, this variable could have been used in the first step estimation, but since there is also work experience in other establishments where training is certainly taken too, I preferred to include it in the second step estimation.

[60] I report robust standard errors, although it may be that such a correction is not needed in the presence of generated variables like the two selection correction terms, imr-work and imr-training.

[61] Results from 1987 for all wage-earners, from 1987 to 1993 for the private and public sectors by gender.

Table 6.4. Wage returns from selection-corrected OLS by gender.

| *Dep. log hourly wage* | *ALL* | | *Females* | | *MALES* | |
|---|---|---|---|---|---|---|
| | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| *Independent*: | | | | | | |
| Male | 0.214** | 0.021 | | | | |
| Uusimaa area | 0.073** | 0.023 | 0.045 | 0.029 | 0.093** | 0.036 |
| log of personnel | 0.046* | 0.006 | 0.045** | 0.008 | 0.048** | 0.009 |
| *Compared to agriculture* | | | | | | |
| Processing industries | 0.121* | 0.049 | -0.107 | 0.119 | 0.196** | 0.050 |
| Private services | 0.091 | 0.050 | -0.042 | 0.118 | 0.126* | 0.053 |
| Public services | 0.037** | 0.049 | -0.093 | 0.115 | 0.061 | 0.051 |
| *The key human capital variables* | | | | | | |
| Years of education | 0.048** | 0.005 | 0.046** | 0.006 | 0.046** | 0.009 |
| Ability | 0.037** | 0.006 | 0.040** | 0.009 | 0.031** | 0.010 |
| Number of training courses | 0.011** | 0.002 | 0.010** | 0.003 | 0.011** | 0.003 |
| Years with other employers | 0.004* | 0.002 | 0.008** | 0.002 | 0.003 | 0.003 |
| Years in other tasks with pres. emp. | 0.006** | 0.002 | 0.007** | 0.002 | 0.006* | 0.003 |
| Years in pres. tasks with pres. emp. | 0.005** | 0.002 | 0.004* | 0.002 | 0.007* | 0.003 |
| *Selection correction* | | | | | | |
| imr-work | 0.073 | 0.054 | 0.039 | 0.059 | -0.038 | 0.100 |
| imr-training | -0.247* | 0.098 | -0.261* | 0.108 | -0.212 | 0.168 |
| Constant | 1.593** | 0.117 | 1.763** | 0.153 | 1.808** | 0.207 |
| Number of observations | 1755 | | 874 | | 881 | |
| F( k, n-k) | 40.910 | | 17.570 | | 21.780 | |
| Prob > F | 0.000 | | 0.000 | | 0.000 | |
| R-squared | 0.278 | | 0.227 | | 0.264 | |
| Root MSE | 0.399 | | 0.377 | | 0.419 | |

Robust standard errors, * and ** are statistically significant coefficients at the level of 0.05 and 0.01

The coefficient estimates for the two selection correction terms, imr-work and imr-training, are different.[62] For imr-work the result is statistically insignificant,[63] but for imr-training the result is statistically significant.[64]

[62] Both correlate negatively with the dependent variable indicating that the earnings capacity of those without wage and training is smaller, compared to those with wage and training. For imr-training the correlation is higher.

[63] The insignificance partly results from the fact that all persons without work experience were excluded from the probit estimations. When included, the coefficient for imr-work was statistically significant at the level of 0.15. But looking more closely at the excluded persons, I found them more or less "handicapped", not fully at the use of the labour market. Therefore, I felt it better to exclude them.

[64] This result also holds after building the corrections terms from two estimated probit models separately. In Cameron and Trivedi (2005, 553-555), estimation procedures affected the outcome.

It follows that the second-step estimates are consistent even without imr-work, but for proper wage estimation, selection for training needs to be controlled for, at least in the case of women. For men both selection correction terms were found insignificant. Moreover, the inclusion of selection correction terms does not essentially change the coefficients reported in Table 6.3.[65]

Finally, Table 6.5 includes results for each of the three sectors of the economy, i.e. the processing industries, the private services and the public services. This is for testing whether there are differences between the public and private sectors, as most of the research is done for private sector only. It is also possible to go further, and test whether there are differences between the processing industries, where co-operation within undertakings started from, and the private services, which, since the 1970s, has been an increasing part of private entrepreneurship. In my opinion, the organisation of work in the private services differs from that of the processing industries in a way that needs to be taken into account.

The results in Table 6.5 suggest that the return to one year of education differs between the sectors of economy. For processing industries it is 7.3 per cent, for private services 3 per cent, and for public services 5 per cent. Moreover, ability brings about a 5.8 per cent return in the processing industries and 3.8 per cent return in public services. But, in private services, the coefficient estimate for ability is statistically insignificant. What is the mechanism behind these differences is a matter of further research. But certainly, these factors have to be controlled for when estimating the return to training.

The return to one training course is 1.8 per cent in processing industries and 1.1 per cent in private services. In public services the return is statistically insignificant. This is somewhat surprising, since returns to all forms of working experience are positive in public services too, not quite as much as in the processing industries but more than in private services. In my interpretation, the explanation for the statistically insignificant training coefficient for public services must then be connected to selection for training. One argument for this interpretation is that if the selection correction term imr-training had not been included in the estimation, the return to one training course in public sector had been positive at the risk level of 8 per cent.

[65] For comparison, Asplund (2000) reported an essential increase in the coefficients for experience and its square after inclusion of selection correction term for employment, i.e. imr-work.

Table 6.5. Wage returns from selection corrected OLS by the sector of economy.

| *Dep. log hourly wage* | *Processing industries* | | *Private services* | | *Public services* | |
|---|---|---|---|---|---|---|
| | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| *Independent*: | | | | | | |
| Male | 0.281** | 0.045 | 0.200** | 0.040 | 0.204** | 0.027 |
| Uusimaa area | 0.004 | 0.052 | 0.107* | 0.042 | 0.063* | 0.032 |
| log of personnel | 0.038** | 0.011 | 0.050** | 0.013 | 0.041** | 0.008 |
| *The key human capital variables* | | | | | | |
| Years of education | 0.073** | 0.012 | 0.030** | 0.010 | 0.050** | 0.007 |
| Ability | 0.058** | 0.012 | 0.015 | 0.012 | 0.038** | 0.009 |
| Number of training courses | 0.018** | 0.004 | 0.011* | 0.004 | 0.003 | 0.003 |
| Years with other employers | 0.010** | 0.003 | 0.003 | 0.004 | 0.005* | 0.003 |
| Years in other tasks of pres. emp. | 0.009** | 0.003 | 0.008* | 0.004 | 0.006** | 0.002 |
| Years in pres. tasks of pres. emp. | 0.011** | 0.004 | 0.003 | 0.003 | 0.005** | 0.002 |
| *Selection correction* | | | | | | |
| imr-work | -0.037 | 0.112 | 0.029 | 0.105 | 0.110 | 0.062 |
| imr-training | 0.313 | 0.195 | -0.358* | 0.177 | -0.541** | 0.142 |
| Constant | 1.079** | 0.246 | 1.952** | 0.215 | 1.709** | 0.127 |
| Number of observations | 465 | | 601 | | 614 | |
| F( k, n-k) | 21.580 | | 14.280 | | 30.380 | |
| Prob > F | 0.000 | | 0.000 | | 0.000 | |
| R-squared | 0.382 | | 0.213 | | 0.326 | |
| Root MSE | 0.379 | | 0.469 | | 0.327 | |

Robust standard errors, * and ** are statistically significant coefficients at the level of 0.05 and 0.01

The coefficient estimate for imr-training is negative and statistically significant in the private services too, indicating that the selection for training may be driven by factors that were used for modelling the probability for training, i.e. occupational groups, primarily. Thus, belonging to a training intensive occupational group, or having a training intensive occupation, may affect wages independent of the number of training courses acquired during the working life. Without the selection correction term imr-training, the return to one training course had been 1.3 per cent and statistically significant.

In the processing industries, imr-training is far from statistically significant. My interpretation of this is that in the processing industries the co-operation procedure in assessing the need for training for the following year differs from the procedures followed in the other sectors of economy. The co-operation regulations stipulate that the assessment should be done by personnel groups, i.e. by occupational groups, in my interpretation. Thus, in the processing industries there may also be some other drivers for training than the nature of work, defined by the relative shares of different occupational groups of the workplace.

By the use of indicator variables for training by sector, it was also possible to test whether returns between the sectors of economy actually differ. According to an F-test, the difference in the return to training between the private and the public sector is statistically significant, and this result holds even after splitting the private sector in two parts, i.e. in comparison to the public sector. But the difference between the two parts of the private sector, the processing industries and the private services, is not statistically significant.

## 6.5 Conclusions

In this chapter, I estimated a modified Mincerian earnings function by means of data from the Adult Education Survey of 2000. Without changing the basic structure of the earnings function, I modified the link between education and work experience years. Instead of potential years of education and work experience, I used actual years, including years of leisure, years out of work and education, and ability, i.e. a measure based on the deviation of each person's actual education years from the mean years of education at each level of education.

Then I estimated the modified earnings function, including the number of training courses, in two steps. In the first step, I modelled selection for positive hourly wages and the positive number of training courses using a seemingly unrelated bivariate probit model. From the fitted values, I then formed the selection correction terms, the inverse Mills' ratios, for both selection processes. Finally, I included these correction terms in the second-step, in estimating the expanded earnings function for log gross hourly wages.

In the first step, the selection for positive hours turned out to depend on a number of factors, such as age, education and family background. Selection for training was restricted to occupational status and age only. All other explanatory variables were excluded. This exclusion, which may cause questions, was made for two reasons: First, to make space for the training-sensitive occupational groups, which, in my interpretation, also reflect the need for proactive training assessment at workplaces. Second, to avoid correlation between the two corrections terms formed from the fitted values of the two probit models. By definition, occupations also include information about educational attainment that otherwise should be included.

The results of these two estimations were close to expectations, except that the probability of males' working is less than that of females'. The results suggest, for example, that the number of children and other annual income decrease the probability of working, especially in the case of women. When it comes to positive number of training courses, occupational structure works as expected. In professional groups with high skill requirements, the probability of training is around twice that of the occupational groups with low skill requirements.

According to second-step estimations, the return to one training course is 1.1 per cent on average. This is less than in the previous chapter based on the standard Mincerian earnings function. But compared with other key factors of the modified earnings function, the return is still high. A model specified in this way reduces the return for one year of formal education to a level of 5 per cent, instead of the 7 to 9 per cent range reported earlier for Finland. Moreover, in a model specified in this way, the relationship between years of education and log wages is linear as opposed to the non-linear relationship based on a standard Mincerian model of the previous chapter.

When socio-economic background and types of work experience, the "weak link" of the basic Mincerian model, are controlled for, the return to one course of training is very similar for men and women, as is the return to one year of education. On the other hand, the results suggest that the returns to training differ by the sector of economy. In the private sector, where the assumption of competitive market behaviour is clearly present in the form of profit and profit sharing, returns to training are higher than in the public sector. Partly, this may be due to profit sharing systems that, in the 1990s, have increased in the private sector, and especially so, in the processing industries. How these systems are possibly connected to training, remains here open. In my opinion, not verified in this thesis, the connection comes through workplace bargaining.

In the model, the returns to training in both the public sector and the private services are sensitive for selection correction, based on the observed correlation between occupations and training and on the assumed role of occupational groups in assessing the need for training at the workplace. Therefore, I conclude that to a large extent the selection arises from the occupational structure, including four skill-levels that are quite comparable with levels of education. In the literature, however, this possibility is not much discussed. There the public sector, where the selection like this is highest, has typically been dropped from

data sets as if absence of price competition would automatically exclude public sector from the domain of human capital theory.

From the viewpoint of human capital theory, it is problematic that in the public sector, where the training intensity is highest, the wage returns to training are smallest, and, actually, statistically zero. The reasons for this, is a topic of further research. I conclude that, in the public sector, there must be other "qualitative" returns instead of nonexistent wage returns. The competing interpretation that, in the public sector, employers reap all the benefits of training is just implausible. In my opinion, it is hard to believe that all the wage-earners of the public sector are satisfied with social returns only, or that all acquired training had been "firm-specific" and non-transferable to the other sectors of economy. Thus, it may be that the "key workers" of the public sector expose themselves for poaching from the private sector where returns to training are monetary.

Comparing these results with other studies is problematic for three reasons. Firstly, in the literature, it is quite unusual to deviate from the potential years of education and work experience, and the few studies that do so are directed at other research problems than the training – wage relationship. Secondly, ability measurements are usually based on a separate test at some earlier point of life, but independent of actual years of education, i.e. ability in one's studies. Thirdly, log hourly wage and log annual wage as independent variables easily lead to differences in results.

# 7. Short-run returns to in-service training

In this chapter, I estimate the effect of in-service training acquired between February 1999 and June 2000 on participants' gross monthly wages in 2001–2002. The estimation method is statistical matching, supplemented with OLS for comparison. The data are from the Adult Education Survey of 2000, compiled by Statistics Finland, and complemented by income data from the tax authority's registers. I focus on in-service training, the Finnish parallel to American on-the-job training. In addition, the data include information on other education acquired during the period examined, such as voluntary vocational adult education and non-vocational adult education. By excluding these other forms of education from the definition of training here, the wage effect of participation in in-service training is estimated by matching the wage development to similar sample persons who had acquired no in-service training.

