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ON-THE-JOB TRAINING:

A SKILL MATCH APPROACH TO THE DETERMINANTS AND

OUTCOMES OF LIFELONG LEARNING

by

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Abstract

Lifelong learning research focuses on formal training, documenting a positive correlation between initial education and continuing training. This "training gap" research disregards two important distinctions: (a) between formal and informal training, and (b) between employee skill supply and job demand. A complete account of work-life human capital formation requires simultaneous analysis of formal and informal activities, and of workers current qualifications and the skill requirements of their current jobs. Less-educated workers may hold jobs with low skill requirements providing little training since the use of high skills is irrelevant. Examining workplace training in Sweden, on the basis of indicators from the Swedish Level of Living Surveys (LNU), we find that informal training quantitatively dominates formal and that both are unequally distributed across skill categories. Job requirements essentially determine the incidence of training, while the net impact of individual education is very small. Employer decisions regarding how to structure jobs and whom to hire appear to be the primary factors behind the training gap in lifelong learning.

Key words: on-the-job training, lifelong learning, educational mismatch, formal training, informal training

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The developing interest in lifelong learning and the dearth of evidence

Recent years have seen the rise of education as a primary social policy concern in many countries. A crucial role in these discussions is played by the idea of lifelong learning, believed to allow for efficient adaptation of workforce skills to rapidly changing economic requirements as well as to alleviate inequalities in initial education. A recurrent issue in this literature relates to training gaps in lifelong learning; the difference in the incidence of formal workplace training between various groups. One dimension were such discrepancies have been identified repeatedly relates to individuals with different levels of initial education, with the less educated receiving less further training (see e.g. OECD 1999, 2003, 2012, European Commission 2015). This inequality in skill formation is pervasive, and casts doubt on the possibilities of achieving human capital compensation over the life course of individual workers. To determine the causes of the gap is therefore an urgent task.

Most research on the topic of lifelong learning has focused on formal training. Reviews have however lamented the fact that there still are large gaps in our knowledge with regard to the incidence and duration of informal training, the relation between informal and formal training, as well as their impact on labor market outcomes (e.g. Pischke 2007). Whether informal training can compensate for a lack of formal training, or whether it instead exacerbates the training gap, is for instance a crucial question for understanding the causes and consequences of lifelong learning. Sound policy must be based on solidly documented facts, and any reforms of the market for training require that these lacunae be dealt with.

The purpose of this paper is to provide an in-depth analysis of formal as well as informal workplace training, including determinants, incidence and outcomes. We seek to extend the analysis of the training gap by pursuing the distinction between the supply and the demand for skills. A straightforward explanation for the training gap is thus that less-educated workers may hold jobs with low skill requirements, jobs providing little training since the use of high skills is irrelevant. Although training supply and demand has been an issue in the training gap literature, only a few studies have attempted to separate them from each other.

We propose to examine them using a model in which further education and training is dependent on the match between existing educational qualifications and the educational requirements of jobs. More specifically, we study training making use of the so-called ORU-model (Duncan and Hoffman 1981), in which the employee's educational qualifications are related to the educational requirements of the job. This juxtaposition generates three categories: the over-qualified, the rightly-qualified, and the under-qualified. The relationship between these three match categories and wages has been extensively studied, with remarkably consistent results (Rubb 2003); see further below. We extend this well-established line of research by replacing wages as outcome measure with workplace training.

The outline of the paper is as follows: Section 2 provides a brief review of the theoretical literature, highlighting the limited attention given to both informal training and job requirements. Section 3 examines previous empirical studies, again underlining the dearth of evidence on these issues. Section 4 places the study in its institutional context, i.e. discusses alternative forms of lifelong learning in Sweden. Section 5 presents the data, drawn from the Swedish Level of Living Survey (LNU). Section 6 contains the results, and Section 7 concludes.

Models and measures of on-the-job training

In reviewing previous research below we distinguish between formal and informal training (or learning), where *formal* refers to training that takes place in a setting specifically designed for the purpose, such as schools or training institutes. Formal training is thus separated from everyday work activities. The training could in principle be provided both on and off the worksite; employees could leave the worksite and go to a training institute (during or after regular working hours), or formal training could take place at the workplace but separate from work. The institutionalization of training and the associated separation from production sets off formal training from *informal* training (or learning) that is obtained at the ordinary workplace as part of the normal work process. Informal learning can take two main forms.

The employee can thus simply learn by carrying out his or her job without instruction of any kind. This process of trial-and-error we refer to as *learning-by-doing*. Alternatively, some form of instruction is involved, from co-workers or supervisors. We refer to such training, where instruction occurs as an integrated part of regular work activities, as *mentoring*.

The scope of workplace training models

Theories of workplace training come in two forms, relating to either formal or informal training. The standard model of human capital formation (Becker 1964) has provided inspiration for much subsequent theorizing on formal workplace training (see e.g. the overviews by Bassanini et al. 2007 and Leuven 2005). Training here involves a distinct learning activity, and learning is seen as "rivalrous with work" (Heckman et al. 2003, 74). Both employers and employees are assumed to have an interest in the employee acquiring new skills, and the analysis focuses on which type of skill will be financed by whom. The main hypotheses derived from Becker's original model are well known: employees would finance general training while both parties would share the costs for specific training. Although Becker defined general skills as skills that are "equally useful in many firms'" (Becker, 1964, 12), later research has emphasized the importance of competition for the actual transferability of skills. If competition is less than perfect, skills that are technologically transferable, i.e. in principle, may thus in practice be specific and firms may as a consequence finance general training as well. A number of different factors that all generate imperfect competition have been proposed, in particular various forms of informational asymmetries. Examples of such asymmetries are the plain knowledge of alternative employers where the employee's skills could be put to productive use, or of potential employees that could have acquired relevant skills.

Human capital theory is also the starting point for theories of informal learning, albeit in a rather indirect manner. The standard human capital earnings equation (Mincer 1974) thus incorporates informal learning in that employees may acquire productive skills either through school or through work. Despite the "learning-by-doing" label attached to some of these

theories (see e.g. Killingsworth 1982), the manner in which skills are acquired on the job is rarely specified. The distinction between learning outside the workplace or as a by-product of work nevertheless implies that the latter in our terminology involves both forms of informal training, in addition to learning-by-doing also what we call mentoring. In contrast to theories of formal learning, the decision regarding training in these models resides solely with the employee.

This brief review suggests several issues of continuing relevance, such as the measurement of training, of costs and of financing, and of returns to training. At a more general level, however, it also highlights the fact that the discussion of the determinants of the supply and demand for training largely has ignored the role of the job. The acquisition of training and skill has thus been seen as a long-term strategy on part of either the employer or the employee, overlooking the more immediate requirements of the job in which the employee is currently working. Likewise, the employee's current skills, and thus need for more or different skills, have also been disregarded in these long-term scenarios.

What we know about on-the-job training

Compared to the theoretical interest in these questions, less is known about different types of training, their distribution and inter-relationships, and their impact on e.g. wages. As we shall see these empirical questions are all crucial for our understanding of continuous training.

