Over-education or Lack of Skills? Job Matching on the Swedish Labour Market 1974 – 2000

First draft
2004-09-23

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- This paper is part of the EDWIN (Education and Wage Inequality) project, financed by the European Commission under the contract HPSE-CT-2002-00108.

Introduction

Two trends with considerable impact on social inequality in the labour market have occurred in parallel in most developed societies in recent decades: an increasing number of people continue to pursue further education, at the same time as employers' demands for a skilled labour are increasing. In Sweden, the expansion of education entails that the proportion of people with only compulsory schooling has fallen dramatically, from 52 per cent of all employees in the mid-1970s to 16 per cent in 2000. The ambitious goals of education policy makers are not only to open upper secondary school to all youths, but also to broaden recruitment into more advanced studies. An expressed goal of the Government is that at least half of each grade that leaves school should begin tertiary studies before the age of 25 years (Department of Education, 2001).

Parallel with the expansion of education, educational requirements in the labour market have risen considerably. For Sweden, this development trend has recently been described by le Grand et al. (2001a). The rise in the level of qualifications has occurred gradually over time and its main cause is a structural transition: The industries and occupational groups where educational requirements are relatively high is expanding. At the same time, the proportion of industries and occupational groups with relatively low skill requirements has been shrinking.

How these changes affect matching between individuals and jobs has been the object of an extensive debate among labour market researchers. If the supply of well-educated people increases more rapidly than the demand for their qualifications in the labour market, many employees will run the risk of ending up in jobs where their competence is not fully utilised. If, on the other hand, educational requirements in the labour market increase at a pace to which the educational system does not manage to adapt, a lack of skills will instead arise.

Which of these scenarios actually takes place is of great significance for peoples' living conditions. Firstly, the degree of match between the workers' skills and the requirements of their job is important for the psychological rewards and pressures that arise in daily work. If the contents of the work deviate significantly from an individual's level of competence, the individual may either become bored or be under too much strain. Both cases involve a risk of impoverishment of individual capacity or loss of self-confidence. Secondly, the individual receives a lower return to his/her education if matching is flawed (Duncan and Hoffman 1981,

with many followers; see Rubb 2003 for a review of empirical results). An empirical generalization on the basis of research in many countries is that education above the educational requirements set by the job is less paid than education up to the level of that is required for the job. Thirdly, a poor match between the worker's skill and the skill required in the job is inefficient, from the point of view of both the company and society, which leads to deteriorating welfare development for the population. Fourthly, the wage distribution is affected by the nature of the matching processes. If the supply of an educated labour force grows more rapidly than what the employers demand (all else being equal), earnings differentials will decrease between groups whith different length of schooling, and vice versa. Such variations in the educational wage premium are potentially an important source of changes in the inequalitiy of society's economic reward structure.

The transition from a labour market dominated by poorly educated people and unskilled jobs, as, for example, in Sweden a quarter of century ago, to the labour market of today with many well-educated individuals and qualified work tasks, involves an important shift between two different social systems. We will argue below that this transformation will soon be complete in Sweden. In the future, matching between individuals and jobs will thus develop differently compared to the most recent decades. There is considerable indication that it follows a curvilinear course, where matching during the ongoing shift between the two social forms deteriorates considerably only to improve later or at least to stabilise. The pattern of change is reminiscent thus far of the development of inequality in incomes that Kuznets (1955) once sketched in a well-known and influential analysis. Kuznets dealt with the transition between agricultural and industrial societies. He assumed that differences in incomes within these two commercial sectors were considerably less than the differences between them. Thus, one could expect overall inequality in incomes to increase markedly during the period of time in which the shift between the social forms was under way, to shrink again later when the transition neared its end. Thus, the course would follow an inverted U-curve over time. Further on in this paper, we do a closer analysis of how the development of the matching process similarly follows a non-linear course during the shift from an unqualified to a highly qualified working life.

In terms of the scenario we have just outlined, differences in the rate of growth between people's qualifications and job requirements may lead either to over-education or to lack of educational skills. Previous research in the area has found support for both developments. A

well-established tradition within labour market research claims that the increase in educational requirements in the labour market is part of a continuous and relatively rapid process, which we have witnessed at least since the 1950s. As the relative income for the better educated (that is, the income of the highly skilled *in comparison with* the unskilled) has increased in several countries in recent years, despite the fact that the proportion of well-educated in the labour force has grown at the same time, the explanation must – according to a conventional economic view – lie in the fact that the demand for an educated labour force has risen even more rapidly than the supply.

The question thus arises why the (relative) demand for a skilled labour should have risen so rapidly. A common assumption is that the rise in the level of work skills is closely linked to technological changes (often with emphasis on the increasing significance of computerisation), stiffening competition on the product markets (for example, via globalisation), and transitions to more flexible organisational designs. Partly through different causal mechanisms, these three factors are assumed to function together to upgrade the level of work qualifications in industrialised countries. The rapid increase of the demand for skills is assumed to lead to major imbalances on the labour market, as the supply of skilled labour does not expand to the same extent. The imbalance between supply and demand is the factor, which pulls the earnings structure apart and creates higher earnings premiums for highly skilled employees. Parts of the economic literature in the area have above all focused on the role that rapid technological development is assumed to play in this context. This theoretical scenario, called *skill-biased technological change* (SBTC), has had a major impact on the research literature but has hitherto received very limited empirical support (Morris and Western 1999; Bernstein and Mishel 2001; Card and DiNardo 2002, but see the extensive review in Acemoglu 2002 for a different interpretation of the status of the evidence).

The second line of research is based on the opposite assumption. It maintains that the expansion of a well-educated labour force is not counter-balanced by an increasing demand for qualifications on the labour market. As early as the late 1940s Harris (1949) discussed this risk, on the basis of an analysis of the labour market for workers with *college*-exams in the USA. After the rapid rise in the number of university students in the western world in the late 1960s, the problems of many of them were experienced as acute. Titles of books from this time like *Education and Jobs: The Great Training Robbery* (Berg 1970) and *The Over-educated American* (Freeman 1976) evoke the picture of a large and growing gap between the

high skills that the labour force was bringing to the labour market and the relatively low requirements for education that the existing jobs posed. One way of summarising this research tradition is to maintain that education from having been a sufficient but non-essential condition to gain a well-paid and attractive job, has become an essential but insufficient condition (see e.g. Jonsson 1984; Smith 1986). An excess of well-educated people changes the nature of the matching process. Attractive jobs are reserved for the well-educated, while at the same time, a growing group of the well-educated have to accept jobs that were traditionally reserved for people with fewer educational merits.

Research[1] in recent years has come to a somewhat contradictory result concerning the degree of over-education and its changes over time. A special edition of the journal *Economics of Education Review* (2000) presents, among other articles, the results of a meta-analysis of earlier empirical studies in the area (Groot and Maassen van den Brink 2000). The conclusion drawn from this analysis is that no evidence exists to show that important differences between supply and demand for education have generally increased during the past twenty years. In the same issue, there are however, analyses that point to an increase in over-education in a number of European countries (Hartog 2000). Development trends are thus unclear.

In Sweden, two analyses of skills structures show that during recent decades the extent of over-education has increased markedly. Firstly, the average educational level of employees has clearly risen more rapidly during the past quarter-century than the average level of job qualifications, measured by the educational requirements posed by the job according to testimony of the employees themselves (le Grand et al. 2001b). Consequently, there is a rapid growth in over-education (see also Böhlmark 2003). Secondly, an important cause of over-education appears to be that the proportion of unskilled jobs, namely jobs demanding education above compulsory school or similar, is declining considerably more slowly than the proportion of employees who have no education above compulsory school level (Åberg 2002).

[1] Economists dominate this field of research today. After early analyses by sociologists, among others Berg (1970) and Kalleberg and Sørensen (1973), and somewhat later by among others, Burris (1983) and Shockey (1989), they appear to have abandoned this area. A critical article by Halaby (1994) appears to have put a stop to the input by sociologists, which is regretable. Åberg (2002) reopened the field in Sweden.