## 7.1 The model

### *7.1.1 Treatment effects*

In the treatment effects literature, the starting point is a situation where participation in some treatment *d*, like training in this case, gets a value of one, and is otherwise zero. Thus keeping in line with Wooldridge (2002), the potential wages of the participants are *y(1)* and of others *y(0)*. Therefore the average treatment effect on the treated (ATT), assuming that di and *y(0)* are uncorrelated, is

$$\text{ATT:} \quad E[y_i(1) - y_i(0) \mid d_i = 1] = E[y_i(1) \mid d_i = 1] - E[y_i(0) \mid d_i = 1] = \\ E[y_i \mid d_i = 1] - E[y_i \mid d_i = 0] \tag{1}$$

It is also the average treatment effect, $E[y_i(1) - y_i(0)]$, provided that $d_i$ and $y_i$ are uncorrelated. In practice, this is a strong assumption and getting the estimation model into a causal form is genuinely difficult. The issue is the term $E[y_i(0)|d_i = 1]$, because it is not known what the non-participants' earnings had been, had they not participated in training.

In the empirical literature, this issue has been approached in various ways. In Leuven's (2004) "tentative" literature survey, a large number of studies are examined. In many studies, the wage effect of the training treatment is found to be positive and, compared to formal years of education, even suspiciously large. In several of the studies surveyed, the results are based on the use of panel data, giving opportunities to control for some possibly unobserved variables. In many studies, however, a number of methods such as difference comparisons and selection models were used.

In the present chapter, I have panel data only for wages. All other information, including that on training, is from the years 1999 and 2000. This information, however, is quite rich in nature, giving good opportunities to model participation in in-service training. Therefore, the most useful method for estimating the treatment effects is to use matched sets of treated and untreated observations, the so-called matching estimation. To be successful in this estimation, the information on factors affecting training participation is important. If this identification is good, the interpretation of ATT is on solid grounds.

### *7.1.2 The matching estimator*

In observational studies, fully controllable repeat measurements are not possible in general. Therefore, information on the effects of certain treatments for participants and non-participants needs to be obtained from different comparisons. In matching estimation, the treated and the untreated observations are matched so that the disparity of the groups does not distort the estimated effect, such as the wage effect of in-service training. Following Cameron and Trivedi (2005), one general form of the matching estimator for the average treatment effect on the treated is

$$\Delta^M = 1/N_T \sum_{i \in [D=1]} [y_{1,i} - \sum_j w(i,j) y_{o,j}] \quad (2)$$

where $0 < w(i,j) \leq 1$, $N_T$ is the group of the treated with measure $[D=1]$ , and $j$ is an element of the set of matched comparison units. By varying the weights w(i, j) given to

each of the comparison units of the treated unit *i*, a group of different matching estimators can be derived, such as the estimators used in this chapter.

Simple matching compares cells with exactly the same discrete characteristics ***x***, i.e.

$$\Delta^M = \sum_k w_k (\bar{y}_{1,k} - \bar{y}_{0,k}) \tag{3}$$

where $\bar{y}_i$ is the mean outcome of the treated, $\bar{y}_0$ is the mean outcome of the untreated and $w_k$ is weight of the k*th* cell, i.e., the fraction of observations in cell k.

In Nearest Neighbour matching, $w(i, j) = 1$ when the untreated person *j* is a neighbour, and zero otherwise. For each treated person, the closest person of comparison is defined by the propensity score index. If there are a number of neighbours, the comparison is based on their weighted average. Thus, in the case of several Nearest Neighbours, the size of the control group has to be a multiple of the size of the treated group. Kernel matching differs from the above in that it calculates the weight *w(i, j)* for several untreated observations and possibly for the entire control group. Thus, the weight depends on the value of the Kernel function *K* evaluated at the distance between *i* and *j*.

$$w(i, j) = \frac{K(x_j - x_i)}{\Sigma_{j=1}^{N_{c,i}} K(x_j - x_i)} \tag{4}$$

where $N_c$,*i* is the size of the comparison group (Cameron and Trivedi 2005, 875). An alternative method that also uses the entire control group is local linear regression (Heckman et al. 2006, 450-451). These estimators have the advantage that they are independent of distributional assumptions. Therefore, the personal characteristics x may be quite diverse, and it is still possible to estimate the average treatment on the treated. The presentation here is based on the assumption that the treatment, in this case training, is binary. Even though the results may also generalise into non-binary measures (Wooldridge 2002, 638–642), the available software routines do not allow for this possibility. This restriction affects the way in-service training is included in the estimations.

Key sources for matching estimators are Rubin (1977) and Heckman et al. (1998, 1999 and 2006). Caliendo and Kopeinig (2005) present practical findings and Zhao (2006) discusses matching estimators and data collection. To the best of my knowledge, there are only few applications focusing on employer-provided training only, and even then it

is difficult to say if the treatment is comparable to Finnish in-service training. Returns to training, such as LaLonde (1986), Deheija and Wahba (1999, 2002), Smith and Todd (2005) and Muehler et al. (2007), are for special training programmes for selected target groups. Therefore, the reference literature of this study cannot be limited to the treatment effects literature only.

### *7.1.3 Results from the literature*

One extensive literature review of the wage effect of training is Leuven (2004), although it is limited to studies on the private sector. Leuven's review is a good secondary source because it tries to take into account the comparison issues caused by differences in data and methods used, typically OLS or IV-estimation. The results can substantially differ by estimation method, as reported by Zwick (2006) for training's productivity effect.

In the UK, Blundell et al (1996) have estimated that the return to participation in on-the-job training for males is 3.6 per cent. In addition, Blundell et al. (1999) have estimated that the wage effect for one course of employer-provided training is 5 to 8.3 per cent. Arulampalan and Booth (2001), instead, report that participation in work-related adult education increased wages by 40 per cent during a longer period in 1981–1991. According to Booth (1991), participation in on-the-job training increases males' gross yearly salaries on average by 11.2 per cent and females' by 8.1 per cent.

In the US, the results are perhaps more diverse. Lynch (1992) has reported that one week of on-the-job training increases wages "only" by 0.2 per cent. According to Veum (1995), one hour of on-the-job training increases wages by 0.7 to 0.9 per cent, according to Parent (1999), one year's time in an on-the-job training program increases wages by 12 to 18 per cent, and according to Frazis and Loewenstein (2003), one week of employer-provided training increases wages by 40 to 50 per cent.

In Germany, according to Kuckulenz and Zwick (2003), participation in external training increases wages by 5 to 13 per cent, while internal training remains insignificant. Muehler et al. (2007) report a 4 to 5 per cent return to general training within a period in 2000 to 2004, but the return to firm-specific training remains statistically insignificant. In the Netherlands, according to Leuven and Oosterbeek (2008), one week of employer-provided training increases wages by 10 to 17 per cent, after matching from a sample

of all wage-earners. For Finland, Asplund (1999) has reported a return of around 10 per cent to participation in in-service training, based on participation in in-service training. Moreover, Kruhse-Lehtonen (2007) has found out that complementary studies among adults were shown to be a less profitable investment than increasing the level of education at a young age.

To sum up, the results, based mainly on wage effects from participation in training in selected target groups, vary. But in general they indicate positive and high wage returns to training. Are these returns true returns to training, is discussed in various contexts with various conclusions by Leuven (2004, 2005), Leuven et al. (2005, 2008) and Bassanini et al. (2005). But what are the matched short-run returns to training in Finland, when the diversity of training is limited to in-service training paid for by employers, and measured by days acquired during a 12-month reference period? And, are the returns to short training spells higher than to long training spells, as suggested by Pischke (2005)? And, are the returns to training same for men and women?

## 7.2 Data

The data of Table 7.1 consists of 1272 observations from the Adult Education Survey of 2000, which has since been complemented by annual wages, a register-based educational attainment variable, and months of employment and unemployment during 2000–2002. Using this information, monthly gross wages, calculated as annual wage income divided by months employed, were derived for sample persons, who had to be wage-earners at the moment the survey was taken.[66]

During the period examined, the sample persons' wage development was rather modest. Monthly wages increased from 2330 euros to 2390 euros from 2000 to 2001, and then decreased to 2320 euros in 2002. The decrease seems peculiar and does not correspond to the information from other sources on the average improvement of wages.[67] For instance, the wage index of Statistics Finland rose by 3.4 per cent in 2002, only slightly less than

[66] In 2000, the number of observations was 1755, but because 483 wage-earners did not have a solid wage history, only 1272 observations remained available. For Heckman (1979) this selection had been the primary source for selection correction, but here it is taken care of by means of matching.

[67] This problem may arise when one divides the annual wage income by the number of months employed. The denominator (months employed) was given as an integer. One decimal would certainly have helped accuracy.

in the previous year. However, the index measures permanent full-time employment only, ignoring the presence of part-timers. Another strange characteristic of wages is that females' average wage was only 70 per cent of males'. According to Statistics Finland, the difference should be around 80 per cent, but, once again, estimated for regular employment only.[68] Also, the proportion of females in the sample group was smaller than in the entire labour force. In the sample, the proportion of females is 45 per cent and in the labour force it is 48 per cent.[69]

At the time of the survey, from February to June in 2000, the sample persons were asked what kind of education they had received in the previous year. This study setup is very typical in the literature discussed above. The interviewers were instructed to take into account all forms of education, both formal and informal. Participation in all forms of education lasting more than 6 hours, except for TV-based driving school tuition, was accepted as adult education. The questionnaire form was so extensive that the interviewee may have felt pressured to show at least some educational activity. As regards in-service training, this may be the case, because the in-service training data produced from the Labour Force Survey shows a 10 percentage points lower participation rate. On the other hand, the companies' in-service training statistics of 1999, where the extent of in-service training is obtained from companies with more than 20 persons, produce almost the same results as the AES of 2000.[70] These questions are discussed in more detail by Blomqvist et al. (2002) and Eurostat (2005).

The training and education acquired during the training period 1999–2000 is divided into three groups by Statistics Finland: in-service training provided by the employer, voluntary vocational adult education and non-vocational education, which according to those interviewed had no vocational objectives. The first one is primarily paid for by the employer, the other two by the individual with some support from the tax-payers. The longer the training spells, the more tax-payers' money is involved.

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[68] http://www.stm.fi/Resource.phx/publishing/documents/16222/summary_en.htx (December 2008).

[69] See Labour Force Survey 2000, Statistics Finland.

[70] The information on companies' in-service training is based on a Europe-wide research project (Continuing Vocational Training Survey - CVTS2), which was carried out by Statistics Finland and mainly financed by the EU Commission.

Table 7.1. Data.

| *Variables* | *ALL* | | *MALES* | | *FEMALES* | |
|---|---|---|---|---|---|---|
| | *Mean* | *Std. Dev.* | *Mean* | *Std. Dev.* | *Mean* | *Std. Dev.* |
| *Outcome variables:* | | | | | | |
| Gross monthly wage 2000, € | 2328 | 2379 | 2644 | 2214 | 1942 | 2515 |
| Gross monthly wage 2001, € | 2386 | 2245 | 2733 | 2356 | 1959 | 2023 |
| Gross monthly wage 2002, € | 2318 | 2284 | 2621 | 1891 | 1946 | 2643 |
| *Treatment variables:* | | | | | | |
| 1–3 days in training in 1999–2000 | 0.23 | | 0.20 | | 0.27 | |
| 4–10 days in training in 1999–2000 | 0.17 | | 0.18 | | 0.17 | |
| > 10 days in training in 1999–2000 | 0.15 | | 0.16 | | 0.14 | |
| All together | 0.56 | | 0.54 | | 0.58 | |
| *Matching variables* | | | | | | |
| Continuous | | | | | | |
| Years of age | 40.4 | 10.1 | 39.7 | 10.2 | 41.3 | 10.0 |
| Years of work | 19.6 | 10.7 | 19.6 | 11.0 | 19.6 | 10.3 |
| Years with other employers | 9.3 | 9.0 | 9.6 | 9.7 | 8.8 | 8.0 |
| Years in other tasks with present employer | 3.5 | 6.4 | 3.4 | 6.4 | 3.6 | 6.4 |
| Years in present tasks with pres. employer | 6.8 | 7.5 | 6.5 | 7.4 | 7.2 | 7.6 |
| Years of education | 12.7 | 3.3 | 12.6 | 3.4 | 12.7 | 3.3 |
| Years of leisure | 1.1 | 3.9 | 0.5 | 2.8 | 1.9 | 4.8 |
| Number of previous training courses | 7..9 | 5.3 | 7.7 | 5.4 | 8.2 | 5.3 |
| *Indicators* | | | | | | |
| Male | 0.55 | | | | | |
| Married | 0.74 | | 0.74 | | 0.73 | |
| *Level of education* | | | | | | |
| Primary | 0.21 | | 0.21 | | 0.21 | |
| Secondary | 0.43 | | 0.45 | | 0.41 | |
| Lowest tertiary | 0.19 | | 0.14 | | 0.25 | |
| Lower tertiary | 0.07 | | 0.09 | | 0.05 | |
| Upper tertiary | 0.10 | | 0.11 | | 0.08 | |
| *Size of establishment* | | | | | | |
| < 20 employees | 0.17 | | 0.20 | | 0.13 | |
| 20–199 employees | 0.23 | | 0.22 | | 0.24 | |
| > 199 employees | 0.60 | | 0.57 | | 0.63 | |
| *Work contract* | | | | | | |
| Typical | 0.81 | | 0.86 | | 0.76 | |
| Part-time contract | 0.06 | | 0.03 | | 0.09 | |
| Fixed-term contract | 0.13 | | 0.11 | | 0.15 | |
| *Employer* | | | | | | |
| Private | 0.69 | | 0.81 | | 0.55 | |
| Public | 0.31 | | 0.19 | | 0.45 | |
| *Control* | | | | | | |
| Examination 2000–2002 | 0.02 | | 0.01 | | 0.02 | |
| Number of observations | 1272 | | 701 | | 571 | |

Figure 7.1. Participation in adult education. Per cent of wage-earners by age group.