OECD (2003) provides a general overview of stylized facts regarding formal workplace training (see also Bassanini et al. 2007). They note that what they call continuous vocational training is an important component of adult education and training, accounting for at least 60% of total education and training. Most of this is either at least partially provided or paid for by the employer. In the OECD countries participating in the International Adult Literacy Survey (IALS), 26% of the employees took part in employer sponsored workplace training in a given year. The average duration per participant amounted to around nine days per year. As regards the specificity of training, OECD (2003, 246) concluded that "most formal training is

quite general and almost all is transferable". This was in particular true of off-site formal training.

This recurrent focus on formal training was lamented by Pischke (2007), who stated that although informal training is hard to measure his crude analysis suggested that the incidence of informal training is five times greater than that of formal training. In this context, he also observed that although it often is implicitly assumed that formal and informal training are positively correlated, and that one therefore can study formal training and learn something about informal, little is actually know about the relationship between formal and informal training.

What could then be said regarding these two forms of training? In what is perhaps the most well-known study of formal and informal training, Loewenstein and Spletzer (1999) explored the explicit measures of both formal and informal training available in the NLSY.[1] The incidence of formal training during the last year was less than half of that of informal training, although in both cases durations conditional on receipt were around 50 hours.[2] Note that this did not include the substantial amount of informal training provided at the start of a match. Mentoring was a quantitatively important part of informal training, around 1/5 of those receiving training during the last year had received it from either supervisors, co-workers, or both, and conditional on receipt instruction averaged around 25 hours. While the structure of the data makes it difficult to compare directly, informal training clearly seems to be quantitatively much more important than formal training. Moreover, there was a "strong" positive correlation between the two types of training (p. 19).

A second influential study is the one conducted by Barron et al. (1997a, 1997b) in which they inter alia examined data from a survey containing information from both

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[1]   They also compared the training information available in four different data sets from the USA (CPS, NLS, EOPP, NLSY). They concluded that there are large variations across surveys, both in formal and informal training incidence (and duration). With respect to formal training, the variation across surveys was in large part explained by differences in sample population, reference period, and question wording. Likewise, some of the differences in informal training could be explained by routing patterns and question wording.

[2]   Note, however, that their definition of informal training also includes "classes/seminars", something we would see as formal training. Although informal training still appears quantitatively more important than formal training, the numbers given above probably overstate the difference.

employers and employees allowing for direct comparison. The results showed both agreement and disagreement between the two. Employers thus generally reported more training, although not all differences were significant. However, they agreed on informal training (here encompassing different forms of mentoring) being about eight times as important quantitatively as formal training. This also roughly corresponded to what had been found in the other studies surveyed.

An additional US study on the relative incidence of formal and informal training is the SEPT95 data used by Frazis et al. (1997). This survey also provided employer and employee information on training. Their results showed that informal training was about three times as frequent as formal training. These three studies all indicate that informal training is more widespread than formal training, yet there still are substantial gaps in our knowledge regarding e.g. the relative extent and inter-relationship between the two forms.

However, informal training in these studies was largely equal to mentoring. What about our last training category: learning-by-doing? Here the information is scant. Indeed, there seems to have been no attempt to measure learning-by-doing. Following their disquisition on formal and informal training, Loewenstein and Spletzer (1999) speculated that "learning-by-doing" might be the most important source of on-the-job training, more important than other forms of non-formal training as well as formal training. Learning-by-doing, they conjecture, could be measured by the questions on amount of training required to gain full competence. They concluded: "An extensive analysis of the relationship between the measures of training and learning by doing – in both the NLSY and the other data sets – remains a topic for future research"(p. 36). Nevertheless, despite this bugle call the issue has remained largely unexplored.

As observed by the OECD (2003), there are stark differences in participation in formal training between educational groups. Whereas only 16% of workers with less than upper secondary school participated in formal training, 35% of those with university degrees did. This pattern has now been documented repeatedly, and several different explanations for it have been suggested. Most prominent is perhaps the view that initial education and further

training are complements. This would be the case if for instance employers provided OJT on the basis of expectations about training costs and returns, and if they treated higher levels of initial education as a signal of either lower training costs (the educated learn quicker), greater returns (the educated are in positions where additional training provides the greatest productivity boost), or both. Conversely, complementarity may also arise if higher educated employees are more prepared to enroll in training programs as a result of their previous educational experience, e.g. due to stronger perceptions of benefits from further education.

Alternatively, the educational training gap may grow out of the structure of initial education. Pischke (2007) thus questioned the separation of initial and further education and training made in the debate, and argued that this may create an artificial training gap. Training may make up a greater proportion of the initial education of the less educated, as they are more likely to have attended a vocational program in which they learn practically useful skills. The training gap, i.e., the additional vocational ('practical') training received by those with higher education, may therefore simply involve compensatory workplace training.[3]

Attempts have been made at examining the causes of the educational training gap. These analyses posit that greater training participation among higher educated may be related to unobserved heterogeneity, for instance regarding the ability to pay for training or the expected returns to training. One approach has been to exploit information on employees who desired to take part in formal training but for some reason never initiated training (see e.g. Leuven and Oosterbeek 1999, OECD 2003, Oosterbeek 1998). A tentative conclusion from this literature is that the training gap is not primarily due to differences in employer supply of formal training opportunities, but rather differences in employee demand. However, this conclusion was based on strong and questionable assumptions regarding the decision making

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[3] Essentially the same point is also made by Brunello (2004), who also provides some cross-country evidence that there is less OJT in countries with more vocational training.

process, and substantial uncertainty regarding the causes of the training gap therefore remains.[4]

From our perspective, a more fundamental critique is that training decisions (by both employers and employees) in these studies are taken to be independent of the worker's job. Although the empirical models supplement educational variables with occupational indicators, the possibility that educational associations may depend on occupation was never explored. This point was indirectly made by Barron et al. (1989) in noting that there are "differences across employers' positions in the amount of on-the-job training required" (p. 2) and that "we should expect to find higher ability workers matched into positions requiring greater on-the-job training" (p. 3). Altonji and Spletzer (1991) hypothesized that training is more likely in jobs with higher skill requirements, and also found such an association in their data. Nevertheless, they never analyzed the interaction between education and skill requirements explicitly.