In their analyses of matching processes on the labour market, many authors thus emphasise the relative changes in supply and demand for skilled labour. Is a well-known fact that expansion of the educational system in general has raised the educational level of the labour force in modern social societies. Less well-known, however, is how this rise is related to the (potentially) increasing demands for education posed by the labour market. Figure 1 shows, for the period 1974–2000, the average number of years of education after compulsory school that employees have, and the average years of schooling (in addition to compulsory school or earlier primary school forms) required in the jobs. As the figure shows, the supply of skills which employees bring with them to the labour market and the skills required on the labour market were in balance at the beginning of the period. Educational expansion nevertheless resulted in the supply of a well-educated labour force increasing more rapidly than what the jobs required. The gap between supply and demand seems to have increased above all during the periods 1974–1981 and 1991–2000.

FIGURE 1

The results in Figure 1 can be interpreted as that the labour market's demands for education has not caught up with the expansion of education, and that this on purely logical terms leads to a situation where the proportion of the over-educated workers increases. (In the next section, we will return to how the expansion of education systems can quite mechanically affect the proportion of over-educated in the labour force.) To be able to draw more reliable and empirically based conclusions, the arguments need to clarify which of the two above-mentioned research traditions is best suited to analysing matching processes on the labour market. The central issue in this context is how the nature of the matching processes should be operationalised. A long tradition exists within empirical labour market research to define the supply of skills in the labour force in terms of the educational level of the labour force, which we also did in the figure. Through this type of operationalisation, the workers whose years of schooling exceeds the number of years of schooling required by their jobs are defined as over-educated. Some authors have, however, maintained that the expansion of education has led to educational inflation, i.e. to a situation where the significance of the level of education as a resource on the labour market has fallen and other resources have gained in importance. Among these other resources the horizontal dimension of education is mentioned, that is, which *type* of education the employees have followed (Erikson and Jonsson 1998; van de Werfhorst 2001; Jackson et al. 2002). On the basis of such a perspective, matching

processes can be specified to relate to both educational dimensions, the vertical and the horizontal.

Often, the employers state their needs for skills both in terms of the level of education and the educational subject matter, which would imply that the horizontal dimension of education is an important part of the matching process. Some researchers argue that the educational subject matter is an increasingly important criterion in the selection processes on the labour market (van de Werfhorst 2001). Despite this, the horizontal dimension of edcuation is an area where less research has been done than in the vertical dimension. The central issues which the literature attempts to illuminate include: which determining factors generate a mismatch between the type of education and the job, and which consequences for careers and labour market outcomes does this matching process entails (Witte and Kalleberg 1995; van de Werfhorst 2001; Wolbers 2003).

On the basis of a specification of matching processes on both the vertical and the horizontal dimensions, it may potentially appear that the research tradition, which maintains that the demand for qualifications exceeds the supply, has empirical support. Yet, the forces that drive structural change in the direction of increasingly higher educational requirements at work may act in a more selective way than the over-education debate assumes and Figure 1 shows. If demand for specific types of education increases at the same time as the supply of people with this educational subject matter is limited, what is called over-education in conventional analyses may be better described as *incorrect education*. A labour force with a relatively high educational level but an incorrect educational subject matter in relation to labour market requirements, may lead to an increasing imbalance and growing income differences on the labour market, that is, to the scenario assumed by the SBTC-perspective (see above).

The above-mentioned results on increasing over-education on the Swedish labour market were both important and surprising, but they were based on fairly rough analyses, and thus gave only a superficial picture of the transition of the skill structure in recent years. This conclusion relates particularly to our own earlier contribution (le Grand et al. 2001b), where the question of growing over-education was only a side-issue in the analysis we were conducting at the time. In this paper, we shall thus focus on the relationship between the individuals' education and the educational requirements of her job, and particularly on how this relationship has changed. We make two main contributions to the Swedish and

international research in the area. Both contributions aim to penetrate behind the general division into under-educated, correctly matched and over-educated which dominate previous studies within the field. These three simple categories are problematically heterogeneous and hide in the net figures the gross changes, which occur below the surface. We maintain that it is difficult to understand the causes of these developments unless one can unsnarl this heterogeneity, and our intention here is to undertake an analysis that will provide more clarification.

In the first place, we differentiate between people with shorter and longer schooling on the one hand, and between unskilled and skilled jobs on the other. The combination of these two dichotomies to make four groups opens new perspectives on the long-term development that is occurring on the Swedish labour market, which results in several interesting conclusions. Secondly, we seek to remove an obvious limitation of most of the earlier analyses of matching between individuals and jobs in relation to education, namely that it is only the *extent of education* that is taken into account. Clearly, it is also important to take account of the *subject matter* studied. It is perfectly possible that a great part, perhaps the main part, of the increasing over-education in Sweden (as in other countries where similar trends are observed) consists of schooling that is largely irrelevant to the specific work tasks which is to be performed. Our other contribution in this chapter is to investigate the extent of such mismatch, and to see how this potential flaw in adaptation between school and labour market modifies our picture of the increase in over-education.

A third object of this chapter is to study which groups of employees, within which kinds of jobs and industries, are more or less likely to be over- or under-educated. We also ask ourselves whether structural changes over time on the labour market, in terms of age, gender, educational level, industry and sector, can explain the changes that have occurred in relation to the proportion of over- and under-educated.

The logic of matching

Literature on over-education has, as far as we are aware, not dealt with the question of how the expansion of the educational system on purely logical grounds can affect the total proportion of the over-educated in the labour force. Such effects are important to take into account if we are to understand the changes in the proportions of over-educated over time. As

we have just indicated we can acquire important insights about how matching changes, by dividing employees in four groups on the basis of the length of their education and the requirements for education in their jobs.

The division into groups is done in the following way: We first differentiate between unskilled and other people, where a low level of education is defined as a maximum of one year's schooling in addition to compulsory school (or comparable). Secondly, we differentiate between unqualified jobs, defined as the jobs that require a maximum of one year's education in addition to compulsory school, and qualified jobs that demand a longer education than that. Later we cross-classify these two dichotomies and arrive at four groups:

(a) educated people in qualified jobs (we call this group UK in the presentation),
(b) educated people in unqualified jobs (called UL),
(c) unskilled people in qualified jobs (called LK), and
(d) unskilled people in unqualified jobs (called LL).

As we will show below, this division is central to understanding how the proportion of over- and under-educated compared to correctly matched employees, develops over time. There is, namely, a logical pattern in the relationship between belonging to one of the four groups, on the one hand, and the probability of being correctly or incorrectly matched, on the other. This logical pattern entails that shifts over time in the relative size of the four groups exert pressure on the proportion of correctly and incorrectly matched employees in a particular direction. Another important insight offered by dividing up the workforce in this way is that the categories correctly matched, under- and over-educated are internally heterogeneous (that is, made up of different components). We will soon return to the empirical side of this phenomenon, but will first indicate what the logical pattern looks like; see Table 1.

TABLE 1

The four groups, which make up the columns in the table, consist of people with:

(a) higher than elementary education in a job which requires qualifications (UK),
(b) higher than elementary education in a job that does not require qualifications (UL),
(c) only elementary education in a job which requires qualifications (LK),
(d) only elementary education in a job that does not require qualifications (LL).

The rows in the table consist of the three categories under-educated, correctly matched with

regard to the level of education, and over-educated. In accordance with the results presented in Figure 1 above, the relative size of the four groups (columns) in recent decades developed in such a way that an increasing proportion of the workforce shifts to the first column. This is a logical consequence of the appreciable rise in both the individuals' educational level and the qualifications required by different jobs during recent decades.

In the group educated people in jobs that require qualifications there are both people whose education exceeds the qualifications required (over-educated), those whose education fits the requirements (matched) as well as people with an educational level below the qualifications required (under-educated). An M in all the cells in the first column of the table shows that all combinations are logically possible.

In addition it can be noted that three of the table's cells consist of logically necessary combinations, marked N. This means that all individuals in the three groups on the right in the table, that is, all people who either are unskilled or have a job requiring low qualifications, can only belong to one of the categories under-educated, matched and over-educated. Naturally, this is in one sense trivial – it follows from the definitions we use. Nevertheless, the conclusion is significant: the proportion of over- and under-educated changes automatically when the three groups on the right in the table grow or shrink in size. The significance of this conclusion increases when, in the long-term, two of the three groups lose ground on the labour market, and within one or two decades should virtually disappear from the labour market. Both groups consist of individuals with very short education, where the proportion of younger age groups is particularly low. At the rate that these unskilled people go on pension, the empirical central point in table shifts to the left. We return to this question towards the end of this section.