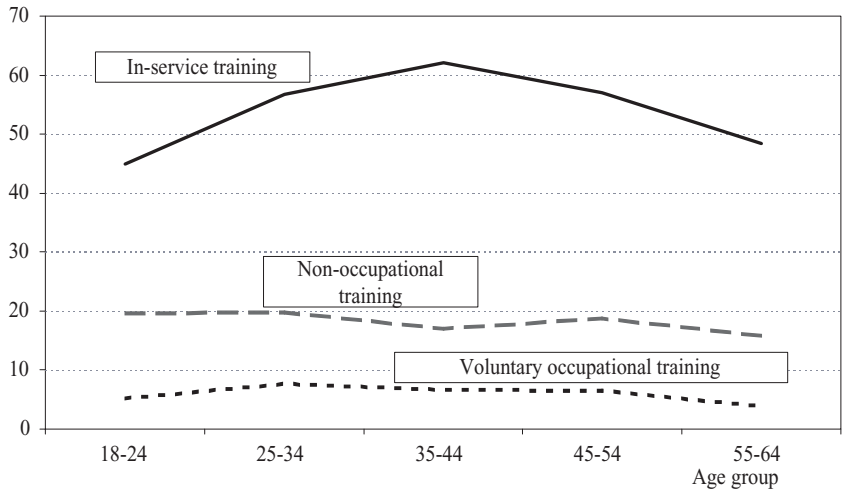
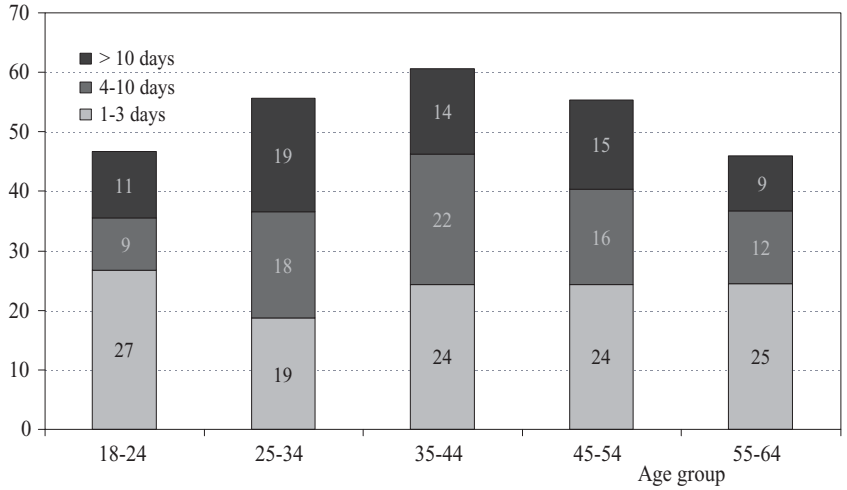



Figure 7.2. Participation in in-service training. Per cent of wage-earners by age group.




The types of education defined in this way do not result in mutually exclusive subsets of sample persons. During the 12-month reference period, these interviewed may have participated in several different types of courses. Courses are not separable by type of education and training, but the days in in-service training are. This is why I focus on days in in-service training instead of courses in training and education that I cannot identify.

In the following estimations, all the persons who had received other adult education than in-service training during the training period 1999–2000, including non-vocational adult education,[71] were excluded from the data. This is because these competing types of education may have influenced wages independent of in-service training, the effect of which I want to estimate. On the other hand, these exclusions may also have affected the above-mentioned differences between the data and wage statistics from other sources.[72]

Participation in different types of adult education is shown in Figure 7.1, based on the whole sample before the above-mentioned exclusions. In-service training forms the greatest part, approximately 70 per cent, of the adult education courses during the training period. In-service training also differs from other adult education in that at younger and older ages, it is acquired less often than during prime working age. Of the 35–45-year-old wage-earners, more than 60 per cent had received in-service training, 7 per cent voluntary vocational adult education and 18 per cent other, non-vocational adult education.

In Figure 7.2, the division of in-service training is shown according to the number of training days. There are three groups: 1 to 3 days, 4 to 10 days and over 10 days. The three groups, approximately equal in size, were used because each group had enough observations in relation to the comparison group, who had not received any training. As depicted in Figure 7.2, there is a representative amount of each in-service training length in each age group. Wage-earners in prime working age, however, are over-represented in the longer training group relative to the younger and the older workers. Around two thirds of in-service training was acquired at workplaces, one third in training institutions outside the workplace. The larger the establishment, the larger the proportion of workplace training is.

Males and females have the same amount of work experience, 19.6 years on average. This average has, however, come about in different ways. Males have acquired work experience with other employers for 9.6 years, about one year more than females. Females have

[71] Non-vocational education is to be considered as consumption. Kodde and Ritzen (1984) have shown that individuals also acquire education for other than professional reasons and that in a model where education consumption is also allowed more education is acquired than otherwise would be.

[72] With the exclusions the sample was reduced by 359 persons. Without the exclusions the average monthly wages of the sample group in 2002 would have been 2270 euros. The difference to the average monthly wages in 2001 would still have been about 3 percent, but the wage difference between males and females would have been slightly less.

acquired work experience in the present tasks with the present employer for 7.2 years, about one year more than males. Both have acquired work experience in other tasks with the present employer almost equally, 3.5 years on average.

At the time of the study, the sample persons' average age was 40 years. By deducting from age the school starting age (7 years), years of education and work experience, we get a difference, which I call years of leisure, i.e. years not in school or work. For males they were few, half a year, but for females almost two years. The average number of previous training periods is 7.7 courses for males and 8.3 for females, measured as a difference between lifetime vocational courses and courses taken during the 12-month reference period.

The years of education are about the same, 12.6 to 12.7 years, for both sexes. Education may also have contributed to the amount of in-service training indirectly. This is because skill levels needed in the professional occupational groups are much higher compared with other groups. Actually, in the revised International Classification of Occupations, ISCO88, the skill level is one principle according to which groups are formed. It includes four skill-levels, which are quite comparable with levels of educational attainment.

According to Barron et al. (1997), for example, establishment size is an essential factor in all research concerning in-service training and its American parallel, on-the-job training. In the AES data, firm sizes are divided into three groups: establishment with less than 20 employees, 20-199 employees and over 199 employees. The the smallest establishment size is used as a comparison group to the larger establishments, which usually have better possibilities to organise training at the workplace, and actually report considerably higher participation rates. As regards the Act on Co-operation within Undertakings (725/1978), the group with less than 30 employees had been a more interesting control group, since below that limit co-operation procedure is voluntary. But because of the solid data classification of AES, the above control group had to be taken.[73]

Also the types of work contract, such as permanent, part-time or fixed-term, and the legal position of the employer, private or public, may affect selection for in-service training, as

[73] The classified data made it possible to control for workplaces outside the co-operation procedures with a variable indicating either less than 20 or less than 40 wage-earners, but not exactly 30 wage-earners. The less than 20 wage-earners limit was chosen because in the renewed co-operation act (334/2007) the obligation to account for training needs is applied to all companies with more than 20 wage-earners.

suggested by Campbell (2001), for example. Therefore, I control for the possible effects of part-time and fixed-term employment.[74] The idea is to see how much these two forms of employment affect selection for in-service training, when the comparison is the typical permanent full-time employment. Correspondingly, I compare the public sector with the private sector.

Finally, having data on formal educational attainment in 2000–2002 makes it possible to control for the possible effect of changes in the formal education code, as is done by Blundell et al. (1999) and Kruhse-Lehtonen (2007), for example. If a sample person's education code has changed, he or she must have finished a degree of some kind. In the data, there were only 20 new degrees by 2002, i.e. 1.6 per cent accumulation within two years. But, anyway, this education may have been independent of in-service training, and the new degrees may have had their own wage effect that should then be controlled for in the estimation.

## 7.3 Matching

### *7.3.1 Selection for in-service training*

In human capital theory, education is treated as an investment, which improves the productivity of an individual and therefore their position on the labour market.[75] This idea developed, among others, by Becker (1962, 1964, 1975), Ben Porath (1967) and Mincer (1974, 1988, 1989) is true for both formal and informal education. By informal I mean education which does not lead to an examination or coded degrees of ISCED, the International Standard Classification of Education. Therefore, human capital theory should also be true for in-service training in Finland, in spite of the fact that its content differs from that of the English-speaking countries where the main part of the literature hails from.

[74] These groups are not entirely mutually exclusive, as almost two per cent were in temporary part-time employment.

[75] Other views of the relationship between education and salaries have also been presented. Arrow (1973) challenged the approach described here with an antithesis, according to which education does not increase individuals' productivity but simply selects more productive individuals for better positions.

In Anglo-American literature, the key word is "on-the-job training", whereby the previously mentioned researchers mean training given at work or at the workplace. The basic assumption is that this training is paid for by the trainee himself either directly or by receiving a lower salary than others during the training period. The division of costs may, of course, be affected by Becker's (1962, 1964) division into general training and firm-specific training, but other reasons certainly exist, as pointed out, for example, by Leuven (2005).

In the case of general training, there is a good motive for the wage-earners to contribute to the training costs, as by definition general training improves the wage-earners' professional position in general – also in other companies than in the one providing the training. However, in the case of firm-specific training, the motive for the wage-earner to contribute to the costs is different, because, by definition, firm-specific training only improves his or her professional position in the company providing the training.[76]

My assessment is that in Finland, this conceptual division does not have as much significance as in the countries where the employee is expected to be the primary payer of training. In Finland, the training is, in general, called in-service training rather than on-the-job training. This is because, by definition, in-service training is paid for by the employer, either partially or in full.[77] This principle was first recorded in education agreements between labour market organisations in the 1960s and then in acts and agreements, sector by sector, as described in Section 2.2.

When one sub-sample of trained wage-earners was directly asked whether it was general or firm-specific, 67 per cent called the training general in nature.[78] Therefore the question of what factors contribute to workers' in-service training in Finland needs to be assessed against the Finnish background. More attention needs to be given to the ability of companies to arrange training for their staff and less attention to workers' ability to pay for the training than might be the case in the US, for example.

The variables that I use to model the selection for different amounts of in-service training are those listed in Table 7.2. The results for males and females separately are shown in Appendices

[76] There may also be exceptions to this generalisation. For example, Autor (2001) suggests that a company can also pay for general training if it can then sell its customers the idea for a prosperous business.

[77] In the data, in 88 per cent of all training cases the costs were paid in full by the employer.

[78] Source: SAK's working conditions survey 2008, available only in Finnish.

7a and 7b. They depict differences in variables like educational attainment and leisure, years off from paid employment and education. Without going to detailed assessment by gender, I refer to Whittock et al. (2002): the challenges of "family-friendly" labour market policies are problematic from the point of in-service training. In practice, they favour males.

As suggested by the coefficient estimates in Table 7.2, socio-economic background variables do not have much effect on selection for in-service training. Gender has no effect at all, and marital status only when the question is of in-service training for 4 to 10 days. But years of work experience typically decrease selection for in-service training, i.e. training is typically given at a young age. Where the work experience is acquired is not a very relevant question in this context, except that years in other tasks of the present employer seems to favour in-service training less than other work experience.

The model was also estimated by summing up all types of experience to one and its square. This is because, as seen in Figures 7.1 and 7.2, the distribution of in-service training over the life cycle is concave. However, the results show that the sign of both terms, work experience and its square, were statistically insignificant. The reason for this may be that the model also includes indicator variables for part-time and fixed-term employment. These forms of work are mostly utilized at both ends of the age distribution, and thus catch the effect that had otherwise affected the coefficient for squared work experience. Fixed-term employment reduces in-service training, while part-time employment remains statistically insignificant.

Besides, there are four factors that clearly affect the acquiring of in-service training: number of previous training courses, educational attainment, the size of the establishment and the employer's legal position. One more training course during working life increases the marginal probability of training during the reference period in all training groups by around 2 per cent. In the case of educational attainment the relationship is the stronger the higher the level of education. For example, the marginal probability of training lasting more than 10 days is 42 percentage points higher on the lower tertiary level compared with the primary level of education. For in-service training lasting 1 to 3 days, there was little effect from education. These results are in line with those published by Fortin and Parent (2009) for Canada, i.e. educational attainment is a strong determinant for "employer sponsored" training.