A small empirical literature has previously explored the link between education-job matching and on-the-job training. Using nationally representative data from the German Socioeconomic Panel (GSOEP), Büchel and Mertens (2004) found that for any given level of education, over-educated workers take part less in both formal training and informal learning than well-matched workers do. Conversely, under-educated workers participate more in training and learning than the well-matched. This pattern was taken to indicate that overeducation and training are substitutes, and would thus tend to diminish the educational training gap; it would also provide a rationale for overeducation as a device for reducing training costs. A concern with their analysis, however, is that the model specification (with years of schooling and dummies for over- and under-education as covariates) does not allow distinguishing between the impact of individual overeducation and being in a low-skill job,

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[4] In cases were training had taken place it is for instance unclear whether, as assumed, employers always were involved in the decision. The wording of the question leaves open the possibility that respondents also consider training courses not offered by their employers, and the reasons given by employees for not participating in training furthermore suggest that they did incorporate such courses in their answers. Likewise, it is unclear if, as assumed, employees always were involved in the training decision. The question thus allows for the possibility that the decision is a prerogative of employers.

nor between undereducation and being in a high-skill job. It is thus unclear if the demand for (less) training is driven from the worker side (surplus education lowers the need for training) or from the job side (low job complexity lowers the need for training). A few other studies of the association between job-education match and training participation exist (Hersch 1991, Groot 1993, van Smoorenburg and van der Velden 2000, Büchel 2002, Verhaest and Omey 2006). Most recently, Verhaest and Omey (2006) used data on a sample of Flemish school leavers to examine associations between a number of alternative measures of overeducation (and undereducation) and various outcomes, including training participation. They find conflicting evidence on the matching-training link depending on choice of measure and model specification. The other studies were also based on selective (nationally non-representative) samples, and generally used less than fully transparent model specifications. Perhaps unsurprisingly, findings regarding whether overeducation is a substitute for or complement with training are conflicting. In all, previous research on the matching-training link has been very limited and has not produced a set of clear empirical findings. The present study hence contributes to filling an important knowledge gap.

An important potential outcome of training is improved labor market prospects, including wage growth and employment chances. A substantial amount of research indicates that workplace training impacts positively on both earnings and employment security (Bassanini et al. 2007, OECD 2003). As with estimates of returns to education, selection into training as a source of bias in effect estimates has been a major issue in more recent empirical studies. Even net of selectivity, the positive effects of training – especially training spells of relatively short duration – are typically found to be substantial.

Most studies assess returns to formal training only. A rare exception is Loewenstein and Spletzer (1999) who examine wage effects of informal as well as formal training. They find strong positive effects on wage growth of both formal and informal training, within as well as between jobs. These results underscore the importance of examining informal together with formal training in order to achieve a comprehensive understanding of skill growth over the life-course.

In sum, despite the growing interest in lifelong learning and the recent surge of research on continuing training, there are still notable gaps in our knowledge regarding how much workplace training of different kinds that is provided, who receives it and why, and what the consequences of training are. In particular, very little is known about (a) informal training, including its prevalence, relationship to formal training, as well as returns, and (b) the importance of job requirements for training opportunities. Filling these gaps is an urgent and important task.

Training in Sweden

To put our analyses of workplace training in Sweden in recent decades into perspective requires a brief excursion into Swedish educational history. Reforms in the late 1960s and early 1970s thus produced a relatively homogenous educational system, most clearly in the case with compulsory school. Nine years of school became the standard, starting at age 7 and continuing up to the age of 16, with a curriculum that was largely identical for all students. More variety was present at the upper secondary level, yet the educational tracks at this level were also limited in number and focused either on traditional academic subjects or on broad vocational skills. Vocational training had thus been integrated into upper secondary education, and public school-based training had become the preferred means of supplying youth with vocational skills.

The proportion of 16-18-year-olds receiving vocational training in upper secondary school increased from 33 % in 1975 to 43 % in 1985 (Statistics Sweden 1988). The Swedish system of vocational training during this period was characterized by having around 25 nationally recognized programs, with subdivisions a total of around 60 certificates. The duration of training was generally two years, and most training was obtained in school. The time spent in a workplace varied substantially, with an average of around one afternoon a week allotted to firm-based training (SOU 1986). Traditional apprenticeships were very limited, basically restricted to a small number of craft occupations.

The first half of the 1990s saw some important changes in these structures, as reforms decentralized governance and introduced additional variation in curricula. Most of the reforms focused on governance, with municipalities becoming the principal authority for compulsory and secondary education. Governance changes also involved the introduction of publicly financed privately operated education, at both levels. At the secondary level, these changes inter alia resulted in an increase in various forms of apprenticeships and company based secondary vocational training. Some big corporations (e.g. Volvo and ABB) thus opened up their own vocational training programs. However, their impact seems to have been relatively limited in terms of enrolment. Finally, the reforms also introduced a third year of mainly theoretical studies into the vocational programs, to give students eligibility for university programs.

Training does however also take place in other settings, and at later stages of the life course. The two forms of further education thus need special mentioning: adult education and labor market policy programs.[5] Since the 1960s, each municipality has been required to provide adults with comprehensive education at the compulsory and upper secondary level. Enrolment in these courses was particularly high between 1997 and 2002 when the Adult Education Initiative (*Kunskapslyftet*) was in place, a program offering adults one year of comprehensive education. The program was mainly aimed at unemployed individuals, but employed adults could also participate if their employer agreed to hire a replacement who previously had been long-term unemployed. Although most adult education is general in character, adult education programs also include supplementary vocational courses at the post-secondary level lasting between six and twelve months. Enrollment during the 1990s in these programs was around 10,000 individuals per year. A somewhat greater number has been enrolled in the Advanced Vocational Education (*Kvalificerad yrkesutbildning*) program initiated in 1996. This too involves post-secondary training, with one third taking place on a work site and financed by the employer.

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[5]   This section draws on Stenberg (2006).

Sweden is also known for its large investments in active labor market policy, involving inter alia vocational training courses. These are intended to answer to skill shortages in the local economy, in part identified by local business representatives. The courses are however aimed at unemployed individuals, or individuals who are in danger of becoming unemployed. Participants are remunerated corresponding to the unemployment benefit.

How these features affect the provision of OJT in companies is not clear. The vocational training in upper secondary education, adult education, and labor market training may both complement, supplement, and be independent of OJT in companies, and there may also be differences in the distribution and complementarity of training across worker categories (Stenberg 2006). In international comparison, Swedes tend to receive more vocational training prior to entering the labor market than is the case in for instance the USA or the UK, although the proportion with initial vocational training is even greater in e.g. Germany. However, this pattern does not seem to be clearly correlated with further education and training. When it comes to participation in formal further education and training among employees, Sweden thus tends to rank above Germany as well as the UK and the USA (e.g. Bassanini et al. 2007, OECD 1999). In a survey of the available evidence regarding whether public and private training provision are complements, substitutes, or independent, Stenberg (2006) concluded that all the three seem to be true to some extent. We therefore proceed on the assumption that different effects of public training on OJT will cancel out, with a total effect close to zero.

Data

The data used in the analyses below come from the Swedish Level of Living Surveys (LNU) 1991 and 2000. These are national probability samples of the ages 18-75. The sub-samples used here are those of employees between the ages 19-65, working at least 10 hours/week. In the cross-sectional analyses of the 2000 wave the sample size is about 3,000, while the sample from the 1991-2000 panel (two time-points) consists of approximately 2,000 individuals.

The data contain a substantial and in many ways unique array of information with regard to on-the-job training (OJT). First, the data allow us to distinguish between introductory (upon entry to current job) training, formal recent (in the last 12 months) training, as well as continuing (current) learning on the job.