Another important conclusion from the pattern in Table 1 is that, within each of the three categories under-educated, correctly matched and over-educated, two different sub-groups exist. Both the under-educated and the correctly matched can be divided into one group with at least two years education in addition to compulsory school (or corresponding) and one group with on the whole only compulsory schooling. Among the over-educated we can instead differentiate between a group of employees which has qualified jobs (which demand at least two years education in addition to compulsory school) and a group which has jobs which do not have such requirements. In all cases, this means that the categories are

noticeably heterogeneous. An analysis of the composition of the categories and the change in size must take this heterogeneity into account to be meaningful.

Furthermore Table 1 shows that there may be three different reasons for a change in the proportion of over-educated among employees who have at least two years education in addition to compulsory school. Firstly, the group of employees who have at least two years education in addition to compulsory school, but who work in unqualified jobs, may grow or shrink in size. Secondly, the total number in the group who have education and work in qualified jobs may grow or shrink in size, without the proportion of over-educated changing within the group. Thirdly, simply the proportion of over-educated within the above-mentioned groups may increase or decrease. To lay bare the driving forces behind a possible change in the extent of over-education, it thus becomes important to differentiate between these three reasons, which we intend to do below.

Finally, we can observe that six of the table's twelve cells are empty. These cells (indicated by a dash in the table) consist of combinations that are logically impossible given the definitions we use.

As discussed above, the proportion of individuals with very short education has fallen dramatically during recent decades. The logically necessary consequence of this is that the proportion of under-educated and correctly matched is falling to the benefit of the proportion of over-educated, if all else remains the same. Before we turn to the empirical results, we should report on a simulation analysis that demonstrates this logic. Here we are calculating the necessary consequences for over-education of given changes in the proportion of people with only elementary education and changes in the proportion of jobs with higher educational requirements. If the proportion of employees who have an education higher than elementary increases over time, the aggregated proportion of over-educated will also increase, even if the probability of over-education among people with education does not change.

TABLE 2

A simple example shows this (see Table 2). At Occasion 1, we assume that the proportion of unskilled people in the labour force is 50 per cent. On the demand side, the proportion of jobs with or without educational requirements is 50 per cent each. Those with an elementary

education fill all the jobs that do not have educational requirements. Those with higher than elementary education are, however, not perfectly matched, even if none of them has a job that has no educational requirements whatsoever. We assume that 20 per cent of this group are over-educated, that is, have jobs with lower educational requirements than the individuals' own educational level.[2] The total proportion of the over-educated at Occasion 1 will then be 10 per cent [(0,50 * 0) + (0,50 * 0,20] = 0,10).

On Occasion 2, we consider two different scenarios. Alternative A entails a structural symmetrical structural change, that is, it is identical on both the supply and demand side. The proportion of people with only elementary education is assumed to fall to 20 per cent, at the same time as the proportion of jobs without educational requirements also falls to 20 per cent. The probability of over-education for people with education remains 0,20, the same as on Occasion 1. The total proportion of over-educated on Occasion 2, according to alternative A, increases to 16 per cent ((0,20 * 0) + (0,80 * 0,20) = 0,16). Despite a symmetrical structural transition on both the supply and demand sides, the aggregated over-education will thus increase by 60 per cent.

On Occasion 2, Alternative B assumes that an asymmetrical structural transition has occurred where the proportion of employees with education increased more (from 50 till 80 per cent) than the proportion of jobs with educational requirements has done (from 50 till 60 per cent). Such a change means that certain people with further than elementary education will of necessity take jobs with lower educational requirements and thus become over-educated. The total proportion of over-educated now becomes as high as 32 per cent, that is, twice as high as in Alternative A. The educational expansion that we witnessed during recent decades means that the Swedish labour market today resembles the B-scenario in the above example.

This analysis indicates that a central cause of the growing over-education quite simply is that the proportion of individuals with very short education has fallen sharply over time. However, we are rapidly approaching the time when the proportion of the unskilled cannot drop any

[2] The group with higher than compulsory education encompasses people with different lengtsh of education, at the same time as the group jobs with educational requirements encompass jobs that make different demands on the length of education. We assume that, within this group, matching between individuals and jobs is not perfect, because of a lack of information and circumstances that entail that certain people cannot take certain jobs (so-called rigidity on the labour market, see Green and McIntosh 2002).

more, since it has soon reached nil. Thus an important driving force for both mismatching and increasing over-education is disappearing, and thereby they can be assumed to become considerably less prominent tendencies during coming years.

Empirical results

In the following empirical section, our point of departure is the simple division that is based on a dichotomy (bi-section) of the length of education of the individual and the jobs' educational requirements. The aim is to depict the character of the changed matching in more detail than in earlier studies conducted in Sweden during recent decades. The empirical section begins with a brief description of how matching on the labour market has changed since the mid-1970s. Four more specific analyses follow. The aim of the first analysis is to study the degree to which the rising average over-education can be explained by changes marginal distributions, that is, changes in the proportion of employees with low education and the proportion of jobs with low educational requirements. The aim of the other analyses is to study how matching between individuals' education and work requirements has changed *within* each category of employees who, according to the definition, can be over-educated, correctly matched or under-educated. The third analysis focuses on which factors affect the probability of an individual having a specific combination of education length and educational requirements at work. The fourth and last analysis studies how matching on the labour market has changed when we pay attention to both the length of education and its subject matter. The overriding question here is: to what degree can development during recent years be described as an increase in incorrect qualifications rather than an increase in over-education?

A. Descriptive survey

In Figure 2 an overview is presented of how matching between individuals and jobs has developed between 1974 and the year 2000. All employed individuals whose own education deviates by no more than one year (upwards or downwards) from the educational demands made in the individuals' work are regarded as correctly matched with regard to educational length. Other employees are seen as either under- or over-educated, depending on whether their own educational level is below or exceeds the job requirements by two or more years.

FIGURE 2
Legend: Under-educated, Matched, Over-educated

The main result shown in the figure is that a marked deterioration in the matching process has occurred on the Swedish labour market during the period. The proportion of employees who are correctly matched, that is, for whom educational length and the job's educational requirements are in parity with each other, has fallen dramatically: from less than two- thirds of all employees to less than half. At the same time, the proportion of over-educated has doubled and in the year 2000 consisted of more than a third of all employees. Broadly speaking, we have already demonstrated these trends in our earlier published analysis (le Grand et al. 2001b).[3]

In Table 3 we do a more in-depth analysis of matching processes by breaking down the categories under-educated, matched and over-educated according to the logical divisions presented in Table 1 above. The method differs from those of earlier studies. The labour market is divided into four categories. The first category (UK) includes the employees whose education exceeds the elementary level and whose jobs require some form of qualification (above compulsory school). The second category (UL) consists of people with education in addition to the elementary in jobs without educational requirements. The category LK consists of people with only elementary education whose jobs make demands on education. Finally, category LL includes the people who have no education above the compulsory, and whose jobs lack educational requirements.

TABLE 3

As we can see, an extensive net transition is under way from group LL (unskilled people in unqualified jobs) to the UK and UL groups which consist of educated people who are either over-educated in unqualified jobs (UL) or spread over all the three matched categories with qualified jobs (UK). The increase is greatest in group A, which has more than doubled in size

[3] The results are, however, not identical, since here we have defined different groups of employees in a partially different way. The difference is that we now bring individuals together with no or one year's education in addition to compulsory school (or corresponding) into the category, 'unskilled' (which gives an educational value of nil), and jobs with no or one year's educational requirements in addition to compulsory school (or corresponding) into one category, 'unqualified jobs' (which gives a demand value of nil). This leads to the estimated proportion of correctly matched, under-educated and over-educated employees changing somewhat. The trends relating to the development of the proportions are nevertheless very similar in both analyses.

and consists of the majority of all employees in the year 2000. Group LK (unskilled people in qualified jobs) is relatively stable in size during the period, but displays a tendency to fall during the 1990s.

The pattern in this substantial shift, which can be seen as a manifestation of the transition from low qualifications to high qualifications in the labour market, has several important consequences. Please note particularly the following:

The decline in the proportion of employees in matched jobs seen over the whole labour market is completely dominated by the rapid reduction of group LL, that is, the unskilled in unqualified jobs. This group's proportion is approaching nil and will in the future leave considerably less of an impression on labour market trends. The other matched group, UKm (educated people in qualified jobs), has instead grown continuously since 1974, as a proportion of all employees.