The third key factor is the size of the establishment. Working in an establishment with 20–199 wage-earners does not seem to increase the likelihood of training, compared to workplaces less with than 20 wage-earners. But if the wage-earner works in an

Table 7.2. Probit regressions for in-service training, marginal effects.

| *Dep.: in-service training* | *1-3 days dF/dx* | *Std. Err.* | *4-10 days dF/dx* | *Std. Err.* | *>10 days dF/dx* | *Std. Err.* |
|---|---|---|---|---|---|---|
| *Independent*: | | | | | | |
| Male | -0.045 | 0.036 | 0.036 | 0.034 | -0.002 | 0.031 |
| Married | 0.056 | 0.037 | 0.089* | 0.034 | 0.035 | 0.032 |
| *Years of experience* | | | | | | |
| with other employers | -0.008** | 0.002 | -0.006** | 0.002 | -0.007** | 0.002 |
| in other tasks, present employer | -0.008** | 0.003 | -0.005 | 0.003 | 0.001 | 0.002 |
| in present tasks, present employer | -0.001 | 0.002 | -0.007** | 0.003 | -0.008** | 0.002 |
| Years of leisure | -0.011* | 0.004 | -0.014** | 0.005 | -0.021** | 0.005 |
| No. of previous training courses | 0.020** | 0.003 | 0.017** | 0.003 | 0.015** | 0.003 |
| *Level of education, cf. primary* | | | | | | |
| Secondary | 0.000 | 0.044 | 0.023 | 0.045 | 0.100* | 0.049 |
| Lowest tertiary | 0.121* | 0.063 | 0.185** | 0.068 | 0.320** | 0.080 |
| Lower tertiary | 0.042 | 0.088 | 0.222** | 0.093 | 0.419** | 0.100 |
| Upper tertiary | -0.016 | 0.073 | 0.080 | 0.078 | 0.253** | 0.092 |
| *Size of establishment, cf. < 20* | | | | | | |
| 20 – 199 employees | 0.027 | 0.054 | 0.104 | 0.062 | 0.078 | 0.061 |
| >199 employees | 0.107* | 0.046 | 0.187** | 0.046 | 0.145** | 0.045 |
| *Work contract, cf. typical* | | | | | | |
| Part-time contract | -0.107 | 0.062 | -0.073 | 0.059 | -0.089 | 0.047 |
| Fixed-term contract | -0.110* | 0.050 | -0.111* | 0.043 | -0.079 | 0.040 |
| *Sector, cf. private* | | | | | | |
| Public | 0.103* | 0.044 | 0.125** | 0.043 | 0.109** | 0.041 |
| obs. P | 0.340 | | 0.276 | | 0.252 | |
| pred. P | 0.317 | | 0.226 | | 0.165 | |
| Number of observations | 859 | | 783 | | 758 | |
| LR chi2(k) | 126.7 | | 182.3 | | 250.4 | |
| Prob > chi2 | 0.000 | | 0.000 | | 0.000 | |
| Pseudo R2 | 0.115 | | 0.198 | | 0.293 | |

* and ** are statistically significant coefficients at the level of 0.05 and 0.01.

establishment with at least 200 employees, depending on training days, they are 11 to 19 percentage points more likely to receive in-service training than an employee working in an establishment with less than 20 employees. This is in line with other research, as depicted by Barron et al (1997). Large companies have completely different opportunities for in-service training than small companies. The result also suggests that the internal labour markets, discussed by Harcourt and Wood (2007), are actually a possibility for large establishments only.[79]

[79] Therefore, from the point of in-service training, it may be irrelevant that the renewed Co-operation Act within Undertakings (334/2007) stipulates a lower, 20-person limit for co-operation procedures.

The fourth key factor is the legal position of the company. The public sector has clearly been more active than the private sector in arranging in-service training, the marginal difference being around 10 percentage points and statistically very significant. But, as depicted in Appendices 7a and 7b, this difference depends on gender. In the case of women, the difference is positive in all training groups. In the case of men, the difference is positive only in the training group of ten days or more. Also the possible effect of union membership, discussed in section 2.2, was tested, but found far from significant in all training classes and for both sexes.

### *7.3.2 Before and after matching*

After the selection for in-service training has been explained with the model presented above, and the propensity score indexes produced by the model are estimated, we end up with the results in Table 7.3. The matching estimators used, and introduced in the introduction, were the Nearest Neighbour estimator with two neighbours, and a Kernel estimator.[80] The common support rule[81] was used for both estimators. For the Kernel estimator, the bandwidth was the default value given by the software.[82]

In Table 7.3, the relative deviations from the group averages before and after matching are presented by days of in-service training. As one can see, the unmatched group averages of the trained and untrained control groups differ substantially, and for the most variables the differences were statistically significant before matching. For example, in the cases of marital status, education, size of establishment and years of leisure, the differences in averages were tens of percentage points. Thus, married employees of large establishments with higher levels of education were over-represented in the trained groups. And without matching, such as described here, the wage effect estimation of in-service training would have been on a rather questionable basis, i.e. comparisons had been misleading.

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[80] According to Pekkarinen (2006), there are no clear selection criteria for which matching methods are to be used. The selection here was made partly for reasons described in the introduction – two different ways to utilise the control data – and partly by experimenting. Experiments show that these two estimators produce slightly differing results.

[81] The common support rule drops the treatment observations whose propensity score (propensity score) is higher than the maximum or less than the minimum propensity score of the controls.

[82] The bandwidth defines how much weight is given for matched pairs far from each other. The default value of PSMATCH2 is 0.06. More narrow bandwidths would lead to substantial loss in observations.

Table 7.3. Treated and untreated variables according to the matching estimator.

| *Estimators* | *Comparison* | *Nn-matching** | | | *Kernel-matching*** | | |
|---|---|---|---|---|---|---|---|
| | Training days: | 1-3 | 4-10 | > 10 | 1-3 | 4-10 | > 10 |
| Variables: | | | | | | | |
| Male | Unmatched | -17.5 | -0.8 | 0.5 | -17.5 | -0.8 | 0.5 |
| | Matched | 0.7 | -1.9 | 2.1 | -1.2 | -0.7 | 7.3 |
| Married | Unmatched | 17.4 | 32.5 | 25.2 | 17.4 | 32.5 | 25.2 |
| | Matched | -5 | 4.4 | -2.4 | -1.7 | 1.4 | -0.1 |
| Years in other jobs | Unmatched | -27.5 | -25.2 | -40.9 | -27.5 | -25.2 | -40.9 |
| | Matched | 3.2 | 2.5 | -4.4 | 0.5 | 0.1 | -2.8 |
| Years in other tasks | Unmatched | 4.6 | 16.6 | 36.2 | 4.6 | 16.6 | 36.2 |
| | Matched | 1.6 | -5.8 | 4.8 | 0.1 | -3.1 | 4.2 |
| Years in present tasks | Unmatched | 26.3 | 4.7 | -10.9 | 26.3 | 4.7 | -10.9 |
| | Matched | -2 | -5.6 | 3.2 | -0.7 | -1.5 | -2 |
| Years of leisure | Unmatched | -20 | -47.8 | -66.3 | -20 | -47.8 | -66.3 |
| | Matched | 3 | -10.5 | 5.2 | 1.7 | -1.4 | -2.7 |
| No.of training courses | Unmatched | 59.1 | 76.4 | 84.9 | 59.1 | 76.4 | 84.9 |
| | Matched | 0.1 | -16.1 | -10.2 | 0.4 | -8.1 | -9.6 |
| Secondary level | Unmatched | -15.7 | -30.1 | -41.8 | -15.7 | -30.1 | -41.8 |
| | Matched | -4.8 | 9 | -3.8 | -1.3 | -2.5 | -5.9 |
| Lowest third level | Unmatched | 26.6 | 37.7 | 45.4 | 26.6 | 37.7 | 45.4 |
| | Matched | 14 | 0 | -0.7 | 7 | 2.3 | -0.1 |
| Lower third level | Unmatched | 13.7 | 29.4 | 43.5 | 13.7 | 29.4 | 43.5 |
| | Matched | 3.1 | 1.8 | 12.5 | 0.5 | 0.1 | 8.9 |
| Higher third level | Unmatched | 10.3 | 24.5 | 36.3 | 10.3 | 24.5 | 36.3 |
| | Matched | -13.6 | 0 | -6.5 | -3.7 | -0.2 | -1.3 |
| 20 - 199 employees | Unmatched | -5.3 | -9.1 | -2.6 | -5.3 | -9.1 | -2.6 |
| | Matched | 4.9 | -3.3 | -9.8 | 1.9 | -6.8 | -4 |
| > 199 employees | Unmatched | 30.6 | 48.8 | 45.2 | 30.6 | 48.8 | 45.2 |
| | Matched | -9.8 | -2.4 | 6.6 | -3.4 | 4 | -0.1 |
| Part time | Unmatched | -16.1 | -15.8 | -23.9 | -16.1 | -15.8 | -23.9 |
| | Matched | -2.9 | -8.8 | -10.6 | 0.6 | -1.4 | -7.5 |
| Fixed term | Unmatched | -20.8 | -25.1 | -26.8 | -20.8 | -25.1 | -26.8 |
| | Matched | 1.5 | 0 | -4 | 2.4 | -1.9 | -3.4 |
| Public | Unmatched | 32 | 39.6 | 35.3 | 32 | 39.6 | 35.3 |
| | Matched | 9.9 | 8.6 | 4 | 6.7 | 9.3 | -0.6 |

* Nn-matching, Nearest Neighbour matching, 2 neighbours

** Kernel-matching, namely Epanechnikov Kernel

After matching, the results look different. Some differences still exist between the two groups, but the t-statistics for the biggest differences after matching are around one, implying that the differences are statistically insignificant. Thus, one could judge that both of the matching methods used here have worked quite well. This makes it possible to continue to the second phase of estimating the ATT, Average Treatment effect on Treated.

## 7.4 Average Treatment effects on Treated, ATT

### *7.4.1 ATT year by year*

In Table 7.4, the results of the monthly wage effect of in-service training, i.e. the Average Treatment effects on Treated (ATT), are presented. The results for three groups of training are estimated independently[83] by means of two different methods and separately for each calendar year. The idea is to clarify the change of ATT over time. This is because the training was acquired during February 1999 to June 2000, and there is no ex ante information on possible lags of the possible effects.[84]

Table 7.4 also includes results for univariate OLS and multivariate OLS.[85] In univariate OLS, the forthcoming gross monthly wages are simply explained by received in-service training and a constant term. In multivariate OLS, all matching variables of Table 7.2 also are included as controls. Univariate OLS works as an example of what happens if circumstances are not controlled for in any way. Multivariate OLS works as an example of what happens when all matching variables are controlled for in a "traditional" way.

The OLS results are both surprising and unsurprising. There is nothing surprising in that the univariate OLS produces a notably high return to in-service training already in the first year after training, the estimates being in the range of 8 to 14 per cent. This must certainly be due to the above-characterized differences before matching. However, it is somewhat surprising that multivariate OLS produces almost the same return as two matching estimators, i.e. around 12-16 per cent for more than 10 days training in 2001-2002. Some differences exist, but they are not very large. The largest differences concern standard errors. They are smaller for multivariate OLS than for matching estimators.

According to the matching estimators, shorter spells in in-service training had no effect on monthly wages during 2000-2002. When less than three days of in-service training were

[83] Another possibility had been a matching analysis, where training can obtain three possible (ordered) values. However, the results of such a model can be very challenging from the interpretation point of view.

[84] Lengermann (1999) reports for young Americans that the largest part of the training returns emerge within one year. But are they that for older Americans as well? And are they that for Finnish wage-earners too?

[85] Only results for in-service training are reported, since coefficient estimates are used here only for comparisons to the primary interest of ATT.

Table 7.4. Returns to in-service training in 1999 by 2000, 2001 and 2002.

| *Dep.:log monthly wage*<br>Models / treatment: | *2000*<br>Coef./ATT | Std. Err. | *2001*<br>Coef./ATT | Std. Err. | *2002*<br>Coef./ATT | Std. Err. |
|---|---|---|---|---|---|---|
| *1 to 3 days in training* | | | | | | |
| Univariate OLS | 0.143** | 0.037 | 0.106** | 0.038 | 0.082** | 0.035 |
| Multivariate OLS | 0.030 | 0.034 | 0.013 | 0.035 | -0.009 | 0.031 |
| Nn-matching | 0.047 | 0.050 | 0.041 | 0.059 | 0.005 | 0.060 |
| Kernel-matching | 0.010 | 0.053 | 0.004 | 0.064 | -0.026 | 0.059 |
| *4 to 10 days in training* | | | | | | |
| Univariate OLS | 0.195** | 0.041 | 0.211** | 0.043 | 0.202** | 0.038 |
| Multivariate OLS | 0.005 | 0.039 | 0.042 | 0.042 | 0.032 | 0.035 |
| Nn-matching | 0.012 | 0.064 | 0.031 | 0.065 | 0.036 | 0.061 |
| Kernel-matching | -0.014 | 0.070 | 0.017 | 0.073 | 0.012 | 0.064 |
| *> 10 days in training* | | | | | | |
| Univariate OLS | 0.325** | 0.044 | 0.390** | 0.047 | 0.369** | 0.041 |
| Multivariate OLS | 0.071 | 0.044 | 0.164** | 0.047 | 0.119** | 0.040 |
| Nn-matching | 0.128 | 0.082 | 0.202** | 0.079 | 0.211** | 0.067 |
| Kernel-matching | 0.084 | 0.077 | 0.180* | 0.079 | 0.154* | 0.073 |
| | | | | | | |
| *treated / untreated* | | | | | | |
| 1 to 3 days in training | 292 / 567 | | 292 / 567 | | 292 / 567 | |
| 4 to10 days in training | 216 / 567 | | 216 / 567 | | 216 / 567 | |
| > 10 days in training | 191 / 567 | | 191 / 567 | | 191 / 567 | |
| Loss of obs. | 5 | | 1 | | 0 | |

* and ** are statistically significant coefficients at the level of 0.05 and 0.01.

acquired during the training period 1999-2000, the ATT of in-service training on the gross monthly wage is around zero. For 4 to 10 days of in-service training, the ATT increase a little from the previous group but so do the standard errors. It follows that all t-statistics are less than one, and the effects must be judged statistically insignificant.