- Introductory OJT: "Apart from the competence necessary to get a job such as yours, how long does it take to learn to do the job reasonably well?" Seven response alternatives; (a) '1 day or less', '2-5 days', '1-4 weeks', '1-3 months', '3 months-1 year', '1-2 years', and 'more than 2 years', recoded to number of months, where the top code is 36 (or 3 years). This indicator was first used in PSID 1976 (Duncan and Hoffman 1979; Mincer 1988).

- Formal OJT: "Have you in the last 12 months received any kind of education on paid worktime?" If yes: "How many whole working days altogether was this education?"

- Continuining OJT: the (self-reported) extent to which the worker's current job requires that s/he keeps learning new things. This variable has five response alternatives: 0=not at all, 1=to a small extent, 2=to some extent, 3=to a large extent, and 4=to a very large extent.

Neither the introductory nor the continuing OJT measure explicitly distinguishes between formal and informal training. However, as will be shown below, the incidence and duration of explicitly reported formal training are much lower than those reported for introductory and continuing OJT, and it therefore seems reasonable to assume that most of the training which is reported for the latter two measures involves informal training. Further, as pointed out above, the conclusion that informal training is much more frequent than formal training is also reached in previous studies based on data in which explicit measures of both training kinds have been available.

Although we treat these three forms of training as distinct in the analyses that follow, it should be noted that they in practice are likely to overlap to some extent. First, workers who are still in a period of 'introductory' training (just under one fifth of the sample) will tend to

affirm that their job requires that they learn new things (i.e., receive what we call 'continuing training') and might also report that they have gone through some amount of 'formal' training in the last 12 months, which then would in fact be part of their 'introductory' training. We have checked whether these kinds of overlap affect our conclusions by rerunning the analyses for only those workers who have passed the stage of introductory training. The outcome of this robustness check is that all major conclusions still hold, and we therefore decided to keep all workers in the sample. Second, regardless of introductory training, some overlap will remain between formal and continuing training because they both refer to roughly similar time periods. Clearly, however, most continuing training is non-formal: more than half of all workers report no formal training, whereas only about one in twenty reports no continuing training (see further below, table 2).

All training variables have been logged, for two reasons. First, especially in the case of formal training, strong non-linearities are evident in its impact on wages, but also in its relations with the other training variables. The log form captures this non-linearity well. While less strong, the same pattern of covariation also applies to introductory and continuing training. The second reason for logging the OJT variables is that it facilitates comparisons of their respective effects. The log transformation scales the three indicators into similar units: percentages.[6] When the outcome is also logged, as in the case of wages, the B coefficients in the regression models may straightforwardly be seen as elasticities.

In addition to these training variables, the analyses will include variants of standard human capital indicators. These include

- Experience: number of years in gainful employment. Usually taken as an indicator of general (with respect to the firm) OJT.

- Seniority: number of years spent with current employer. Usually taken as an indicator of firm-specific OJT.

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[6] This does of course not apply in a strict sense to ordinal scales with intervals between scale values of arbitrary length, such as for the response scale of the continuing training measure. However, results presented below involving this variable are robust to imputed variations in interval length.

- Education: number of years of full-time education beyond compulsory school.

- Educational requirements: the required amount of education in the worker's current job, according to the respondent's own assessment. The variable is based on two interview questions: (a) "Is any schooling or vocational training above elementary schooling necessary for your job?". (Yes – No.) (b) "About how many years of education above elementary school are necessary?" (Number of years.)

- Excess educational requirements: number of years of required education in respondent's current job in excess of her/his attained education.

- Excess education: number of years of respondent's attained education in excess of required education in her/his current job.

Finally, training and the other human capital variables will also be related to two outcome variables, namely

- Wage: the sum of earnings in current job during a specific time period (usually one month) divided by the number of hours worked during the same period. Logged.

- Unemployment: Take-up of unemployment compensation.

Method

In an influential article, Duncan and Hoffman (1981) decomposed attained education (in years) into three parts defined in relation to the educational requirements of the job held. This decomposition is expressed by the equation

$$AE = RE + OE - UE, \tag{1}$$

where AE denotes attained education, RE is the required amount of education in the job that the worker holds, OE is the amount of education attained by the worker that is in excess of what the current job requires, and UE is the amount of education required by the job that is in excess of what the worker has attained. Hence, OE is zero for correctly matched and undereducated workers, while UE is zero for correctly matched and overeducated workers.

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The equation thus reduces to AE = RE for the correctly matched, to AE = RE + OE for the overeducated, and to AE = RE – UE for the undereducated.

The three types of educational match categories defined in the equation above have then been incorporated into a standard Mincer wage equation, producing the ORU wage equation

$$W_{ti} = \beta_1 RE_{ti} + \beta_2 OE_{ti} + \beta_3 UE_{ti} + \gamma X_{ti} + \varepsilon_{1i} \qquad (2)$$

Here X is a vector of independent variables including a constant, γ is a corresponding vector of coefficients, and ε_1 a standard error term. For correctly matched workers, β_1 indicates the total schooling return. For mismatched workers, the effects β_2 and β_3 interpreted in conjunction with β_1 yield estimates of the total impact of their education. The total return to schooling among overeducated workers is thus β_1 for the years of schooling corresponding to the job requirements together with β_2 for the additional years. Among undereducated workers the total return to schooling is given by β_1 again indicating the return to the years of schooling corresponding to the job requirements but less β_3 for the missing years of schooling.

The following results from cross-sectional wage regressions have been found in virtually all published studies, regardless of time and place (see Rubb, 2003, for a recent overview): (a) overeducated workers earn more than correctly matched workers in the same kind of jobs, but less than correctly matched workers with a similar amount of education; while (b) the converse pattern holds for undereducated workers: they earn less than correctly matched workers in the same kind of jobs, but more than correctly matched workers with a similar amount of education.

In our empirical analyses below, we use a slightly modified specification of the ORU model. The match component has been defined as AE-OE (i.e., the number of years of attained education that correspond to the required years of education) in advance of estimation. This re-specification allows all three elements in the model to be interpreted immediately. Specifically, the B coefficient of UE in the revised model directly expresses the

net impact of educational requirements, rather than the difference between this net impact and the effect of the matched component. In the following tables, the three components of the revised model are called Ed req, Ed match and Ed. The B coefficients of all three can be interpreted as direct (net) effects.

All models are estimated by OLS regression. We thus do not attempt to model the underlying decision processes of employees and employers regarding current training participation, something that is directly related to our belief that on-the-job learning is largely the outcome of the skill requirements of the job itself and of the qualifications of the job holder. A complete model of these learning opportunities would require modelling employers' decisions regarding production and staffing as well as employees' strategies with respect to education and job search, an undertaking beyond the current paper. The results presented below should therefore be seen as correlations, not as estimates of causal parameters.