The total proportion of under-educated is more or less constant at 16 to 18 per cent of all employees since 1974. The heterogeneity is also noticeable here (as in the case of the correctly matched), at least during the 1990s: the proportion in group LK (unskilled in qualified jobs) reflects a falling tendency since 1991, while the proportion of educated in qualified jobs (UKu) has risen somewhat.

The proportion of over-educated of all employees doubled between 1974 and the year 2000 (see Figure 2). In Table 3, we divide this trend into three components. We see firstly that over-education has increased more among employees in qualified jobs (group UKo) than among those who have unqualified jobs (group UL). In 2000, the majority of all over-educated had a job with low qualifications. Within the whole group with qualified jobs (UK) the over-educated (UKo) proportion grew markedly between 1974 and 1981 (from 18 to 26 per cent), while the proportion of under-educated (UKu) fell during the same period (from 21 to 13 per cent).[4] During the 1980s these trends continued but at a slower pace, only to stop after 1991. The proportion of correctly matched within the group UK has been nearly constant at just over 60 per cent during the whole period. We can thus observe that the main reason for the increasing proportion of over-educated on the whole labour market is that the group of

[4] These figures are thus the proportions of all people in group UK who belong to the sub-groups UKo and UKu.

educated in qualified jobs (group UK) has grown substantially. Another important reason is that the group of educated employees in unqualified jobs (group UL) has also grown, even though not as much as the group UK, with the exception of the past decade. The third conceivable driving force to the increasing over-education – that the proportion of over-educated within group A has risen – was only valid to the early 1980s. Subsequently this proportion has, as previously mentioned, been relatively stable.

If group A and B are combined, that is, if we look at the whole group with more than elementary education, then the proportion of over-educated increased between 1974 and 1981 (from 44 to 48 per cent). Thereafter this proportion has been relatively stable. Since the proportion of under-educated in this group has fallen over time, the trend is that proportion of correctly matched has increased somewhat, from 41 per cent 1974 to 46 per cent in 2000 (these percentages are only indirectly revealed in Table 3).

The overriding conclusion of the results in Table 3 is that there is above all one type of position on the labour market that has expanded during the analysed period. Qualified jobs held by people with upper secondary education or higher (group A) were under 30 per cent of the labour market at the beginning of the period, but nearly 60 per cent in 2000. At the same time, the proportion of employees with low education in unqualified jobs (group D) has fallen dramatically, from nearly half of the labour market to just over one tenth. The shift in the qualifications structure between these two categories explains the entire fall in the proportion of correctly matched relative to educational level (proportion correctly matched within group A has not fallen at all), and more than half of the increase in the proportion of over-educated.[5]

TABLE 4

Underlying the trends analysed in Table 3, major differences exist between different sectors of the labour market. This is obvious when we compare the changes in the distribution of each category within the labour market's different branches. According to the pattern that emerges in Table 4, both levels and trends are partially different for, on the one hand, manufacturing

[5] The increase of 11 of a total of 19 percentage points of the proportion of over-educated between 1974 and 2000 are found again in the group UK. Between 1981 and 2000 the corresponding figure is 6 of a total of 11 percentage points without any significant change in the proportion of over-educated within the group UK.

industry, trade, hotel and restaurants, transport and communications and, on the other hand, banking and insurance, public administration as well as care services and education. Category UK (qualified jobs held by employees with at least upper secondary school or similar) is the largest job category within banking and insurance, public administration, care services and education during the entire period studied. The size of the group is increasing gradually and, towards the end of this period, the employees within this category make up about three-fourths of all who work within the banking and insurance sectors, and care services and education, and nearly two-thirds of the employees within public administration. Also, within manufacturing industry, a gradual increase in the size of the A-group is occurring, until they become the majority of all employees in the year 2000.

The proportion of over-educated in unqualified jobs (group UL) has increased continuously during the whole period within all branches except the care services and education, public administration, and banking and insurance. The increases are particularly noticeable within trade and transport where about four out of every ten employees had jobs for which they were overqualified in the year 2000. These two businesses are the only ones where the group UL is the largest category, while the group UK (educated people in qualified jobs) makes up more than half of the employees in all other branches.

The general pattern in the development of qualifications structures over time is clearly seen if one compares the size of the groups LK (unskilled people in qualified jobs) and LL (unskilled in unqualified jobs) in 1974 with the size of the groups UK and UL in 2000. In all branches, the group LL was clearly larger than group LK in 1974 and these two groups together made up the majority of the employees in all branches except banking and insurance, care services and education, and public administration. In 2000, the picture has changed completely. A clear majority of employees in all commercial activities now belong to either of the groups UK and UL, while trade and transport clearly deviate from the general pattern since group UL (educated people in unqualified jobs) is larger than group UK (educated people in qualified jobs). Thus it is in these two branches that a job structure requiring relatively low qualifications has remained during the transition to a labour market dominated by well-educated employees. As we have shown in a recently published analysis (le Grand et al. 2003), the number of unqualified jobs within trade and transport has remained more or less constant since the 1970s. How to fill these jobs when the proportion of unskilled people in the labour force approaches nil is undeniably a challenge for the future.

B. Determining factors for the opportunities for elementary or over- education

In this section, we focus the analysis on the groups of qualifications that have grown during recent decades (group UKu, UKm, UKo and UL as they were defined in Table 3 above). Common to these employees is that they have an education of at least two years in addition to compulsory school. Thus it is within these groups that all over-educated on labour market exist (groups UKo and UL), but many of the under-educated and correctly matched exist here also, during recent times becoming the majority of these (group UKu respective UKm).

We have two aims in this section. The first aim is partly explorative, namely, to study if and how, within labour market research, often used individual and work related characteristics are linked to matching between individuals and jobs. These characteristics are gender, age, educational level, working time, commercial or industrial branch, and occupational category. Since, in several cases, we have clear expectations of the significance of these characteristics the aim of this analysis nevertheless to some extent also involves testing a hypothesis.

Firstly, we expect that women have a higher probability of being over-educated and a lower probability of being under-educated than men. Such a hypothesis follows from the well-known pattern of the reward processes of the labour market, where women's opportunities of reaching advantageous positions are generally worse than men's, and given the size of human capital (education and work experience).

Secondly, we can assume that younger people have a greater probability of being over-educated, and a lower probability of being under-educated than older people. This follows from the traditional theory of human capital, where the amount of human capital is not only determined by formal education, but also by experience and on-the-job training. Given a certain educational level, more experienced employees (normally the older) have more human capital at their disposal than younger employees. Correspondingly, their chances of getting a qualified job are thus better.

Thirdly, it is likely that individuals who work part-time have a higher probability of being over-educated than full-time employees. The main reason for this is that many qualified jobs are only available to full-time workers, and that the people, who for different reasons prefer to

work part-time (for example, many women with small children), can face the choice of either taking a job that fits their own educational level or of shorter working hours. In addition, a contributory cause to (the possible) link between over-education and working time may be that the amount of human capital formed through labour market experience is less among part-time employees than among full-time employees, thus their accumulated experience (counted in hours) is shorter.

Alongside the investigation of the connections we have just discussed, the second main aim in this section is to analyse to what extent changes in matching categories' relative size over time can be explained by a changing distribution among employees with regard to different individual and job-related characteristics. The object is thus to determine to which degree changes between 1974 and 2000 of the proportions of over- and under-educated is related to structural changes in the composition of the labour force and the economy.

Table 5 shows the results of the multinomial logit-regressions of relative risk quotas (also called odds) of belonging to a certain matched category (for a brief explanation of multinomial logit-regression, see Appendix 2). The group used as a reference category in the analyses is UKm, that is, employees with an education that is higher than compulsory school level and whose educational length is roughly the same as the educational requirements for the work they have. We call this group "correctly matched". The other match categories are "under-educated with qualified jobs"[6] (group UKu), "over-educated with qualified jobs" (group UKo) and "over-educated with unqualified jobs" (group UL). The independent variables are educational level (upper secondary school, short and long tertiary education), a division between blue collar workers and clerical staff, commercial or industrial branch (eight categories), a division between part-time and full-time work, gender, and age group (three categories). We present results from an analysis where employees at all points in time (1974, 1981, 1991 and 2000) are included in the same model, and a separate analysis for 2000.