The ATT for in-service training of more than 10 days was positive in 2001 and 2002, but statistically insignificant for year 2000.[86] This must be because part of the sample persons had acquired their in-service training during the year 2000 and its effects may not have entirely contributed to the annual salary of that year. But for the following two years the effects are positive and about the same size, 18 to 20 per cent for 2001 and 15 to 21 per cent for 2002, depending on the used matching estimator. Nearest Neighbour estimator produces higher and statistically more significant ATT than Kernel estimator.

[86] The group sizes of the treated and the untreated groups are shown in the lower part of the table. There is also shown the loss of observations resulting from the use of the common support rule. Six observations were lost because the propensity score index was greater or smaller than the control group's maximum or minimum.

### *7.4.2 ATT by 2001–2002*

The earlier research is based on data sets hard to compare, except perhaps with respect to gender. Gender is usually controlled for, and often results differ according to gender. For the US and Canada, Parent (1999, 2003) has reported higher returns for males. For the UK, Booth (1991) and Blundell et al. (1996, 1999) have reported higher returns for females. Against this background, I wanted to see the results for Finland when matching estimator is used.

Table 7.5 shows the results by gender. The results are estimated using exactly the same methods as before, but now for the average of monthly wages for the years 2001–2002. The aim of this arrangement is to get an idea of in-service training's wage effect in the short term in general. Possible lags in effects are a more difficult subject to be examined, because there is no ex ante information on the lag process between training and wages. From the table, the coefficients estimated by OLS are dropped, since they have been used for comparison purposes only, and this point of view is certainly fulfilled by now.

In Table 7.5, the ATT estimates for shorter spells of training are rather close to zero and the standard errors are large. Matching estimators produce statistically significant ATT estimates only when more than 10 days of in-service training are acquired, i.e. 17 to 21 per cent compared to no training at all. Actually, we can talk about 17 per cent, since Nearest Neighbour estimate is sensitive to the number of neighbours, and including a third neighbour reduces the ATT to 17 per cent.

However, ATT by gender is uncertain, even in this training group. For males ATT is 15 per cent and statistically significant when estimated by Nearest Neighbour. Estimation by Kernel leads to a point estimate of 13 per cent, suggesting that ATT is positive at the level of 8 per cent. The ATT for females are at least on the same level as those for males, but because of bigger standard errors the t-statistics suggest that ATT for women is positive at the level of 7 to 10 per cent.[87]

[87] For reasons that I do not know, the loss of observations was higher for females, i.e. 7 observations compared to 3 for men. But technically it was because of the common support rule. It drops the treatment observations whose propensity score is higher than the maximum or less than the minimum propensity score of the controls.

In the table, there are also results for 10 days or more in in-service training with two modified treatment and/or control groups. First, > 10 days, no degree, depicts the effect for more than 10 days in training as compared to all others, except those who have taken a new degree by 2002. This is for controlling the possible wage effect of formal degrees. Second, 11 to 49 days in training, depicts the effect for 11 to 49 days in training when longer spells of training are dropped as potential outliers, i.e. as "educational" training hard to compare with ordinary in-service training. This is for testing whether the ATT remains positive after training spells longer than two months are dropped.

The results from the first estimation show that when new degrees, as measured by change in the education code, are dropped, the ATT for more than 10 days in training remains positive. The point estimates for matching estimators are 17 to 18 per cent for the whole sample. My judgement about this is that the possible direct wage impact of the new degrees remains unclear, since the change in point estimates is smallish and statistically

Table 7.5. Returns to in-service training in 1999 by 2001-2002, by gender.

| *Dep.:log monthly wage* | *ALL* | | *Males* | | *Females* | |
|---|---|---|---|---|---|---|
| *Models / treatment* | *ATT* | *Std. Err.* | *ATT* | *Std. Err.* | *ATT* | *Std. Err.* |
| *1 to 3 days in training* | | | | | | |
| Nn-matching | 0.023 | 0.049 | -0.028 | 0.071 | -0.016 | 0.067 |
| Kernel-matching | -0.011 | 0.050 | -0.004 | 0.063 | -0.013 | 0.068 |
| *4 to 10 days in training* | | | | | | |
| Nn-matching | 0.034 | 0.061 | -0.008 | 0.073 | 0.050 | 0.075 |
| Kernel-matching | 0.014 | 0.061 | -0.015 | 0.064 | 0.051 | 0.076 |
| *> 10 days in training* | | | | | | |
| Nn-matching | 0.207** | 0.069 | 0.148* | 0.069 | 0.157 | 0.097 |
| Kernel-matching | 0.167** | 0.064 | 0.129 | 0.072 | 0.177 | 0.098 |
| *> 10 days, no degree* | | | | | | |
| Nn-matching | 0.181* | 0.076 | 0.117 | 0.074 | 0.138 | 0.093 |
| Kernel-matching | 0.170* | 0.071 | 0.124 | 0.078 | 0.149 | 0.097 |
| *11 to 49 days, no degree* | | | | | | |
| Nn-matching | 0.142* | 0.074 | 0.103 | 0.083 | 0.122 | 0.116 |
| Kernel-matching | 0.187* | 0.073 | 0.150 | 0.087 | 0.149 | 0.090 |
| | | | | | | |
| treated / untreated | | | | | | |
| 1 to 3 days in training | 292 / 567 | | 142 / 325 | | 150 / 242 | |
| 4 to 10 days in training | 216 / 567 | | 123 / 325 | | 93 / 242 | |
| > 10 days in training | 191 / 567 | | 110 / 325 | | 81 / 242 | |
| > 10 days, no degree | 186 / 561 | | 108 / 322 | | 78 / 239 | |
| 11 to 49 days, no degree | 158 / 561 | | 94 / 322 | | 64 / 239 | |
| Loss of observations | 6 | | 3 | | 7 | |

* and ** are statistically significant coefficients at the level of 0.05 and 0.01.

insignificant. On the other hand, this is not surprising as there were only 11 new degrees, 5 in the treatment group and 6 in the control group.[88] However, along with this adjustment, also the ATT for men becomes statistically insignificant.

The results from the second measurement show that the ATT for 11 to 49 days in training remains positive, i.e. dropping the 28 observations with training spells longer than two months does not change the general picture. The point estimates for matching estimators are 14 to 19 per cent for the whole sample. Thus, longer training spells are superior to shorter training spells even after the effect of "educational", apprenticeship kind of training spells are abolished from the comparison. The data do not reveal if these "educational" training spells actually are apprenticeships. Such cases, where employers pay for the costs of formal apprenticeships as in the case of "normal" in-service training, are possible in the Finnish educational system. But, from the data I can see that there must be other "educational" training programmes as well, the nature of which the data do not reveal.[89]

By dropping more observations from the upper end of training days, I found out that the point estimate for ATT became statistically insignificant at the level of maximum 30 days in training with both matching estimators. This, of course, is just experimenting. But it also includes the message that instead of two or three weeks in training one should also consider longer training spells, at least from the wage point of view. Other possible reasons, such as to make it possible to start with new tasks, is another research topic and is not discussed here.

Finally, I focused on some small groups. First, I estimated the ATT for the private sector and the public sector separately to find out whether the results between those two differ, as they differed in the life cycle model of Chapter 6. According to the results, both matching estimators bring about the same results for ten days or more in training.[90] For the private sector, Nearest Neighbour with two neighbours and Kernel brought the following results (standard errors in parenthesis): 0.155 (0.087) and 0.176 (0.095). Thus, for the private sector, the ATT is positive and statistically significant at the risk level of 6 to 7 per cent. For the public sector, these estimates were far from the statistically significant level.

[88] Besides, there were 9 new degrees with training less than 10 days.

[89] The data reveal if the person has taken part in apprenticeship during the last 12 months, but not days in it. However, by cross-tabulating it is possible to estimate that 5 of the 28 "educational" training spells probably were apprenticeships. Only one of those 5 had finished his degree by 2002, i.e. his education code had changed.

[90] Also results for shorter training spells were estimated but found statistically insignificant.

However, these estimates are only suggestive, as they were estimated from less than 200 observations.[91] But, with this reservation, the results by the sector of economy are in line with those in Chapter 6. The returns to training are better in the private sector. Moreover, they are very near to those depicted in Table 7.5 for all wage-earners.

Second, focusing only on training that is totally paid for by the employers, the corresponding results were 0.094 (0.085) and 0.115 (0.078) suggesting that the point estimates are lower and that the results are statistically significant only at risk the level 12 to 25 per cent. In my interpretation, these somewhat weaker results do not indicate smaller returns to totally employer-paid training. They just indicate that employers seldom finance all of the costs of long "educational" training spells, which usually are connected with higher wages.

Third, focusing only on those who were 45 or older in 2000, the age group with "education deficit", the corresponding ATT-estimates were as follows: 0100 (0.135) estimated by Nearest Neighbour and 0.053 (0.127) estimated by Kernel. These results suggest that the ATT for the official target group of adult education policies is far from statistically significant level. But also these results are suggestive, since the number of observations was around 200. From the evaluation point of view, this is unfortunate. But, taking the estimator as given, there is not much more to do.

## 7.5 Conclusions

In this chapter, I estimated the effect of in-service training acquired during the 12-month reference period in 1999–2000 on participants' gross monthly wages in 2000–2002. The results show that 10 days or more of in-service training have a positive wage effect. In-service training of more than 10 days during 1999–2000 increased gross monthly wages by 17 to 21 per cent by 2001–2002, depending on the used matching estimator. However, a statistically significant effect was found only for males.

The wage effect seems, once again, almost suspiciously high when compared with the return to formal educational attainment. Particularly so, since in the Finnish in-service training, the direct education costs are paid for by the employer. But, the results found in some other countries indicate that a suspiciously high return to training is not only a

[91] For the public sector, the results of the probit models for the given training spells were "strange" in a way that the only significant coefficients were found for years of work experience and previous training. Educational attainment and establishment size were found statistically insignificant.

Finnish phenomenon. Therefore, these results give at least as strong a basis for suspecting under-investment in in-service training in Finland as there are grounds for suspecting under-investment in on-the-job training in Anglo-American countries.

But are the results solely a consequence of in-service training acquired during the training period of 1999–2000? It is also possible that the wage effect is a consequence of career development, including promotions that are not included in the data. Therefore, in-service training would work as a filter for well paid positions just as higher education did in Arrow's (1973) screening hypothesis. In other words, in-service training would be a way of marking the promising wage-earners as the core labour force of the company, with lucrative career development prospects. This could be the weak point of this study, a problem of identification with regard to selection by the management.

The sample persons' self evaluation can be seen as support for this conclusion. They feel that wage returns have not been the most typical returns to the training acquired. The most acknowledged returns to training are reported to be improved chances for better or more demanding tasks. According to AES 2000, the percentage of sample persons giving feedback like this is twice as large as those who say they received positive wage returns. And if this really is the case, part of the better wages are due to these better and more demanding tasks, which are not controlled for in the matching process.

Another uncontrolled factor is working hours. From the discussions of the preceding chapters it should be clear that the results of the OLS estimations are sensitive to the way of measurement of the dependent variable, and there is no reason to believe that matching estimation would be free of this measurement problem. Thus, part of the ATT could be caused by an increase in working hours, without corresponding increase in hourly wages. However, in spite of these uncontrolled factors, I conclude that high returns to training are a good hypothesis for further research.

In the literature, there are competing explanations for the high returns to training, both from the demand and supply side of training, as discussed in section 7.1. Without opening here the discussion, based mainly on wage effects from participation in training, I focus on one point of Pischke (2005, 6). He makes a difference between short and long spells of training and argues, in a hypothetical manner, that "short training spells indeed have high returns, but long training spells have low returns". The results of this chapter suggest

the opposite, i.e. long spells, such as several weeks in training, yield better returns than, for example, one week, preferred by Pischke.

Moreover, these results are more positive for adult education and training than the results published by Kruhse-Lehtonen (2007). Her results suggest that complementary adult education, as measured by a change in the degree code, is less profitable than education at a young age. But, on the other hand, the results based on formal education like this, is another matter than results based on informal training, like in-service training, which only seldom leads to a change in the degree code. And when it does, it very often seems to take place before the prime working age of 35 to 54, as if those people had been finalizing their basic vocational education.

I conclude that the inclusion of in-service training into the system of complementary vocational education and training has to be considered. The volume of formal complementary vocational education is just too small to form the core of vocational adult education. With around 0.8 per cent average annual change in the degree code of wage-earners, the problem of "education deficit" of the elderly wage-earners will not be solved. This is especially true, since most of the new degrees are taken before the lower age limit of the official target group, i.e. 45 and older in year 2000.

On the other hand, the results from the probit regressions indicate that the possibilities for the internal labour markets, where the above suggested formalisation of in-service training could possible work, are limited to large establishments, i.e. establishments with at least 200 persons on the pay-roll. Thus, other kind of arrangements should be considered for around 40 per cent of the wage-earners too. And depending on how many and what kind of workplaces the establishment consist of, also other characteristics than size of establishment are needed to form a coherent concept of internal labour markets.