Still, we believe that the estimates can be highly informative, mainly through a comparison of the estimates for formal and informal training. Note that many of the arguments regarding unobserved heterogeneity put forth as explanations for the training gap in formal training (see e.g. OECD 2003) do not apply to informal training. There will for instance be no costs connected to informal training, so considerations regarding employee capital constraints are irrelevant. Nor will the "pedagogy" of informal training resemble that of initial education, so arguments regarding employee learning capacities are beside the point as well. A comparison of the results for formal and informal training will therefore be indicative of the importance of these types of selectivity. If participation in formal training is closely tied to attained education but participation in informal training is not, this would suggest that unobserved employee heterogeneity is a likely explanation for the gap in formal training. Similar training gaps for both formal and informal training would in contrast suggest that such selectivity is less of an issue, and that the causes for the training gap are likely to lie with the employer.

In one case below – unemployment (table 11) – the outcome variable in the regression is binary. In the recent literature, the widespread practice of applying logistic regression in

such cases has begun to be seriously questioned. An argument that is achieving increasing

support is that the advantages of OLS even for binary outcomes tend to outweigh the

drawbacks (see e.g. Mood 2010). Most importantly, the interdependence between the B

coefficients in a logistic model makes interpretations of individual coefficients difficult, or at

least complex. By comparison, the main disadvantage with the OLS model for binary

outcomes – that its predictions in rare cases may lie outside the 0-1 interval, is usually of less

concern.

Results

Before examining the antecedents and outcomes of training, it is informative to look at the

univariate distributions of different kinds of training. As can be seen in Tables 1 and 2, most

respondents say that their current job tends to require a fair amount of introductory informal

training. The average duration of introductory training is around nine months, while the

median duration is about three months. The variation is thus quite large, with one fourth of all

workers saying that their job requires a month or less of introductory training. To put this

figure into some perspective, it may be noted that the average seniority among all workers is

around 10 years (the median is 6). The typical employee would thus appear to have spent a

little less than one tenth of her or his time with the current employer in introductory informal

training.[7]

Formal on-the-job training appears to be much less frequent. Table 2 shows that most

employees did not receive any formal training at all during the 12 months preceding the

interview. Nevertheless, as in the informal case, there is a significant amount of variation;

around one fourth of all workers state that they received at least a week. The mean number of

formal training days is somewhat less than a work-week (the median is zero), so the average

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[7] This relies on the implicit assumption that all working time while in introductory training is devoted to training only, while none of it involves productive work. The assumption may seem rather unrealistic, and Loewenstein and Spletzer (1999) found that introductory training among full-time workers in the U.S. on average involved 16 hours per week (for six weeks). But the dividing line between informal training and productive work is obviously not sharp.

employee would appear to allot some 2 percent of the working year to formal training. If one assumes that annual days of training are constant across time spent with each employer, the average employee (with 10 years of tenure) has obtained 10 weeks of accumulated formal training at their current workplace. Although this assumption of a constant supply of formal training with increasing tenure is supported by the relationship between formal training incidence and seniority, which appears to be constant (the correlation is close to zero; see table 3 below), it may nevertheless be a rather strong assumption. As table 2 shows, the elasticity over time (across survey waves) for formal training is far below 1, so the assumption of constant training rates over individual time probably leads to an overestimate of the amount of formal training that employers offer, and is likely to provide an upper bound of the estimate of formal training incidence.

Continuing training is more evenly distributed than introductory and formal training. Only five percent of all workers say that their job does not involve any requirements of learning new things. At the other end of the scale, almost one worker in five says that their job requires learning new things "to a very large extent". Another indication of this slight skewness to the right is that the mean of the continuing training scale (which runs from 0 to 4) is about 2.4 while the median is close to 2.

Tables 3 and 4 contain calculations intended to produce a more systematic assessment of the relative prevalence of formal and informal training. The first table examines changes in the incidence of training within the LNU panel, i.e., among respondents who have been interviewed at both time-points (1991 and 2000). Both the elasticities (regression coefficients) and the correlations indicate that there is a fair degree of stability in individual training participation over time. The stability of participation in introductory training would appear to be higher than that of the other two (formal and continuing training), yet this is partly a result of the fact that many of the individuals are in the same job at both occasions. Based on this information, Table 4 elaborates on the rather crude computations from Table 1 and 2, offering another perspective on the question of relative incidence. Both alternative measures in Table 4 (Share 1 and Share 2) turn out to convey exactly the same message as the previous indicators;

that is, the vast majority of training received by workers appears to come in the form of informal training.

Taken together, these calculations suggest that the average employee tends to receive around five times as much informal as formal training. As noted, this estimate of relative prevalence involves a fair amount of uncertainty. In addition to the remarks above, it should for instance be noted that we have disregarded any informal training taking place after the introductory round, as well as training received in previous jobs. Hence, while each period of introductory training is unlikely to consist of training only (see above), there might be several such periods over an average working life and significant amounts of informal training probably takes place after completion of introductory training. Our estimate of the informal share of all training – between 80 and 90 percent – therefore appears at least equally likely to be an underestimate as an overestimate.

Moving then to the correlations between the training measures and the measures of education and educational job requirements (see Table 5), we find a rather remarkable pattern. While both education and educational requirements are positively related to all three training measures, the associations between job requirements and training are much stronger than those between education and training. This issue is examined in much more detail below. An additional point, given the focus on training in the human capital model, are the rather weak and sometimes even negative correlations between the three training measures and both experience and seniority. Here, it is important to note that the training measures do not express accumulated training over the course of an individual's working life, but the incidence of training in the current job or in the previous year. The weak association between duration since labor market (or firm) entry and training is therefore likely to reflect the counteraction of two tendencies: on the one hand, the concentration of training to early career phases (for future-looking investment reasons); on the other hand, the advancement to jobs with higher skill – and therefore higher training – requirements as careers progress.

Another interesting question, given that it often remains an implicit assumption due to lack of appropriate data, regards the correlation between formal and informal training. This

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correlation is here found to be rather low; as shown in Table 5 the association between the two forms of training (as measured by Pearson's r) is 0.23. Accordingly, the two kinds of training appear to share only 5 percent of their variance. Even if this is most probably an underestimate, given the difference in time frames used across the two measures, it would seem to be highly unlikely that the true common variance comes even close to half. The standard assumption in previous research of a tight empirical correspondence between formal and informal training, so that only one of them needs to be measured, apparently lacks foundation. Observe further that continuing training is more strongly associated with informal than with formal training (r = 0.33 versus 0.22), which again underlines the importance of the informal component.

After having gained some insight into the distribution of and relationships between the different forms of training, we now turn to an examination of the training gap. In the next set of tables (6 through 8), we present results from analyses where the three training measures have been regressed on experience, education, and educational job requirements. As discussed above, the equations are modified human capital regressions, with attained education decomposed into the three parts: matched education, excess education, and excess educational requirements.

Several important patterns stand out among the empirical findings. In most regressions, both matched education and excess educational requirements are strongly and positively related to the incidence of training, and often of roughly similar magnitudes. In contrast, the relationship between excess (net) education and training is much weaker, in most cases not even significantly different from zero. Hence, it is misleading to refer to the training gap as an inequality connected to individual education. The gap is much more closely tied to the skill characteristics of jobs than to the human capital of individuals. While the match between traits of individuals and jobs is often highly important, education net of job requirements is typically of no significance for the likelihood of receiving training.