Results for the period 1974 to 2000 as a whole

The column on the far left in each of the three match categories in Table 5 shows results

[6] By qualified jobs we mean here only that the educational demands for a job are more than one year longer than compulsory school.

when, for the whole period 1974–2000, employees are included in the same model.[7] In the category under-educated (relative to the reference group, the correctly matched) we see a strong connection with age. The "risk" of having an education that is too low in relation to the job requirements (compared to being correctly matched) is much greater among older employees (50–65 years) than among younger (19–29 years). The main explanation of this is hardly that the older employees have a shorter education (educational level is included in the model). In line with the hypothesis that we earlier gave, it is more probable that many of the older ones have succeeded in moving upwards in the job structure during the course of a long occupational life and that they have thereby reached a level above their original schooling. To the extent that this is correct, their membership of the group under-educated may be partly misleading, namely, if they through their labour market experience (including on-the-job training in the firm) have acquired the competence that is required for the job.[8] Age has no connection to over-education in a qualified job, but for the risk of being over-educated in a job with low qualifications, the connections are on the contrary even weaker than for elementary education. The relative risk quota of being over-educated in a job with low qualifications is, in other words, clearly greater among younger than among middle-aged and older employees.

Men are over-represented in the group under-educated, that is, it is easier for men than for women to get a job that tends to demand more education than they have themselves. In a corresponding fashion, women clearly run a greater risk of finding themselves in either of the groups of the over-educated, compared to being correctly matched. This is particularly true for the sub-group that is over-educated with completely unqualified jobs. Note that these conclusions require keeping constant the variable for whether employees work full-time or

[7] Observations exist for the same individuals at several different points in time. These observation cannot be assumed to be independent of one another. To correct for this, the so-called "*cluster-option*" has been specified, which affects the estimated standard deviation and estimated variance-covariance matrix. In addition, "robust standard deviations" (the so-called *Huber White sandwich* estimator for the variance) has been used in all models. This approach has also been used in the analyses in Table 6.

[8] This interpretation gains support from the results of a completmentary analysis where labour market experience, measured in terms of the number of gainfully employed years, is used instead of age. Experience can be seen as a more direct indicator of competence gained in occupational life rather than age. The results, which are not reported in table form, show that when either age or experience are used, the substantive conclusions remain the same. But the positive connection to the relative risk of being under-educated is stronger for experience than for age.

part-time, which (as we will see below) also affects the relative risk quota for over-education in a job requiring low qualifications. If we take into account that a much greater proportion of women than men work part-time, women's over-representation among the over-educated thus becomes even greater. These gender differences are expected against the background of the hypothesis we mentioned earlier. A possible mechanism is that men receive more informal coaching and in-house education in the companies than women. On the basis of this, men have perhaps greater opportunities to develop the competence required to accomplish the tasks for which higher education would otherwise be demanded.

As expected, employees who work part-time run a greater risk than full-time employees of being over-educated in unqualified jobs. Green and McIntosh (2002) report similar results from Great Britain, namely, that employees who work part-time are more often over-educated than those who work full-time. A reasonable interpretation is that certain people (mainly women) are prevented from accepting all the jobs to which they are suited because of family obligations. This link can thus be assumed to reflect the fact that many women are forced to choose between either having a full-time job which is suited to their own educational level or to take a part-time job for which she is overqualified. It is also worth noting that this connection means that the proportion of all the working hours completed by the over-educated is lower than the proportion of all employees in the labour force.

Commercial or industrial branches as such do not have a clear connection with elementary education. The only statistically established difference is that employees in the manufacturing industry have a lower proportion of under-educated than the reference category of health and care services, and teaching.[9] With regard to the risk quota for over-education with qualified work, the variation between branches is small. The branch groups that here deviate from the others are banking, insurance and property management, where employees are more likely to be over-educated in qualified work than other employees. Yet, the *proportion* of over-educated in unqualified jobs varies considerably between commercial or industrial branches. The proportion is clearly lowest within the building industry and thereafter within the health and care services, and teaching. Very large proportions of overqualified people with work requiring low qualifications exist in transport and communications and within the trade, hotel

[9] Since it is not possible to differentiate between care services and educational sector for 1974, these branches are merged for every year.

and restaurant sectors. Shop assistants, cleaning and kitchen staff, drivers, and unqualified jobs within the post office are common occupations in this group of branches. Probably many of these posts are of relatively short duration, which in that case may mean that over-education is a temporary problem for numerous individuals.

Educational level and the division between blue collar workers and clerical staff have, on the whole, the expected connections with the risks for under- or over-education. Thus employees with upper secondary school as their highest educational qualification as well as people in clerical jobs are over-represented among the under-educated, while employees with long tertiary education and those with blue-collar jobs are over-represented in the group of over-educated with qualified jobs. Within the group of over-educated with work requiring low qualifications, blue-collar jobs are very common, while people with long tertiary education (at least six years in addition to compulsory school) have a lower risk compared to employees with shorter education.

TABLE 5

Table 5 presents a separate model for 2000 (the second column in every matched category), so that the changes in connections over time can be assessed. (We have also estimated separate models for 1974, 1981 and 1991 but, for reasons of space, we do not report these results in table form.) On the whole, it appears that the connections may be quite stable over time. One exception to this that we should comment on is the commercial or industrial branch. In the group of over-educated with unqualified jobs the connections with the commercial or industrial branch has been markedly strengthened during the 1990s (at the same time as an increased expansion of part-time work has occurred in this group). The proportion of over-educated in work requiring low qualifications has risen above all among employees in the trade, restaurant and hotel industries, and within transport and other private services.

Changes in matched categories' size over time

Table 6 reports results from multinomial logit-analyses with the same design as those in Table 5. The reference category is thus the "correctly matched". The aim here is to analyse which changes in matching categories' relative distribution have occurred over time. In the first

model (a) only dummy variables for the years 1974, 1981 and 1991 are included, that is, the year 2000 is the reference group that adopts the value a. In model (b) the independent variables from Table 5 are included as control variables.

TABLE 6

We see from the first column in model (a) that the relative risk quota of being under-educated in a qualified job (group UKu), compared to being "correctly matched" (group UKm), fell between 1974 and 1991. During the 1990s, this risk quota was unchanged. The relative probability of being under-educated compared to being correctly matched was thus roughly as great in the year 2000 as in 1991, but clearly less than before 1991. When we in model (b) hold changes between the years constant in regard to educational level, gender, age group, branch, the proportion of clerical staff and the proportion with part-time work, no noticeable changes in risk quotas occur over time for the under-educated. The reduction of the proportion of the under-educated between 1974 and 1991 appears thus to depend on factors other than the structural changes which we measure here.

The risk of being over-educated in qualified work, compared to being correctly matched, increased from 1974 to 1981 and has subsequently been relatively constant (see the second column in model a). From model (b), however, it emerges that the results become very different if we keep the control variables constant for change over time. Instead, the relative risk quota becomes less in the year 2000 than in 1981 and 1991, while the differences between 2000 and 1974 are not statistically significant.

It follows from these interesting results that if we conducted the "conceptual experiment" of assuming that employees maintained the same distribution concerning educational level, working time, gender, age, branch membership and proportion of clerical staff during this period, the proportion of over-educated with qualified jobs would have *fallen* during the past two decades. More in-depth analyses that are not reported here in table form indicate however that it is the educational level that almost completely explains this result. More specifically, it is the increasing proportion of employees with long tertiary education (at least six years education after compulsory school) in relation to those with a short tertiary education (4–5 years in addition to compulsory school) who provide the explanation.

TABLE 7

To portray the meaning of these results more concretely, Table 7 (the first three rows) shows the three educational groups as a proportion of the total number of employees (with an education which is at least two years in addition to compulsory school) in 1981, 1991 and 2000. The second panel in the table shows the employees in each educational group as a proportion of different matched categories during the same period of time. In 1981, employees with short and long tertiary education had roughly equal proportions (about a quarter each of all employees with an education after compulsory school), while in 2000 those with short tertiary education only made up about two-thirds of those with long tertiary education (about 23 compared to 34 per cent of all in the whole group of employees). We have seen in Table 5 that the relative risk of being over-educated with qualified work is much greater for employees with long tertiary education than for those with short tertiary education. This also appears in Table 7. The proportion of over-educated with qualified jobs is much greater among those with long tertiary education compared to those with short tertiary education (about 45 compared to 21 per cent). Thus if everything else remains the same, the total proportion of over-educated with qualified work will increase if the proportion of employees with long tertiary education increases. If the increase of the tertiary educated slows down in the future, we can, on the basis of these results, expect the proportion of over-educated in qualified jobs to fall.