These figures and principles are of course tentative, but certainly there are also a number of establishments unable to formalise their in-service training to such "products" that possibly could form modules for exams of the degree-based educational system. Especially problematic this is for small establishments, say 20 persons or less, which also today are forced to organise their training in the form of learning-by-doing, or very near to that. However, why not to start from the big establishments, where internal labour markets exist, and there is a win-win opportunity available?

In the literature, there are differences in returns by gender, in one country for the benefit of males, in another for the benefit of females. For Finland, according to this study, the return for females is about the same size as for males. However, the return for females is more uncertain, as one can see from the bigger standard errors. They are also reported in some other studies, such as those for the UK in Table 2.1 of Chapter 2. On the other hand, the results suggest that the returns to the private sector are better than for the public sector. These results are suggestive, i.e. not statistically significant in the strict sense of the work, but in line with results of Chapter 6.

Comparing these results with results from other countries is difficult, as any results are always dependent on the data and the methods used as well as the institutions involved. A good comparison would require close comparability of both the data characteristics and the methods used, as Zhiao (2006) suggests for the type of matching estimators used here. For other estimators, Zwick (2006) reaches similar conclusions with respect to productivity research. In addition, differences in labour market institutions, such as the way of organizing training given at the workplace, raise additional doubts about the comparability of the results.

Would it not then be better to state that Finnish in-service training has its own special context, and without specific reasons, the results should not be compared with results from countries where training is for the most part paid for by the wage-earners? Mincer's (1989) note of the importance of direct education costs can be interpreted as such a warning. If direct costs are not taken into account, the return to training is over-estimated. But as in Finland in-service training costs are paid for by the employers, this problem of over-estimation is not so obvious. Accordingly, the above returns should be very close to "pure income" for wage-earners.

# 8. Summary

The wage effect of training is a difficult research topic. Typically, the results from the literature suggest that returns to training are substantial, even surprisingly so, as compared to the return to other human capital investments, such as the return to formal education measured by levels of education. On the other hand, these results are open to criticism based on differences in models, methods, country context and data. Therefore, these matters were discussed in detail in Chapters 2, 3 and 4 before the three empirical research topics of Chapters 5, 6 and 7 were modelled.

*Chapters 2 to 4*

In Chapter 2, I report results from the literature, and conclude that returns to training are good, almost too good to be true returns to training. Besides, I conclude that two points of view look particularly interesting when contributing to the returns to training discussion. First, if the research problem concerns the rate of return over the life cycle, in comparison to other human capital variables, the OLS estimation of Mincer's earnings function (1974) looks like a natural starting point. For life-long learning a life sycle model is needed.

Second, if the research topic is short-run returns to training, other models and methods, where alternative wage effects are controlled for, need to be assessed. In all cases, the processes behind the selection for training must be clarified in a national context, since it seems to be that training in Finland differs from that in the US and the UK, on which most of the research is based. And so do the labour market institutions, such as collective bargaining, which in Finland is coordinated and leaves much less space for workplace bargaining than in the US, for example.

In Chapter 3, I focus on the Finnish educational system, including adult education and training. First, I show that the actual years of education vary around the norm lengths used for estimating the standard Mincerian earnings function. Second, I discuss the problems of the Finnish educational system, such as "education deficit", which challenge adult education and training. Third, I conclude that training is still to be seen as an external activity beyond the formal educational system, since the most common form of vocational adult education, in-service training – a Finnish parallel to American on-the-job training, only seldom leads to changes in the education code.

In Chapter 4, I describe the available data, the Adult Education Surveys of 1990, 1995 and 2000, carried out by Statistics Finland, and the income data from the tax authority's register, wages and months worked in a calendar year. From the income data, I construct the dependent variable, gross hourly wages, and show how it differs from the typically used annual earnings. From the survey data, I present descriptive statistics on the key human capital variables, such as the actual years of education and work experience, the number of life-time training courses, and the number of days in in-service training during the 12 months' reference period, and discuss the possibilities and restrictions of the data. I conclude that the number of life-time training courses is a good measure to be used in estimations over the life cycle. The number of days in in-service training during the 12 months' reference period suites best for longitudinal estimations, where the focus is on short-run returns to training.

*Chapter 5*

In Chapter 5, I focus on the 1990s. I start from Mincer's earnings function and ask what happens when the earnings function is expanded to include the lifetime stock of vocational training courses, which, in the 1990s, have increased most at the primary level of education. The focus of the analysis is not just on returns to training, but also on other effects, such as changes in returns to educational attainment and work experience. First, these issues are analysed by means of three cross-sections of 1990, 1995 and 2000 separately. Then I switch to pooled data and estimate the earnings function by gender and wage level in order to discover whether training has a statistically significant role in wage differences between these groups.

The results of Chapter 5 show that training matters. When training is included in a quite typical Mincerian earnings function, coefficient estimates for the key human capital variables, such as educational attainment and work experience, decrease. The biggest decrease for educational attainment was located to the lowest tertiary level of education, where the largest groups are technicians, business services, marketing, and grammar school personnel, suggesting that the biggest wage premiums for training take place right there.

The coefficient estimate for the training variable itself proves to be positive across several specifications, such as training included as a set of indicator variables and as a continuous variable indicating the number of training courses acquired during the working life, a training measure that was constructed in the very same way as the years of education in the standard Mincerian approach, i.e. by replacing the training indicators' training ranges by their class midpoints. After pooling the data, the results suggest that the wage effect of training is biggest in the lowest income deciles. Thus, training, as well as education, has the potential to decrease income inequalities between wage-earners. But in the case of training the potential seems to be more powerful, as compared to the results that are available for education.

I conclude that the change in training allocation, as identified by a decrease in the difference of training courses for those with a primary level of education and those with a tertiary level of education, is likely to be demand driven, i.e. driven by labour shortages at the end of the 1990s. In such circumstances employers had to invest more in wage-earners with lower levels of education. But, it is also possible, that the supply of formal adult education and training has favoured wage-earners with lower levels of education. The data do not allow division into two exact proportions, according which I could conclude which of the two has contributed more. All we know is that, in the 1990s, the proportion of in-service training of all vocational education and training has remained dominant and, actually, increased a bit.

*Chapter 6*

In Chapter 6, I focus on year 2000 and deepen the previous analysis in three ways: first, by modifying the earnings function; second, by modelling the selection processes for positive wages and the positive number of training courses; and third, by expanding the

set of explanatory variables. The modification of the earnings function includes replacing potential years of education and work experience by actual years, allowing for years of leisure, measured as years out of work and education, and a measure of ability, measured as the deviation of the actual mean years needed to execute each level of education. The modified earnings function is then estimated in two steps, including the selection correction terms and a rather qualified set of work experience variables, such as seniority and tenure. Special attention is given to gender and the sector of the economy.

The results of Chapter 6 show that model specification matters. When the Mincerian earnings function is modified in the way described above, the results differ from those presented in Chapter 5. The coefficient estimate for one training course is still positive, i.e. around 1.1 per cent, but less than that without the modification. The decrease in the coefficient is due to better measurement of the "competing" key human capital variables, including ability. But yet the results suggest under-investment in training, since the relative wage effect of one training course, on average around one week in training, is about one fifth of the wage effect of one more year of education. However, apart from the results of Chapter 5, after controlling the types of work experience, the returns for men and women are about the same size. But the returns for the private sector are bigger than for the public sector, where the selection for training affects the results most. The two-step estimation method refers to occupations, and occupation-related co-operation procedures in assessing the need for training, as a probable source for selection.

After looking more closely at the data, it is possible to talk about self-selection-oriented training in the public sector, since training choices are typically employee-driven, as compared to the private sector, where employers usually take the initiative. In the public sector, the typical reason for training is the ambition for (vocational) self-development and job security. According to subjective statements, this seems to hold for the professional occupations too. On the other hand, also market conditions in the 1990s, such as the tight budget constraints for the public sector, must have affected to selection for training.

These ambitions seem to contribute to the demand for training too: 74 per cent of the wage-earners in the public sector, as compared to 62 per cent in the private sector, expressed a wish to participate in training during the next year after the interview in year 2000. This contradicts human capital theory, which assumes that the demand for training arises from expected wage returns, i.e. the higher the returns the more training. Here it is the opposite. In the public sector, where returns are the weakest, and statistically zero, the demand for

training is highest. Thus, if we still talk about rational behaviour, the demand has to be driven by other returns than wage returns. Even consumption kind of demand may be possible in the public sector.

*Chapter 7*

In Chapter 7, the study problem differs from the life sycle approach of the two previous chapters. I focus on in-service training, acquired during the 12-month reference period before the interview for the adult education survey of 2000, and estimate the short-run returns to that training over the following two years. A matching model is constructed to estimate the Average Treatment effect on Treated, ATT, through comparisons with those who did not receive in-service training during the reference period. All other forms of adult education are ignored. The matched observations are then used to estimate the effect of in-service training on monthly wages over the years 2001–2002. Special attention is given to gender and control over the composition of the "treated" group.

The results of Chapter 7 show that the number of days in in-service training matter. After matching the short-term wage effects of three training groups with three similar comparison groups, only training of 10 days or more brings about a statistically significant positive wage effect of around 17 per cent. The results suggest, at least in some specifications, that this wage effect is statistically significant for men, but not for women. For women, the point estimate is about the same size as that for men, but because of bigger standard errors the result is statistically insignificant. The wage effect also remained positive after persons with "educational" training, such as apprenticeships and other exceptionally long-lasting training and training that during the two-year follow-up period had led to changes in their education codes, were dropped.

But is 17 per cent a true return to in-service training of 10 days or more? I conclude that it is a good hypothesis for further research to test, since high returns is quite a typical result in the field's literature. On the other hand, there are some uncontrolled factors, such as other management programmes and working hours, which I was not able to include in the matching process. Therefore, it is possible that part of the return is due to some other factors than those identified in the matching process. One part of the return is possibly due to firm-specific selection processes, and the other part is possible due to increase in working hours.

*Altogether*

The results of chapters 5 to 7 reinforce the picture arising from the literature. Training has a positive wage effect independent of other "competing" key human capital variables. Moreover, the wage effect of training is large, even suspiciously large, compared with that of educational attainment acquired at a young age. According to point estimates of a life cycle model, the return to one training course varies from 1 to 1.6 per cent, depending on the model used. It is a very good average return compared with the 5 to 7 per cent average return on one year of education. This conclusion holds even if the return on one more year of education should be downward biased, as the critics of the Mincerian earnings function approach would possibly argue.

Are we talking about under-investment in training? I think we are, and we should consider investing more in training. This conclusion arises from both training measurements of the thesis, i.e. the number of training courses over the life cycle and the number of training days during one year's reference period. However, my policy recommendation is not to substitute training for education, since good results from training are connected to good results from basic education. My suggestion is to retain the focus on the complementarity of education and training, but in a way that challenges the restrictions of the Finnish educational system, especially in both ends of working life.

In 2000, the educational system was not able to provide more than 80 to 85 per cent of the young with vocational degrees, i.e. around as much as in 1990. Thus, new forms of vocational education and training, after the basic level of education, are needed even at a young age, but especially among people who today are 50 and older. I conclude that these new forms of activity should be connected to training at work, since in-service training has remained the dominant form of vocational adult education and training, and, in spite of official goal-setting of the 1990s, advancement in other forms of complementary education and training has remained limited.

Actually, during the period of 1995 to 2000, the proportion of in-service training of all adult education and training has increased. In the beginning of 2000s, as an example of formal adult education, less than one per cent of the wage-earners took new degrees in one year's time, and almost half of them before the prime working age. This is just too little to challenge the "education deficit" among the elderly wage-earners for whom the pay-off time, both mental and economic, is just too short to motivate them to schooling type

of voluntary adult education. Among the younger, naturally, all other forms of education and training are needed too.

According to some studies, the returns to training are different for men and women. But in Finland, according to my thesis, the wage effect is about the same size for both sexes, when the model is specified in a proper way. The difference that remains is that the effect is more uncertain for females than for males. My own assessment of the possible reasons for this rests on the relationship between family and working life. Females' obligations in the family have led to discontinuous work careers, and, thus, decreased opportunities in utilizing the training obtained at work. I conclude that this interpretation may not be a surprising item of news, but it certainly refers to a persistent kind of problem.

When it comes to differences between the private and the public sector, they seem to be real. The results suggest that the returns to training in the private sector are better than those in the public sector. But, these results are sensitive to selection for training, particularly in the public sector and the private services, where the factors affecting selection for training, may also affect wages directly. This selection may be due to the tradition of co-operation when the need for training at workplaces is assessed. But there may be some other reasons too. Whatever the reasons are, they need to be clarified for the public sector particularly, since, in the long run, positive wage returns to training are necessary for the public sector as well. Otherwise problems like poaching, i.e. "fishing" people from the public to the private sector, are difficult to resist.