In the analysis of the determinants of introductory training (see Table 6), the effects of both matched education and excess (net) educational requirements are thus positive and very

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strong, while the impact of excess (net) education is close to zero. The results for formal training (see Table 7, model 1) largely reiterate the ones in Table 6. But in this case education actually makes a difference: the positive impact of educational requirements is – in distinction to the determination of informal training – stronger if backed by matching individual education. Excess (net) education, however, is still unimportant. The addition of seniority in model 2 does not change the picture; as indicated above, seniority appears to be unrelated to training as measured here. Note also that in models 3 and 4 (of Table 7), informal introductory training is positively associated with formal training, even after taking the other variables into account. As for continuing training (see table 8), the estimates show much the same patterns as the earlier analyses, but closer to the case of informal than of formal training. The effects of matched education and of excess educational requirements are thus positive, strong and about equal in magnitude, while excess (net) education has an insignificant or barely significant impact. Again, seniority is unrelated to training, and earlier training is associated with subsequent training. As indicated by the correlations in table 5, informal introductory training is more strongly tied to continuing training than formal training is. This conclusion evidently holds even when other skill variables are held constant.

Finally, we turn to the relationship between training and three central labor market outcomes: current wages, wage growth, and future unemployment. With respect to the impact of training on current (cross-sectional) wages, three findings are especially interesting (see Table 9). First, both introductory and formal training appear to be clearly associated with higher pay. Second, continuing training seems be without importance for contemporaneous wages. Third, seniority has a significantly positive association with wages even when all training measures have been taken into account (model 4). This indicates either that the seniority-wage gradient is not (entirely) explained by training or that the training measures do not (perfectly) reflect accumulated training (or some combination thereof). Much the same results are also evident in the analyses of wage change in Table 10, although here all training measures have a strongly positive association with wage growth. In fact, continuing training appears to have the strongest impact. This finding is consistent with human capital theory,

according to which skill growth strongly affects wage growth. The dynamic association between skills and wages is difficult to assess empirically if – as in most studies – the measurement of skill is based on schooling information only, since significant changes in education after establishment in the labor market are relatively rare. Therefore, the strong association shown in Table 10 between continuing on-the-job training – net of previously accumulated education and training – and wage growth is a result of considerable theoretical significance.

Our last empirical analysis (see Table 11) concerns the impact of training on the risk of unemployment (between the two survey waves). Three results are particularly interesting. First, formal training appears to have a strongly protective impact against unemployment, net of all other factors considered (see models 1 through 4). Second, the effect of introductory training on unemployment risk is significantly negative (i.e., protective) but runs entirely via seniority, which in turn has a very powerful impact (compare models 3 and 4). Third, continuing training seems to hardly affect the risk of unemployment at all (see models 1 through 4). The three-way association between introductory training, seniority and unemployment risk may be explained in the following manner: Employer-worker matches where both parties spend time and other resources on significant amounts of introductory training are relatively likely to last, i.e., to positively affect seniority, at least to the extent that the training contains a sizeable component of firm specificity. But firm-specific training is not an asset in the external labor market, so given seniority its impact on unemployment risk should be close to zero. However, introductory training of a general kind – which is likely to be the dominant part (see, e.g., Tåhlin 2007) – should be a useful external asset, but apparently not sufficiently so for a significant protective effect to show up in the present analysis. By contrast, formal training appears to strongly reduce the risk of unemployment, regardless of seniority. There are at least two conceivable mechanisms here. One is that the receipt of formal training can typically be better documented as explicit qualifications, useful in the external market, than many forms of informal training. Another mechanism is selective rather than causal: Workers who are perceived as especially promising by their current

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employer have relatively good chances to get further training. These workers may be perceived favorably by other employers as well, without the training itself directly affecting the risk of unemployment. The lack of association between continuing training and unemployment risk, finally, is more difficult to explain. We saw above (Table 10) that continuing training strongly affects wage growth, plausibly due to an increase in productivity. If this increase in capacity does not come about before unemployment hits, however, the protective effect would be potential rather than real. And in this particular case, Sweden 1991 to 2000, unemployment risks were rather heavily concentrated to the early part of the period due to the severe economic recession of 1992-93.

Conclusions

Much has been written about on-the-job training, yet reviews still end with calls for more research. We have tried to heed this call, and have attempted to provide new evidence on a number of previously under-explored issues. These include the relative incidence of formal and informal training, the correlation between these different forms of workplace training, as well as their impact on central labor market outcomes.

As noted by OECD (2003), since the 1960s FET policy in Europe has focused on the supply of formal training outside of the workplace. However, a shift has now taken place towards training decisions in the workplace, and some surveys have tried to examine the extent of on-the-job training. However, these surveys have generally focused on formal training. Our results show that a substantial amount of workplace training takes place in Sweden, but that most of it is informal. Both forms of training are positively correlated over time, yet the correlation between them is surprisingly low.

Our results regarding the training gap elucidate the analyses of Altonji and Spletzer (1991) and others, and show that given the educational requirements of the job training is basically independent of education. In almost all cases, the effect of education above the requirements is non-significant and/or extremely small, so that for all practical purposes it is

job requirements that determine the amount of training received. This pattern is evident for both formal and informal training, indicating that arguments regarding unobserved differences in employee demand for training are less of a concern. It is in other words the supply of training by employers that causes the training gap, not variations in demand for training among employees with different levels of education.

This would in turn suggest that the debate as to whether initial education and on-the-job training should be regarded as complements or substitutes is somewhat misdirected. Although there are some indications that overeducation may be associated with more training, these are weak and do not indicate strong complementarities between education and training. There is in other words no general complementarity between education and training, nor are the two typically substitutes. Instead the relationship between initial education and on-the-job training is dependent on the requirements of the job.

OECD (2003) argues that policies intended to change the incidence and/or distribution of workplace training will have to differentiate between situations where lack of training is due to a want of employee demand or a dearth of employer supply (see also OECD 2005, 2016 for further discussion.). With respect to the less educated, their policy suggestions involves the extended use of co-financing schemes in which costs are shared between firms and government (e.g. levy/grant schemes, tax deductions, train-or-pay schemes). They also propose further use of co-financing schemes involving employees and employers (e.g. apprenticeships and pay-back clauses).

Our results suggest that this could be a way of confronting the educational training gap. We thus find that it is the characteristics of the job that largely determine the likelihood of training, implying that the driving factor is employers' training needs. Nevertheless, if employer needs are driven by job tasks, the suggested strategy may involve a substantial deadweight loss since much of the training would have been carried out in any case. Furthermore, if such schemes are to have an impact on the training gap they need to be targeted at the less educated.