Let us return to Table 6. The third column in model (a) shows that the relative risk of being over-educated in work requiring low qualifications, compared to being correctly matched, reveals the same pattern as for the group of under-educated. The relative risk quota fell between 1974 and 1991 and was relatively constant during the 1990s. No statistically significant differences exist between 2000 and 1991, but the total pattern indicates that the group of over-educated with unqualified jobs had a tendency to shrink. The introduction of control variables in model (b) reinforces the falling trend of the risk quotas, but does not change the conclusion we drew on the basis of model (a).

C. The subject matter of education

In this section, we will examine how matching on the Swedish labour market has changed over time from a different aspect than our earlier studies. Here we analyse to which extent the

subject matter in the education and training that the employees have followed suits the specific demands for education that the work poses. We have constructed a measure for matching in this respect by classifying the subject matter of education in accordance with the first figure in the Swedish education nomenclature (Svensk Utbildningsnomenklatur, SUN) and by combining jobs coded according to the Nordic classification of occupations (Nordisk Yrkesklassifisering, NYK). On the basis of these classifications, we create a variable which assumes value a if the subject matter of the occupation and education correspond with each other and the value nil if they do not. In this way, for example, people in technical occupations get the value *correctly matched* (=a) if they have studied technical subjects. For certain occupations it was, however, nearly impossible to judge what the correct type of education. Individuals in these occupations have been excluded from these analyses. We have also excluded individuals who have less than two years education in addition to compulsory- or primary school or whose jobs lack requirements for such education. The reason is partly that jobs, which by and large lack demands for education in addition to compulsory school, can hardly pose specific demands in the subject matter of education, and partly that compulsory school does not have any specific subject matter. (For a more detailed description of matching procedures, see Appendix 1 in this chapter.)

These exclusions limit the selection of those who are analysed to 35, 38, and 48 per cent of all employees in the years 1981, 1991, and 2000. The category we are analysing, in other words, corresponds to the group we call UK.[10]

[10] That the proportions in the table are somewhat lower than the proportion of employees who make up the category UK is due to it not being possible to assign certain occupations to any specific course of education and to an internal fall in occupational coding. There is less information on whether the subject matter of education is of greater importance for 2000 than for 1991 and 1981. This is largely due to this variable not being completely coded when the analyses for this paper were done. Other information from the standard of living surveys done in 1991 and 2000 however shows that the difference in the fall between these years does probably not affect the results. We have utilised the question "To which extent have you in your daily work been able to make use of what you learnt during your education or in earlier jobs?" The average answer among individuals, where there is no data on adaptation to the job and the subject matter of their education, is on the whole identical in 1991 and 2000. With reservation for the possibility that the formulation of the question not only refers to education, but also to experience, this indicates that while there is a greater fall in 2000, it has the same true distribution between good and bad adaptation as the lesser fall in 1991.

TABLE 8

Table 8 shows matching between individuals and jobs with respect to both the level of education (Un) and its subject matter (Ui). The object of the table is to show to what extent the under- and over-educated as well as the correctly matched have an education the level of which is relevant to the work they do. If, for example, the (apparently) over-educated have subject matter in their education, which does not suit the nature of the job, it becomes more reasonable to regard them as incorrectly qualified rather than over-qualified. In short, the following results emerge from the table:

A clear majority of employees in the category studied have studied subjects in their education, which (at least roughly) suits the jobs they have. They make up about three-quarters of all employees in group A who have work where the subject matter of their own education and job is correctly matched. This proportion has not noticeably changed during the period 1981 to 2000 (we lack data on the subject matter of education for 1974).

About half of the employees are correctly matched with respect to both the level of education and its subject matter. This proportion is relatively stable during the years studied. The group that is matched on both educational level and subject matter is clearly the largest at all three points in time.

The next largest group consists of people who have the right (in relation to the nature of the job) subject matter in their education, but who are over-educated when it concerns the level (given the job requirements). This group can be called the genuinely over-qualified and consists of fewer than 20 per cent of the employees at all three points in time.

A clear majority of all the “over-educated” have the right subject matter in their education. Yet, the minority of the apparently over-educated who appear rather to be incorrectly qualified is fairly large: between a third and a quarter.

The proportion of under-educated is relatively stable during the period. This applies both to people with the right subject matter in their education and the individuals with the incorrect subject matter.

An overriding conclusion of the results in the table is that over-education is real rather than apparent, in the sense that the main part of the over-educated have studied subject matter during their education that is suited to the jobs they have. Over-education has nevertheless (as we pointed out earlier) not grown during recent years among employees with at least two years education in addition to compulsory school.

FIGURE 3 Per cent
Social sciences, Technology, Health & care, Other

To analyse more closely how the matching process develops over time within different sections of the labour market, we have differentiated four job sectors where specific forms of qualification are required: jobs with education in the social sciences, jobs with technical education, health and care work, and other jobs.[11] Figure 3 shows that the proportion of employees correctly matched on subject matter is relatively low within the social sciences. For jobs within the technology sector, the proportion of matched employees is relatively high during the whole period. During the 1990s, however, a statistically significant deterioration of matching occurs within this category. The process through which employers' demands for technologically qualified personnel meets with the supply of technological knowledge among the labour force thus appears to have deteriorated in recent years. Within the care sector, the matching process appears to have deteriorated somewhat between 1981 and 1991 to later remain unchanged during the 1990s. Within the other job sectors the proportion of correctly matched people has not changed appreciably during the period studied.

FIGURE 4 Per cent
Social sciences, Technology, Health & care, Other

In Figure 3, we looked at the matching process on the basis of the approximate demands for education in the subject matter of the job. In Figure 4, we take the opposite perspective and study the extent to which individuals with different types of subjects in their education are correctly matched or not. The four groups of subject matter are divided in the same way as the job sectors in Figure 3. We differentiate between socially related, technological and health

[11] The category 'other jobs' includes jobs that require education in the humanities, teacher training, education in communication, agriculture and services. These categories are too small to make separate analyses possible.

and care education and other education (which subject matter is included in the last category is mentioned in footnote 11). The figure generally portrays a picture of how specific subjects in education are to a high degree transformed into jobs with activities that require precisely that type of education. This applies both to education in the social sciences and to education in technology and care services. Changes over time are relatively small, but for education in the health and care services, one can note that the proportion of correctly matched employees was highest in 1991.

Conclusions

Sweden, like many other developed countries, has during recent decades experienced an expansion of tertiary education. This trend has entailed that the average educational level of the inhabitants of this country and in the labour force has gradually risen. Parallel with this development, a structural change has occurred on the labour market. The occupations and branches that pose relatively high demands for qualifications in the labour force have expanded at the expense of the occupations and branches where educational requirements are lower. Of these two trends, the former has been the stronger. One can thus say that the supply of educated labour power has risen more rapidly than the demand for education qualifications on the labour market.

These trends together have meant that the nature of matching processes on the Swedish labour market has changed. The proportion of all employees who are correctly matched to their work in relation to their educational level clearly fell between 1974 and 2000. At the same time, the proportion of over-educated has fallen markedly, while the proportion of under-educated has on the whole remained constant. The decline in the proportion of correctly matched employees is linked to the fact that the group that for many decades dominated the labour market – unskilled people in unqualified jobs – has shrunk dramatically in size and appears to be gradually disappearing from the labour market.

A group of employees who have, however increased considerably in size, is educated people in qualified jobs. That this group of employees with an educational level that matches the educational requirements of their work has increased, does, however, not compensate for the reduction of the unqualified group. This is because the proportion of correctly matched *within*

the qualified group has remained constant during the whole period studied.

The sharp rise in the proportion of the over-educated among all employees is linked to two trends. One is that the proportion of educated people in qualified jobs increased without the proportion of over-educated *within* this category rising during the two past decades. The other trend is that the proportion of educated people in unqualified jobs has risen. Of these two trends, the former has been somewhat more important than the latter as an explanation. This signifies, in other words, that people with only compulsory education cannot per definition be over-educated. If this group shrinks over time, the proportion of over-educated among all employees will grow, even if the proportion of over-educated has not changed within the group with more than compulsory education. This pattern means that both the fall in the proportion of correctly matched employees and the rise in the proportion of the over-educated has probably peaked, since the proportion of unskilled employees is now so low that further reductions will only have marginal effects on the labour market as a whole.