The institutional framework in assessing the need for training, the co-operation regulations within establishments, was created in the processing industries one generation ago. This framework is proactive, as today's social scientists would argue, but under-utilized and not a framework for today's training discussion. In Finland, the economic literature on this topic is almost nonexistent, and so it seems to be with social sciences as well. The only science that has had some follow-up activity is labour law. But even there the focus has been on reactive action, such as the role of training in collective dismissals. In the context of local bargaining, i.e. workplace and enterprise bargaining, there is also some evidence of proactive bargaining on training. However, if the co-operation regulations had had a strategic role in the proactive adaptation for technological change in general, we would today face an extensive literature of the impacts of these regulations in many sciences. This is not the case in Finland.

From the viewpoint of economics, the reasons for this may be connected to economists' understanding of the competitive market behaviour. "Easy fire - easy hire" policies, arising either from the flexibility literature of the 1980s and the "flexicurity" literature of the 2000s, do not favour collective co-operation procedures based on the values of employment protection. In my opinion, not verified in this thesis, it is also possible that these policies undermine government's contributions, such as investments in apprenticeships and training for labour market reasons, aiming to increased employability. Without establishments' commitment to the values of employment protection, such as permanent employment after the training, the social returns to training remain limited. But, of course, there is always a limit, conditional to market demand, for to duties of an establishment. Training is not a cure for market instability, but it is one more marginal opportunity for a resourceful agent.

I conclude that in spite of some restrictions of the data, the results of my thesis give a representative picture of training and its wage effect among Finnish wage-earners. I also conclude that the results increase our understanding of the economic relationship between education and training in the Finnish educational system. Basically, these results are for Finland and should not be compared with countries where the context is different. My policy suggestion is that we should consider the inclusion of in-service training in the Finnish educational system by strengthening its co-operative nature in assessing the need for training at workplaces. In my interpretation, this would be in line with the steps taken in the 1990s, the steps for lowering the borderline between education and training.

On the other hand, the underlined co-operation procedure within establishments has remained kind of a "black box" of the thesis. This is problematic, since without a good understanding of the social and economic drivers within establishments, the internal labour markets remain an under-utilized opportunity. The results suggest that the internal labour markets are actually a possibility for large establishments only, since the probability of in-service training is so much higher there. But is this just because of the size of establishments? Or is it so that size only facilitates, through the hierarchies of work organisation, and necessitates, through the co-operation regulations and committees, activity that in small establishments takes the form informal learning-by-doing?

In the thesis, these questions remain open. Therefore, further research is needed of the true workings of the box. Some questions for further research would thus be the following: What is the relationship between wage and training bargaining, i.e. is it complementary, and if, in which way? Do the co-operation procedures within establishments actually

work in such a proactive way as they are written in acts and agreements? Are the shop stewards and managers able to distinguish training from other questions, such as wages and working times? How does the co-operation actually take into account the needs of general and firm-specific training? And what are the impacts of other possible drivers, such as management programs for key personnel, on selection for in-service training?

To the best of my knowledge, social partners have never evaluated these questions in a strategic way, i.e. including an explicit kind of separation between wages and training in collective bargaining. From the trade-unions side, the separation could take the form of dual representation at the workplace: a shop-steward for wages and a learning representative for training, with special attention on those working without a vocational basic education and on those working in small establishments.

From the employers' side, the separation of training and wage-setting would open up a new window for enterprise bargaining, which anyway seems to be employers' priority all over the world. One might expect to see more training in the new ways working, such as team work and lean production, which usually are questions of co-operation and collective bargaining. In collective bargaining between unions and confederations this possibility is discussed, but it has never become a common priority. I conclude that it should become. According to the results, there is a "win-win opportunity" available.

For utilising this opportunity in the micro-level, some macro-level arrangements are needed. One arrangement is a financial framework agreement specifying the contributions from the stakeholders of this enlarged system of formal vocational adult education. In a "Latin-European way", for example, a certain percentage of the wage sum – zero point something - could be put aside either for training on bi-partite basis or then for a training institution of the formal educational system. Another arrangement is the design of the system as a whole, making it functional, transparent and open for political adjustment. In the literature, this seems to be a very complicated and a very delicate matter, which I gladly leave for the future research to solve.

During the course of this study, some results of the Adult Education Survey 2006 become public on the internet. They depict an increase in the volume of adult education in all age groups, and especially among the 55 to 64-year-olds. This observation has led to discussions about training as a means of delaying retirement by positive means, instead of just stipulating a higher pension age. This is certainly another topic for further research,

since, as discussed in this thesis, there are also other returns than wage returns to be evaluated. And, as also depicted in this thesis, "education deficit" is biggest among the oldest wage-earners.

But "education deficit" among the elderly is not the only challenge to be studied. There are also problems regarding the young, such as the risk of labour market exclusion among those below 20 years of age and the slow school-to-work transition among the 20 to 29 year-old population, where the role of training is to be clarified. Thus, we also need to find out what else has happened in the 2000s, as compared to the findings from the 1990s. For example, has the good development of the low-skilled continued, as measured by the increase in training for those working without a vocational degree?

After a perusal of the codebook of the Adult Education Survey 2006, one problem seems to remain. In the data, it is still impossible to distinguish between general and firm-specific training. From the viewpoint of empirical research this is problematic and underlines the importance of other data sources in clarifying the question of transferability of skills between establishments and sectors of economy. For country comparisons, a common database, such as the European Social Survey, is needed.

# Appendices

Appendix 5.1. OLS for earnings function without training

| *Dep.: log hourly wage* | *1990* | | *1995* | | *2000* | |
|---|---|---|---|---|---|---|
| | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| *Independent*: | | | | | | |
| Male | 0.249** | 0.030 | 0.198** | 0.024 | 0.181** | 0.023 |
| Uusimaa area | 0.158** | 0.033 | 0.108** | 0.026 | 0.102** | 0.027 |
| Processing industries | 0.348** | 0.133 | 0.211* | 0.097 | 0.235** | 0.058 |
| Private services | 0.285** | 0.134 | 0.178 | 0.096 | 0.186** | 0.058 |
| Public services | 0.391* | 0.134 | 0.242* | 0.096 | 0.164** | 0.057 |
| Secondary | 0.162** | 0.037 | 0.094 | 0.034 | 0.036 | 0.032 |
| Lowest tertiary | 0.370** | 0.044 | 0.226** | 0.043 | 0.259** | 0.037 |
| Lower tertiary | 0.566** | 0.054 | 0.459** | 0.053 | 0.391** | 0.042 |
| Upper tertiary | 0.753** | 0.069 | 0.692** | 0.053 | 0.676** | 0.070 |
| Work experience | 0.030** | 0.005 | 0.039** | 0.004 | 0.029** | 0.005 |
| Work exp.squared/100 | -0.036** | 0.011 | -0.059** | 0.010 | -0.045** | 0.010 |
| Constant | 1.180** | 0.138 | 1.321** | 0.118 | 1.640** | 0.075 |
| Number of observations | 2069 | | 2008 | | 1875 | |
| F( k, n-k) | 35.69 | | 40.55 | | 35.02 | |
| Prob > F | 0.000 | | 0.000 | | 0.000 | |
| R-squared | 0.158 | | 0.196 | | 0.218 | |
| Root MSE | 0.655 | | 0.534 | | 0.474 | |

Robust standard errors, * and ** are statistically significant coefficients at the level of 0.05 and 0.01.

Appendix 5.2. OLS for earnings function by gender and level of education

| *Dep.: log hourly wage* | *All* | | *Females* | | *Males* | |
|---|---|---|---|---|---|---|
| | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| *Independent* | | | | | | |
| Male | 0.206** | 0.015 | | | | |
| Uusimaa area | 0.111** | 0.017 | 0.101** | 0.022 | 0.129** | 0.025 |
| Processing industries | 0.259** | 0.054 | 0.247* | 0.120 | 0.269** | 0.061 |
| Private services | 0.193** | 0.054 | 0.240* | 0.119 | 0.167** | 0.061 |
| Public services | 0.233** | 0.054 | 0.295* | 0.118 | 0.178** | 0.061 |
| Secondary level | 0.092** | 0.031 | 0.118** | 0.045 | 0.063 | 0.043 |
| Lowest tertiary level | 0.185** | 0.044 | 0.194** | 0.060 | 0.133* | 0.063 |
| Lower tertiary level | 0.299** | 0.064 | 0.324** | 0.103 | 0.270** | 0.078 |
| Upper tertiary level | 0.650** | 0.101 | 0.630** | 0.164 | 0.669** | 0.127 |
| Work experience | 0.024** | 0.003 | 0.020** | 0.004 | 0.029** | 0.004 |
| Work exp.squared/100 | -0.034** | 0.006 | -0.025** | 0.009 | -0.044** | 0.009 |
| Training*primary | 0.016** | 0.002 | 0.013** | 0.003 | 0.019** | 0.003 |
| Training*secondary | 0.013** | 0.002 | 0.008** | 0.003 | 0.018** | 0.003 |
| Training*lowest third | 0.018** | 0.003 | 0.014** | 0.004 | 0.025** | 0.004 |
| Training*lower third | 0.023** | 0.004 | 0.013 | 0.007 | 0.030** | 0.006 |
| Training*upper third | 0.012 | 0.007 | 0.009 | 0.011 | 0.014 | 0.009 |
| 1995 | -0.094** | 0.018 | -0.116** | 0.026 | -0.077** | 0.025 |
| 2000 | -0.126 | 0.016 | -0.122** | 0.022 | -0.127** | 0.023 |
| Constant | 1.487 | 0.066 | 1.510** | 0.137 | 1.649** | 0.076 |
| Number of observations | 5952 | | 2932 | | 3020 | |
| F( k, n-k) | 80.65 | | 29.87 | | 49.23 | |
| Prob > F | 0.000 | | 0.000 | | 0.000 | |
| R-squared | 0.210 | | 0.160 | | 0.225 | |
| Root MSE | 0.558 | | 0.548 | | 0.565 | |

Robust standard errors, * and ** are statistically significant coefficients at the level of 0.05 and 0.01.

Appendix 5.3. Quantile regression by gender.

| | *Dep.: log hourly wage* | *Females* | | *Males* | |
|---|---|---|---|---|---|
| | *Independent:* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| q10 | | | | | |
| | Uusimaa area | 0.100 | 0.043 | 0.043 | 0.037 |
| | Processing industries | 0.221 | 0.554 | 0.495 | 0.128 |
| | Private services | 0.205 | 0.558 | 0.280 | 0.125 |
| | Public services | 0.273 | 0.561 | 0.421 | 0.124 |
| | Secondary | 0.018 | 0.063 | 0.058 | 0.048 |
| | Lowest tertiary | 0.203 | 0.059 | 0.208 | 0.060 |
| | Lower tertiary | 0.341 | 0.076 | 0.384 | 0.062 |
| | Upper tertiary | 0.452 | 0.097 | 0.538 | 0.087 |
| | Work experience | 0.034 | 0.008 | 0.041 | 0.008 |
| | Work exp.squared/100 | -0.044 | 0.016 | -0.071 | 0.019 |
| | Training courses | 0.026 | 0.004 | 0.032 | 0.004 |
| | 1995 | 0.349 | 0.086 | 0.027 | 0.043 |
| | 2000 | 0.472 | 0.085 | 0.135 | 0.047 |
| | Constant | 0.389 | 0.557 | 0.658 | 0.125 |
| | Pseudo R2 | 0.183 | | 0.167 | |
| q20 | | | | | |
| | Uusimaa area | 0.111 | 0.021 | 0.089 | 0.027 |
| | Processing industries | 0.291 | 0.145 | 0.352 | 0.078 |
| | Private services | 0.264 | 0.140 | 0.213 | 0.079 |
| | Public services | 0.287 | 0.139 | 0.228 | 0.074 |
| | Secondary | 0.067 | 0.027 | 0.028 | 0.029 |
| | Lowest tertiary | 0.222 | 0.031 | 0.154 | 0.034 |
| | Lower tertiary | 0.337 | 0.039 | 0.314 | 0.034 |
| | Upper tertiary | 0.503 | 0.037 | 0.513 | 0.041 |
| | Work experience | 0.028 | 0.004 | 0.036 | 0.005 |
| | Work exp.squared/100 | -0.037 | 0.008 | -0.061 | 0.011 |
| | Training courses | 0.019 | 0.002 | 0.023 | 0.002 |
| | 1995 | 0.066 | 0.032 | -0.023 | 0.027 |
| | 2000 | 0.165 | 0.029 | 0.093 | 0.024 |
| | Constant | 0.958 | 0.149 | 1.181 | 0.094 |
| | Pseudo R2 | 0.142 | | 0.165 | |
| q30 | | | | | |
| | Uusimaa area | 0.093 | 0.015 | 0.093 | 0.022 |
| | Processing industries | 0.127 | 0.105 | 0.258 | 0.043 |
| | Private services | 0.115 | 0.100 | 0.137 | 0.048 |
| | Public services | 0.122 | 0.101 | 0.126 | 0.044 |
| | Secondary | 0.059 | 0.018 | 0.046 | 0.019 |
| | Lowest tertiary | 0.197 | 0.022 | 0.184 | 0.027 |
| | Lower tertiary | 0.331 | 0.031 | 0.356 | 0.032 |
| | Upper tertiary | 0.485 | 0.034 | 0.560 | 0.037 |
| | Work experience | 0.021 | 0.003 | 0.031 | 0.003 |
| | Work exp.squared/100 | -0.030 | 0.006 | -0.051 | 0.006 |
| | Training courses | 0.013 | 0.001 | 0.020 | 0.002 |
| | 1995 | -0.002 | 0.019 | -0.035 | 0.022 |
| | 2000 | 0.106 | 0.017 | 0.059 | 0.020 |
| | Constant | 1.439 | 0.103 | 1.451 | 0.051 |
| | Pseudo R2 | 0.140 | | 0.170 | |