However, OECD (2003) also proposes to deal with the educational training gap by introducing further co-financing schemes for individuals (vouchers, learning accounts, grants). In the light of our results, reforms such as these would seem rather futile. The fact that job characteristics are central to the training outcome suggests that employee characteristics (such as credit constraints or lack of motivation) are of little importance.

Finally, it is interesting to note that none of these policies deals with the core training determinant itself: the nature of the job. The employer oriented polices mentioned above are intended to influence employer training provision given the job, not to affect the job structure itself. How the latter task could be achieved is obviously a more difficult question.

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Tables

Table 1. Descriptive statistics for all variables used. Swedish LNU surveys, 1991 and 2000.

	n	min	max	mean	sd	cov
Ln wage/hour	2949	3,55	7,46	4,70	0,31	0,07
Experience (years)	3055	0	53	19,59	12,38	0,63
Experience at firm entry (years)	3051	0	49	9,46	9,61	1,02
Seniority (years)	3056	0	49	10,23	10,22	1,00
Education (years, post-comp.)	3058	0	12	3,78	2,86	0,76
Educational requirements (years)	3028	0	12	3,05	2,63	0,86
Excess educational requirements (yrs)	3026	0	10	0,59	1,22	2,08
Matched education (years)	3026	0	12	2,46	2,50	1,01
Excess education (years)	3026	0	12	1,32	1,80	1,36
Introductory OJT (days)	3038	0,87	690	257,48	254,14	0,99
Formal OJT (days)	3053	0	230	4,44	13,10	2,95
Continuing OJT (scale)	3047	0	4	2,42	1,08	0,45
Ln wage/hour, 1991 (panel)	1970	3,50	5,80	4,49	0,28	0,06
Ln wage/hour, 2000 (panel)	1942	3,61	7,46	4,75	0,31	0,07
Unemployment 1991-2000 (panel)	1985	0	1	0,33	0,47	1,43

Note: All variables refer to 2000 unless otherwise indicated. For variable definitions, see section Data and methods. Sd is standard deviation. Cov is coefficient of variation (sd/mean).

Table 2. Distribution of introductory, formal and continuing
on-the-job training. Percentile values. Swedish LNU
survey, 2000.

	Introductory	Formal	Continuing
prop min	0,016	0,512	0,053
5	3	0	0
10	11	0	1
25	38	0	2
50	144	0	2
75	345	5	3
90	690	10	4
95	690	16	4
prop max	0,217	0,002	0,180

Note: Introductory and formal OJT are measured in days,
continuing OJT is a scale. (For variable definitions,
see section Data and methods.) Prop min and prop
max are the proportions of all respondents having the
minimum and maximum values, respectively, on each
variable. (For definitions of min and max values for
each variable, see Table 1.)

Table 3. Time elasticities and correlations for on-the-job training and hourly wage. OLS regressions, Swedish LNU surveys, 1991 and 2000.

	elasticity	elast > 0	correlation	corr > 0
Introductory OJT	0,429	0,483	0,479	0,497
Formal OJT	0,247	0,177	0,267	0,141
Continuing OJT	0,331	0,330	0,338	0,261
Wage (/hour)	0,726		0,649	
N i	1962	1907	1962	1907
N f	1981	970	1981	970
N c	1975	1877	1975	1877
N w	1927		1927	

Note: Elasticity is the unstandardized regression coefficient (B) of the logged value at 1991 with the logged value at 2000 as dependent variable. Correlation is the Pearson correlation (in the bivariate case equal to the standardized regression coefficient, beta).

Table 4. Frequency comparison between introductory and formal on-the-job training (OJT). Swedish LNU survey, 2000.

	mean days	Elasticity	mean total exper	mean jobs	product days	share 1	share 2
Introductory OJT	257	0,429		4,34	478,5	0,908	0,841
Formal OJT	4,44	0,247	44,35		48,6	0,092	0,159
Sum					527,1	1,000	1,000

<u>Note</u>: 'Mean days' from table 1, 'elasticity' from table 3, 'mean total exper'=mean+2sd of experience from table 1, 'mean jobs'='mean total exper' divided by mean seniority from table 1, 'product days'=product of columns 1, 2 and 4 for introductory OJT and product of columns 1, 2 and 3 for formal OJT, 'share 1'=share of product days, 'share 2'=product days replaced by mean days for introductory OJT

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Table 5. Correlations (Pearson) between wage (/hour), experience, education, educational requirements and on-the-job training (OJT). Swedish LNU survey, 2000.

	wage	exper	prev exper	seniority	educ	educ req	introductory OJT	formal OJT
Experience	0,169							
Prev experience	0,083	0,600						
Seniority	0,126	0,644	-0,224					
Education	0,338	-0,324	-0,193	-0,211				
Educ req	0,480	0,042	-0,027	0,078	0,581			
Introductory OJT	0,419	0,165	0,062	0,141	0,199	0,402		
Formal OJT	0,263	-0,005	-0,072	0,063	0,199	0,264	0,234	
Contin OJT	0,216	-0,054	-0,049	-0,017	0,224	0,317	0,328	0,216

Note: The OJT variables and wage are logged. All other variables are measured in years. 'Experience' is measured at interview, 'Prev experience' at entry to current firm. 'Seniority' is time spent at current firm. (For variable definitions, see section Data and methods.)

Table 6. Introductory on-the-job training by experience,
education and educational requirements. OLS
regression. Swedish LNU survey, 2000.

	B	T
(Constant)	3,780	55,6
Experience	0,018	2,1
Exper sq	0,000	-0,8
Ed req	0,283	11,3
Ed match	0,249	21,4
Ed	-0,012	-0,7
R^2	0,167	
N	2996	

Note: The dependent variable is logged. All
independent variables are measured in years.
Experience is measured at entry to current
firm. 'Ed req' is educational requirements in
excess of education, 'Ed match' is education
matched by educational requirements, 'Ed' is
education in excess of educational requirements.

Table 7. Formal on-the-job training (OJT) by experience, education, educational requirements and introductory OJT. OLS regressions. Swedish LNU survey, 2000.

	Model 1		Model 2		Model 3		Model 4	
	B	t	B	t	B	t	B	t
(Constant)	0,629	13,5	0,547	9,7	0,235	3,6	0,196	2,8
Experience	-0,007	-1,2	-0,005	-0,8	-0,008	-1,5	-0,007	-1,3
Exper sq	0,000	0,1	0,000	0,1	0,000	0,2	0,000	0,2
Seniority			0,005	2,6			0,003	1,5
Ed req	0,087	5,0	0,077	4,3	0,056	3,2	0,051	2,9
Ed match	0,117	14,6	0,119	14,8	0,091	10,6	0,093	10,7
Ed	0,013	1,1	0,020	1,7	0,014	1,2	0,019	1,6
Introductory OJT					0,105	8,5	0,103	8,2
R^2	0,074		0,076		0,095		0,095	
N	3009		2990		2990		2990	

Note: The dependent variable and introductory OJT are logged. All independent variables except introductory OJT are measured in years. 'Experience' is measured at entry to current firm. 'Seniority' is time spent at current firm. 'Ed req' is educational requirements in excess of education, 'Ed match' is education matched by educational requirements, 'Ed' is education in excess of educational requirements.