Another question identifies the branches where the proportions of over- and under-educated are large or small and asks which groups of employees run the greatest risk of being over- and under-educated. Our results show firstly that the increasing proportion of educated people in unqualified jobs has been particularly prominent in the following groups of industries: trade, hotel and restaurant work, and transport and communications. Within these sectors, the number of simple jobs has not fallen since the 1970s. However, rationalisation seems to have involved a clear upgrading of the job structure within these industries. If this trend continues, the unqualified jobs in these industries will in the future be so few that they will only have a marginal impact on the total number of simple jobs (le Grand et al. 2003). One can assume that unqualified jobs may be difficult to rationalise away in certain parts of the service sector. With continued expansion of education, a reasonable prognosis is thus that employees with relatively good formal education will also in the future carry out many simple tasks. Already now, many more unqualified jobs exist than unskilled individuals.

Men and older people predominate among employees who have a formal education below the educational requirements of a job (the under-educated), while the over-educated are chiefly women and younger people. The latter applies particularly to the group of over-educated in

unqualified jobs. Changes in the composition of the labour force in terms of these demographic factors, however, do not contribute to explaining the increase in over-education.

Another result worth mentioning is that employees with a long education (at least six years in addition to compulsory school) have clearly a greater likelihood than those with medium-length education (4–5 years in addition to compulsory school) of being over-educated in qualified jobs. Although the proportion of employees with long education has risen much more rapidly than those with medium education during the past two decades, the relative probability of being over-educated with qualified work has remained constant. If all else is equal, this means that if the proportion with long and medium-length education remained unchanged during this period of time, the proportion of over-educated with qualified jobs would have fallen. Another conclusion is that if the expansion of people with long education stops in the future, the proportion of over-educated in qualified jobs will also fall.

A possible objection to our analyses of over-education on the Swedish labour market is that even if the labour force has a relatively high education level, the subject matter in this education is incorrect in relation to what the labour market requires. Our results indicate that three-quarters of all educated employees in qualified jobs are correctly matched with their jobs in terms of the subject matter of their education. Two-thirds of these in turn also correctly matched in terms of the length of the education. These proportions have been virtually constant since the beginning of the 1980s. The exception is the technical job sector (chiefly the manufacturing industry), where a moderate deterioration of educational matching with subject matter has occurred during the 1990s.

The connection between the two types of matching (educational length and subject matter) is weak. This entails that the risk for having an incorrect subject matter in one's education in relation to the nature of the work is not very much higher among over-educated employees than among the rest. The strength of the connection has not changed during the period. The assumption that the increase in over-education actually consists of an increase in incorrect qualifications can thus be rejected.

We discussed at the beginning whether adaptation between individuals' qualifications and work requirements affects people's conditions of living in several important respects. Let us end by mentioning which consequences for social welfare the development of the matching process can have had during recent times and can be expected to have in the future. The extensive expansion of education has, as we earlier pointed out, led to the proportion of correctly matched people falling at the same time as the proportion of over-educated has risen. This has probably meant that inequalities in income in relation to education have been kept down. The reason is that education gives a return in terms of higher incomes, particularly when the qualifications of employees are used in the work that is done. The income premium for the education that exceeds the requirements of the job is, however, less. During the 1980s and 1990s, a certain increase in income differences has nevertheless occurred, largely via larger education premiums (le Grand et al. 2001b). This increase in inequality would probably have been greater if the proportion of over-educated had not risen during the same time. In future, we may see that the nature of matching stabilises. The decline in the proportion of correctly matched people is falling, as the category of unskilled employees in unqualified jobs (who per definition are correctly matched) will soon be emptied of people. The rise in the proportion of over-educated is similarly declining, since the category of educated employees in unqualified jobs (who per definition are over-educated) will probably stop increasing in size, or at least increase at a slower pace than in the recent past. This stabilisation of the matching processes means that downward pressure on the level of income differences is falling. Income inequality can thus be expected to increase more rapidly in the future than during the 1980s and 1990s.

An increase in income distribution ought to be weighed against the advantages that a better adaptation between individual qualifications and work requirements can give. On an individual level, work becomes psychologically more interesting and more developing at the same time as the economic returns on education improve. On workplace and societal levels, efficiency increases and this promotes the average development of the welfare of the population. In this way, income distribution and other important welfare dimensions occur in a balancing relationship to each other: reduced over-education makes the distribution of income more uneven, but can at the same time involve gains in welfare in other respects.

Matching development and its consequences on a more long-term perspective is more difficult to judge. We know that the labour market will in future be more concentrated to two categories, a predominant group of educated people in qualified jobs, and a group of educated people in unqualified jobs. With considerable certainty, we can also say that the latter group will during the foreseeable future, encompass about a fifth of the labour force (see le Grand et al. 2003). To avoid significant loss of motivation and efficiency, it is important that the individual's opportunity to move from unqualified jobs to more demanding tasks is good. How career opportunities will actually develop we do not know very much about. This problem deserves to be more closely studied in the future. Within the predominant category in the labour market, that is, educated people in qualified jobs, how change will affect matching is an open question. Expansion of education will probably continue at a relatively rapid pace during coming years, not least with arguments on distribution policies as a motor (alongside more or less well-founded ideas of how job skills requirements are changing). It is not possible to know the extent to which educational requirements for jobs can keep pace with these developments. It should not be too bold to predict that demands are likely to rise somewhat moere slowly than individuals' educational level. Two factors speak for this view: development has been along these lines during recent decades, and education can be politically manipulated to a much higher degree than work requirements.

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Appendix 1:

Codes relating to matching between educational subject matter and occupation

Basic codes:

Utb3 = educational code, SUN, first three figures (see SCB 1988).
Yrke3 = occupational code, NYK, version Fob80, 3- figures (see SCB 1989, p. 244–247).
Ng3 = commercial or industrial branch code, SNI69, first three figures (see SCB 1992, p. 323–335).

Variable constructions (syntax according to SPSS):

```
Recode yrke3
 (61, 93 = 1)
 (50, 52, 53, 54, 56 = 2)
 (71, 72, 74, 91, 92, 94, 95, 96, 101, 118, 201, 208, 290,
 292, 296, 297, 311, 312, 313, 333 = 3)
 (1, 2, 3, 4, 5, 6, 7, 9, 11, 13, 22, 678, 701 thru 899, 931 = 4)
 (601, 603, 621, 631, 651, 661 = 5)
 (14, 21, 31, 32, 40, 41, 42, 43, 44, 45, 46, 47, 914, 915 = 6)
 (23, 24, 402, 403, 411, 441 = 7)
 (901, 902, 911, 912, 941, 981 = 8)
 into yrke1.

comp utb1 = trunc (utb3 / 100).
if utb3 = 900 utb1 = 0.

comp match = 9.
if yrke1 ge 1 and yrke1 le 8 and utb1 ge 0 and utb1 le 8 and yrke1 ne utb1 match = 0.
if yrke1 ge 1 and yrke1 le 8 and utb1 ge 1 and utb1 le 8 and yrke1 eq utb1 match = 1.
if any (yrke3, 21, 31, 32, 40, 51, 71, 72) match = 1.
if yrke3 = 55 and (utb1 = 2 or utb1 = 4) match = 1.
if yrke3 = 55 and utb1 ne 2 and utb1 ne 4 match = 0.
if (yrke3 = 97 or yrke3 = 111) and (utb1 = 3 or utb1 = 4) match = 1.
if (yrke3 = 97 or yrke3 = 111) and utb1 ne 3 and utb1 ne 4 match = 0.
if yrke3 = 331 and ng3 ge 610 and ng3 le 629 and utb1 = 3 match = 1.
if yrke3 = 331 and ng3 ge 610 and ng3 le 629 and utb1 ne 3 match = 0.
if yrke3 = 331 and ng3 ge 200 and ng3 le 499 and (utb1 = 3 or utb1 = 4) match = 1.
if yrke3 = 331 and ng3 ge 200 and ng3 le 499 and utb1 ne 3 and utb1 ne 4 match = 0.
recode match (9 = sysmis).
```

Result:

Match = matched or mismatched with reference to educational subject matter; 1 = yes, 0 = no.

Appendix 2:

Multinomial logit-regression: a short explanation

Multinomial logit-regression is an expansion of logical regression. The differences are that logical regression departs from a dependent variable that has two values, while multinomial logit has one dependent variable that assumes more than two values and these values cannot be ranked on a scale from high to low (that is, the variables are measured on a nominal scale level). One of the values on the dependent variable is selected as the reference category and the probability for an individual to belong to one of the other categories is compared with the probability of belonging to the reference category.