... continues

| | *Dep.: log hourly wage* | *Females* | | *Males* | |
|---|---|---|---|---|---|
| | *Independent* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| q40 | | | | | |
| | Uusimaa area | 0.089 | 0.013 | 0.112 | 0.019 |
| | Processing industries | 0.108 | 0.085 | 0.224 | 0.037 |
| | Private services | 0.105 | 0.080 | 0.123 | 0.041 |
| | Public services | 0.100 | 0.080 | 0.100 | 0.039 |
| | Secondary | 0.045 | 0.021 | 0.045 | 0.021 |
| | Lowest tertiary | 0.183 | 0.022 | 0.181 | 0.028 |
| | Lower tertiary | 0.316 | 0.028 | 0.348 | 0.034 |
| | Upper tertiary | 0.517 | 0.041 | 0.551 | 0.035 |
| | Work experience | 0.018 | 0.002 | 0.031 | 0.003 |
| | Work exp.squared/100 | -0.027 | 0.005 | -0.051 | 0.006 |
| | Training courses | 0.013 | 0.001 | 0.019 | 0.002 |
| | 1995 | -0.043 | 0.020 | -0.086 | 0.022 |
| | 2000 | 0.067 | 0.018 | 0.026 | 0.021 |
| | Constant | 1.609 | 0.080 | 1.608 | 0.043 |
| | Pseudo R2 | 0.137 | | 0.174 | |
| q50 | | | | | |
| | Uusimaa area | 0.088 | 0.014 | 0.127 | 0.021 |
| | Processing industries | 0.081 | 0.067 | 0.206 | 0.035 |
| | Private services | 0.082 | 0.063 | 0.121 | 0.040 |
| | Public services | 0.074 | 0.064 | 0.068 | 0.037 |
| | Secondary | 0.049 | 0.019 | 0.040 | 0.023 |
| | Lowest tertiary | 0.176 | 0.022 | 0.173 | 0.031 |
| | Lower tertiary | 0.307 | 0.027 | 0.356 | 0.034 |
| | Upper tertiary | 0.539 | 0.035 | 0.561 | 0.034 |
| | Work experience | 0.017 | 0.002 | 0.029 | 0.003 |
| | Work exp.squared/100 | -0.023 | 0.005 | -0.047 | 0.007 |
| | Training courses | 0.012 | 0.001 | 0.018 | 0.001 |
| | 1995 | -0.074 | 0.018 | -0.110 | 0.018 |
| | 2000 | 0.039 | 0.019 | 0.004 | 0.019 |
| | Constant | 1.729 | 0.067 | 1.744 | 0.041 |
| | Pseudo R2 | 0.128 | | 0.177 | |
| q60 | | | | | |
| | Uusimaa area | 0.084 | 0.016 | 0.134 | 0.020 |
| | Processing industries | 0.128 | 0.057 | 0.214 | 0.044 |
| | Private services | 0.123 | 0.052 | 0.129 | 0.047 |
| | Public services | 0.103 | 0.051 | 0.065 | 0.045 |
| | Secondary | 0.046 | 0.017 | 0.030 | 0.025 |
| | Lowest tertiary | 0.184 | 0.020 | 0.160 | 0.027 |
| | Lower tertiary | 0.293 | 0.028 | 0.342 | 0.039 |
| | Upper tertiary | 0.573 | 0.042 | 0.567 | 0.044 |
| | Work experience | 0.017 | 0.003 | 0.025 | 0.003 |
| | Work exp.squared/100 | -0.023 | 0.006 | -0.039 | 0.008 |
| | Training courses | 0.011 | 0.002 | 0.018 | 0.002 |
| | 1995 | -0.133 | 0.021 | -0.124 | 0.023 |
| | 2000 | -0.025 | 0.019 | -0.004 | 0.021 |
| | Constant | 1.827 | 0.054 | 1.873 | 0.053 |
| | Pseudo R2 | 0.118 | | 0.178 | |

* standard errors by bootstrapping

... continues

| | *Dep.: log hourly wage* | *Females* | | *Males* | |
|---|---|---|---|---|---|
| | *Independent* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| q70 | | | | | |
| | Uusimaa area | 0.079 | 0.018 | 0.143 | 0.020 |
| | Processing industries | 0.177 | 0.068 | 0.203 | 0.038 |
| | Private services | 0.174 | 0.068 | 0.128 | 0.040 |
| | Public services | 0.153 | 0.063 | 0.053 | 0.040 |
| | Secondary | 0.074 | 0.021 | 0.030 | 0.020 |
| | Lowest tertiary | 0.192 | 0.026 | 0.156 | 0.027 |
| | Lower tertiary | 0.303 | 0.032 | 0.348 | 0.041 |
| | Upper tertiary | 0.629 | 0.045 | 0.600 | 0.037 |
| | Work experience | 0.015 | 0.003 | 0.022 | 0.004 |
| | Work exp.squared/100 | -0.020 | 0.006 | -0.031 | 0.008 |
| | Training courses | 0.009 | 0.002 | 0.016 | 0.002 |
| | 1995 | -0.152 | 0.024 | -0.136 | 0.019 |
| | 2000 | -0.061 | 0.021 | -0.021 | 0.019 |
| | Constant | 1.911 | 0.070 | 2.009 | 0.053 |
| | Pseudo R2 | 0.105 | | 0.186 | |
| q80 | | | | | |
| | Uusimaa area | 0.080 | 0.018 | 0.141 | 0.022 |
| | Processing industries | 0.185 | 0.085 | 0.142 | 0.063 |
| | Private services | 0.168 | 0.085 | 0.084 | 0.064 |
| | Public services | 0.162 | 0.082 | 0.005 | 0.067 |
| | Secondary | 0.066 | 0.020 | 0.046 | 0.025 |
| | Lowest tertiary | 0.163 | 0.025 | 0.176 | 0.032 |
| | Lower tertiary | 0.308 | 0.048 | 0.388 | 0.036 |
| | Upper tertiary | 0.674 | 0.072 | 0.626 | 0.053 |
| | Work experience | 0.006 | 0.004 | 0.015 | 0.004 |
| | Work exp.squared/100 | -0.005 | 0.007 | -0.014 | 0.010 |
| | Training courses | 0.009 | 0.002 | 0.015 | 0.002 |
| | 1995 | -0.150 | 0.021 | -0.137 | 0.020 |
| | 2000 | -0.084 | 0.023 | -0.012 | 0.022 |
| | Constant | 2.137 | 0.087 | 2.205 | 0.068 |
| | Pseudo R2 | 0.101 | | 0.186 | |
| q90 | | | | | |
| | Uusimaa area | 0.063 | 0.037 | 0.175 | 0.042 |
| | Processing industries | 0.151 | 0.107 | 0.109 | 0.074 |
| | Private services | 0.207 | 0.107 | 0.039 | 0.079 |
| | Public services | 0.228 | 0.103 | -0.017 | 0.083 |
| | Secondary | 0.062 | 0.050 | 0.083 | 0.037 |
| | Lowest tertiary | 0.115 | 0.047 | 0.179 | 0.049 |
| | Lower tertiary | 0.328 | 0.079 | 0.387 | 0.063 |
| | Upper tertiary | 0.732 | 0.077 | 0.867 | 0.131 |
| | Work experience | 0.003 | 0.008 | 0.019 | 0.006 |
| | Work exp.squared/100 | 0.000 | 0.018 | -0.020 | 0.013 |
| | Training courses | 0.007 | 0.003 | 0.013 | 0.003 |
| | 1995 | -0.138 | 0.035 | -0.128 | 0.037 |
| | 2000 | -0.060 | 0.043 | 0.017 | 0.037 |
| | Constant | 2.314 | 0.123 | 2.336 | 0.087 |
| | Pseudo R2 | 0.093 | | 0.166 | |
| | Number of observations | 2932 | | 3020 | |

Appendix 7a: Probit regression for in-service training, marginal effects for males.

| *Dep.: In-service training (0,1)* | *1-3 days* | | *4-10 days* | | *>10 days* | |
|---|---|---|---|---|---|---|
| | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| *Independent:* | | | | | | |
| Married | 0.103* | 0.047 | 0.103* | 0.045 | 0.096* | 0.039 |
| *Years of experience* | | | | | | |
| with other employers | -0.010** | 0.003 | -0.010** | 0.003 | -0.009** | 0.003 |
| in other tasks, present employer | -0.013** | 0.004 | -0.006 | 0.004 | -0.006 | 0.003 |
| in present tasks, present employer | 0.003 | 0.003 | -0.008* | 0.003 | -0.009** | 0.003 |
| Years of leisure | -0.011 | 0.008 | -0.014 | 0.008 | -0.023** | 0.007 |
| No. of previous training courses | 0.020** | 0.005 | 0.018** | 0.005 | 0.018** | 0.004 |
| *Education, cf. primary* | | | | | | |
| Secondary level education | -0.038 | 0.056 | 0.063 | 0.061 | 0.067 | 0.063 |
| Lowest tertiary level education | 0.038 | 0.086 | 0.247** | 0.098 | 0.297** | 0.115 |
| Lower tertiary level education | 0.083 | 0.117 | 0.265* | 0.126 | 0.433** | 0.129 |
| Upper tertiary level education | -0.081 | 0.078 | 0.043 | 0.095 | 0.052 | 0.093 |
| *Workplace size, cf. < 20* | | | | | | |
| 20–199 employees | -0.093 | 0.061 | 0.092 | 0.075 | 0.130 | 0.088 |
| >199 employees | 0.093 | 0.057 | 0.168** | 0.060 | 0.225** | 0.061 |
| *Work contract, cf. typical* | | | | | | |
| Part-time contract | -0.156 | 0.089 | -0.139 | 0.080 | -0.105 | 0.062 |
| Fixed term contract | -0.094 | 0.073 | -0.085 | 0.065 | -0.065 | 0.057 |
| *Sector, cf. private* | | | | | | |
| Public | 0.030 | 0.066 | 0.100 | 0.062 | 0.117* | 0.061 |
| obs. P | 0.304 | | 0.275 | | 0.253 | |
| pred. P | 0.271 | | 0.224 | | 0.146 | |
| Number of observations | 467 | | 448 | | 435 | |
| LR chi2(15) | 84 | | 104 | | 171 | |
| Prob > chi2 | 0.000 | | 0.000 | | 0.000 | |
| Pseudo R2 | 0.146 | | 0.197 | | 0.348 | |

* and ** are statistically significant coefficients at the level of 0.05 and 0.01.

Appendix 7b: Probit regression for in-service training, marginal effects for females.

| *Dep.: In-service training (0,1)* | *1-3 days* | | *4-10 days* | | *>10 days* | |
|---|---|---|---|---|---|---|
| | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* | *Coef.* | *Std. Err.* |
| *Independents:* | | | | | | |
| Married | 0.013 | 0.058 | 0.110* | 0.050 | -0.020 | 0.052 |
| *Years of experience* | | | | | | |
| with other employers | -0.005 | 0.004 | 0.001 | 0.003 | -0.003 | 0.003 |
| in other tasks, present employer | -0.003 | 0.005 | -0.001 | 0.005 | 0.008* | 0.004 |
| in present tasks, present employer | -0.006 | 0.004 | -0.003 | 0.004 | -0.004 | 0.004 |
| Years of leisure | -0.012* | 0.006 | -0.014* | 0.006 | -0.024** | 0.006 |
| No. of previous training courses | 0.020** | 0.005 | 0.017** | 0.005 | 0.010* | 0.005 |
| *Education, cf. primary* | | | | | | |
| Secondary level education | 0.030 | 0.072 | -0.028 | 0.068 | 0.108 | 0.075 |
| Lowest tertiary level education | 0.170 | 0.094 | 0.174 | 0.103 | 0.352** | 0.114 |
| Lower tertiary level education | -0.018 | 0.136 | 0.157 | 0.139 | 0.140 | 0.168 |
| Upper tertiary level education | 0.060 | 0.139 | 0.230 | 0.154 | 0.509** | 0.139 |
| *Workplace size, cf. < 20* | | | | | | |
| 20–199 employees | 0.185* | 0.092 | 0.102 | 0.113 | -0.034 | 0.076 |
| >199 employees | 0.154 | 0.078 | 0.206* | 0.075 | 0.034 | 0.069 |
| *Work contract, cf. typical* | | | | | | |
| Part-time contract | -0.075 | 0.087 | -0.009 | 0.084 | -0.053 | 0.071 |
| Fixed term contract | -0.131 | 0.071 | -0.123 | 0.062 | -0.065 | 0.061 |
| *Sector, cf. private* | | | | | | |
| Public | 0.165* | 0.059 | 0.138* | 0.059 | 0.119* | 0.056 |
| obs. P | 0.383 | | 0.278 | | 0.251 | |
| pred. P | 0.362 | | 0.214 | | 0.166 | |
| Number of observations | 392 | | 335 | | 323 | |
| LR chi2(15) | 64 | | 94 | | 109 | |
| Prob > chi2 | 0.000 | | 0.000 | | 0.000 | |
| Pseudo R2 | 0.122 | | 0.237 | | 0.300 | |

* and ** are statistically significant coefficients at the level of 0.05 and 0.01.

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