Table 8. Continuing on-the-job training (OJT) by experience, education, educational requirements, and introductory and formal OJT. OLS regressions. Swedish LNU survey, 2000.

	Model 1		Model 2		Model 3		Model 4		Model 5	
	B	t	B	t	B	t	B	t	B	t
(Constant)	1,013	62,0	1,039	52,8	0,799	35,1	0,836	34,5	0,827	34,3
Experience	0,000	0,1	0,000	-0,3	-0,001	-0,4	-0,002	-1,1	-0,002	-0,9
Exper sq	0,000	-0,8	0,000	-0,8	0,000	-0,7	0,000	-0,6	0,000	-0,7
Seniority			-0,002	-2,4			-0,003	-4,3	-0,003	-4,5
Ed req	0,044	7,2	0,047	7,5	0,028	4,6	0,033	5,3	0,031	5,1
Ed match	0,049	17,6	0,049	17,3	0,035	12,0	0,033	11,3	0,030	9,9
Ed	0,008	2,0	0,006	1,3	0,008	2,1	0,004	1,0	0,003	0,8
Introductory OJT					0,057	13,2	0,059	13,8	0,055	12,8
Formal OJT									0,039	6,3
R^2	0,103		0,104		0,152		0,157		0,168	
N	3005		2988		2988		2988		2982	

Note: The dependent variable and the independent OJT variables are logged. All other independent variables are measured in years. 'Experience' is measured at entry to current firm. 'Seniority' is time spent at current firm. 'Ed req' is educational requirements in excess of education, 'Ed match' is education matched by educational requirements, 'Ed' is education in excess of educational requirements.

Table 9. Wage (/hour) by experience, education, educational requirements and on-the-job training (OJT). OLS regressions. Swedish LNU survey, 2000.

	Model 1		Model 2		Model 3		Model 4	
	B	t	B	t	B	t	B	t
(Constant)	4,181	192,8	4,180	192,4	4,265	215,8	4,205	202,4
Experience	0,010	7,6	0,011	7,6	0,006	4,2	0,008	5,5
Exper sq	-0,013	-4,3	-0,013	-4,3	0,000	-1,8	0,000	-2,0
Seniority			-0,001	-1,2			0,004	8,5
Ed req	0,023	5,3	0,023	5,3	0,029	6,7	0,022	4,9
Ed match	0,048	22,1	0,048	22,1	0,047	21,4	0,049	22,5
Ed	0,017	5,7	0,017	5,6	0,011	3,7	0,016	5,5
Introductory OJT	0,041	12,8	0,041	12,8	0,046	14,4	0,042	13,2
Formal OJT	0,029	6,4	0,029	6,5	0,032	7,0	0,030	6,8
Continuing OJT	0,014	1,1	0,014	1,0	0,002	0,1	0,011	0,9
R^2	0,343		0,343		0,323		0,339	
N	2883		2879		2879		2879	

Note: The dependent variable and OJT are logged. All independent variables except OJT are measured in years. 'Experience' is measured at interview (models 1 and 2) and at entry to current firm (models 3 and 4). 'Seniority' is time spent at current firm. 'Ed req' is educational requirements in excess of education, 'Ed match' is education matched by educational requirements, 'Ed' is education in excess of educational requirements.

Table 10. Wage growth 1991-2000 by experience, education, educational requirements and on-the-job training (OJT). OLS regressions. Swedish LNU surveys, 1991 and 2000.

	Model 1		Model 2		Model 3		Model 4	
	B	t	B	t	B	t	B	t
(Constant)	1,976	20,2	1,971	20,1	2,061	21,0	1,968	20,0
Wage/hour 1991	0,601	25,6	0,602	25,5	0,560	24,2	0,593	25,1
Experience	-0,013	-7,0	-0,013	-6,8	-0,006	-3,1	-0,008	-4,1
Exper sq	0,028	5,3	0,028	5,3	0,000	2,0	0,000	2,2
Seniority			0,000	-0,3			-0,004	-5,7
Ed req	0,013	2,7	0,013	2,8	0,011	2,3	0,015	3,1
Ed match	0,025	9,4	0,025	9,4	0,027	9,9	0,024	8,9
Ed	0,020	5,6	0,020	5,6	0,023	6,7	0,019	5,4
Introductory OJT	0,011	3,4	0,011	3,3	0,010	2,9	0,011	3,3
Formal OJT	0,016	3,6	0,016	3,6	0,015	3,2	0,015	3,4
Continuing OJT	0,038	2,7	0,038	2,8	0,043	3,1	0,041	2,9
R^2	0,493		0,492		0,477		0,486	
N	1805		1796		1796		1796	

Note: The dependent variable is wage/hour 2000. All independent variables refer to 1991. The dependent variable and OJT are logged. All independent variables except OJT are measured in years. 'Experience' is measured at interview (models 1 and 2) and at entry to current firm (models 3 and 4). 'Seniority' is time spent at current firm. 'Ed req' is educational requirements in excess of education, 'Ed match' is education matched by educational requirements, 'Ed' is education in excess of educational requirements.

Table 11. Unemployment 1991-2000 by experience, education, educational requirements and on-the-job training (OJT). OLS regressions. Swedish LNU survey 1991.

	Model 1		Model 2		Model 3		Model 4	
	B	t	B	t	B	t	B	T
(Constant)	0,836	18,4	0,825	18,4	0,529	12,7	0,752	18,0
Experience	-0,032	-8,4	-0,023	-6,1	-0,001	-0,3	-0,010	-2,7
Exper sq	0,049	4,7	0,042	4,1	0,000	-0,1	0,000	0,3
Seniority			-0,013	-8,2			-0,021	-15,6
Ed req	-0,006	-0,6	-0,005	-0,5	-0,031	-3,2	-0,003	-0,3
Ed match	-0,034	-7,0	-0,032	-6,6	-0,029	-5,6	-0,035	-7,2
Ed	-0,007	-1,0	-0,008	-1,1	0,011	1,5	-0,009	-1,3
Introductory OJT	-0,009	-1,5	-0,009	-1,5	-0,023	-3,5	-0,010	-1,6
-Formal OJT	-0,042	-4,7	-0,040	-4,6	-0,047	-4,9	-0,042	-4,7
Continuing OJT	-0,008	-0,3	-0,004	-0,1	0,017	0,6	0,000	0,0
R^2	0,150		0,180		0,063		0,172	
N	1862		1853		1853		1853	

Note: The dependent variable is unemployment between 1991 and 2000, dichotomized into zero versus at least one day of registered unemployment. All independent variables refer to 1991. The OJT variables are logged. All other independent variables are measured in years. 'Experience' is measured at interview (models 1 and 2) and at entry to current firm (models 3 and 4). 'Seniority' is time spent at current firm. 'Ed req' is educational requirements in excess of education, 'Ed match' is education matched by educational requirements, 'Ed' is education in excess of educational requirements.