Four possible values (mismatching categories) exist for an employed person: the reference category is to be matched with a qualified job (UKm). The probability of being (UKu) under-educated in qualified work, (UKo) over-educated in qualified work, or (UL) over-educated in work requiring low qualifications is compared to the probability of (UKm). We have a number of independent variables X which we assume affect the probability for a person to be within a certain matching category.

Since the dependent variable assumes four values, three equations are calculated which are shown in Table 5. We calculate a number of coefficients β(UKu), β(UKo), β(UL) for each matching category in addition to the reference category for which we set β(UKm) = 0. The calculated equations become:

$$\Pr(y = UKu) = \frac{e^{X\beta(UKu)}}{1 + e^{X\beta(UKu)} + e^{X\beta(UK\ddot{o})} + e^{X\beta(UL)}}$$

$$\Pr(y = UK\ddot{o}) = \frac{e^{X\beta(UK\ddot{o})}}{1 + e^{X\beta(UKu)} + e^{X\beta(UK\ddot{o})} + e^{X\beta(UL)}}$$

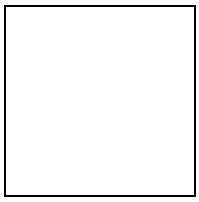
$$\Pr(y = UL) = \frac{e^{X\beta(UL)}}{1 + e^{X\beta(UKu)} + e^{X\beta(UK\ddot{o})} + e^{X\beta(UL)}}$$

For the reference category UKm:

$$\Pr(y = UKm) = \frac{1}{1 + e^{X\beta(UKn)} + e^{X\beta(UK\ddot{o})} + e^{X\beta(UL)}}$$

The relative probability of, for example, being under-educated in qualified work, compared to

being correctly matched, given X is:



The exponential value of a coefficient is called the relative risk quota (or odds quota) for a unit's change on the X-variable. In Table 5, for example, the coefficient 0,40 in column (UKu), row 19–29 years, can be interpreted as the relative risk quota (odds quota) for being under-educated in qualified work compared to being correctly matched for 19–29 year olds, which is 40 per cent of the corresponding relative risk quota for 30–49 year olds.

Table 1. Per definition connections between different combinations of education and requirements for education. Combinations: N = logically necessary, M = logically possible, but not necessary, – = logically impossible.

	Individuals' educational level			
	Higher than elementary		*Elementary*	
	Educational requirements for the job		*Educational requirements for the job*	
	Exist	*Do not exist*	*Exist*	*Do not exist*
Under-educated	M	-	N	-
Matched	M	-	-	N
Over-educated	M	N	-	-

Note: Elementary education = Not more than one year in addition to compulsory school
No requirements = The job requirement for education in addition to compulsory school is no more than one year

Table 2. Three hypothetical examples of how change in the marginal distribution affects the average proportion of over-educated.

Time 1				**Time 2, Alternative A**			
Individuals' education	**Job education requirements**			**Individuals' education:**	**Job education requirements**		
	No demands	Krav finns			No demands	Krav finns	
Elementary	50 % p=0	0 % p=0	50 %	Elementary	20 % p=0	0 % p=0	20 %
Higher than elementary	0 % p=1	50 % p=0,20	50 %	Higher than elementary	0 % p=1	80 % p=0,20	80 %
	50 %	50 %	100 %		20 %	80 %	100 %
Total proportion over-educated = 0,50 * 0,20 = 0,10.					0,80 * 0,20 = 0,16		

	Time 2, Alternative B		
Individuals' education:	**Job education requirements**		
	No demands	Krav finns	
Elementary	20 % p=0	0 % p=0	20 %
Higher than elementary	20 % p=1	60 % p=0,20	80 %
	40 %	60 %	100 %
Total proportion over-educated = (0,60 * 0,20) + (0,20 * 1) = 0,32			

Note: p is the proportion of the over-educated.

Table 3. The relationship between the workers' education (U) and the job's educational requirements (K) 1974–2000 among employeep. Per cent.
(U>0, K>0: minimum two years education compared to educational requirements ;
U=0, K=0: maximum one years education compared to educational requirements.)

Workers' educational level (U)	Job's educational requirements (K)	Match Category	1974	1981	1991	2000
Higher than elementary	Requirements exist	UK) Mixed	28 *	38 *	45 *	58
	Of which U<K	UKu) Under	6	5	4 *	6
	U=K	UKm) Match	17 *	23 *	28 *	37
	U>K	UKö) Over	5 *	10 *	13 *	16
Higher than elementary	No requirements	UL) Over	13 *	16 *	17 *	21
Elementary	Requirements exist	LK) Under	12 *	11	14 *	10
Elementary	No requirements	LL) Match	48 *	36 *	24 *	11
Higher than elementary		(UK + UL)	41 *	54 *	62 *	79
Elementary		(LK + LL)	60 *	47 *	38 *	21
	Requirements exist	(UK + LK)	39 *	48 *	59 *	68
	No requirements	(UL + LL)	61 *	52 *	41 *	32
Total			100	100	100	100
N			3065	3175	3294	3026

Note: * = Significant difference (5%-level) in proportions, compared to the year 2000.

Table 4. Matched categories (UK, UL, LK, LL)[1] among employees 1974–2000 by sector. Per cent.

	1974	1981	1991	2000		1974	1981	1991	2000
Manufacturing					Trade, restaurants and hotels				
UK	19*	30*	35*	52	UK	17*	22*	29*	37
UL	14*	16*	19*	24	UL	13*	18*	30*	42
LK	13	13	17	13	LK	8	11*	13*	7
LL	54*	41*	29*	11	LL	62*	48*	27*	13
Tot.	100	100	100	100	Tot.	100	100	100	100
n	1010	865	771	643	n	318	320	338	354
Transport					Banking				
UK	18*	22*	24	31	UK	36*	46*	60*	75
UL	19*	25*	27*	37	UL	22*	13	12	14
LK	6*	6*	15	14	LK	13*	14*	15*	6
LL	57*	46*	34*	19	LL	29*	26*	13*	6
Tot.	100	100	100	100	Tot.	100	100	100	100
n	197	233	251	232	n	178	187	283	349
Public administration					Care, medical services and education				
UK	36*	53*	55	64	UK	45*	48*	58*	73
UL	15	10	17	13	UL	11	16*	12	11
LK	14	13	10	11	LK	3*	5*	7	8
LL	36*	24*	18	12	LL	40*	31*	21*	8
Tot.	100	100	100	100	Tot.	100	100	100	100
N	226	232	204	210	n	613	932	979	809
Other private services					Building industry				
UK	34*	36*	44*	60	UK	31*	49*	44*	60
UL	11*	15	17	20	UL	5*	6*	10	12
LK	15*	13*	15*	6	LK	28	23	26	21
LL	40*	36*	23*	14	LL	36*	22*	19*	7
Tot.	100	100	100	100	Tot.	100	100	100	100
N	181	130	185	223	n	254	210	232	168

Note: * = Significant difference (5%-level) in proportions, compared to the year 2000.

[1] UK: U>0, K>0; UL: U>0, K=0; LK: U=0, K>0; LL: U=0, K=0. See table 3.

Table 5. The association between individuals' education and the job's educational requirements 1974–2000 among employees with at least two years education in addition to compulsory school, by education level, occupational group, industry, work hours, gender and age. Multinomial logit regression analyses (reference category is UKm, i.e. education = educational requirements), relative risk ratios.

	(UKu) Under-educated, skilled jobs		(UKo) Over-educated, unskilled jobs		(UL) Over-educated, skilled jobs	
	1974–2000	2000	1974–2000	2000	1974–2000	2000
19–29 years	0,40*	0,34*	0,98	0,90	1,45*	1,54*
30–49 years	1,00	1,00	1,00	1,00	1,00	1,00
50–65 years	1,87*	2,09*	0,90	1,00	0,76*	0,78
Women	0,45*	0,65*	1,39*	1,41*	1,64*	1,57*
Men	1,00	1,00	1,00	1,00	1,00	1,00
Part-time	0,99	0,63	1,11	1,01	1,45*	1,58*
Full-time	1,00	1,00	1,00	1,00	1,00	1,00
Manufacturing industry	0,71*	0,83	0,85	0,74	2,35*	3,30*
Construction industry	1,18	0,66	0,80	0,55	0,54*	0,97
Trade, hotel, restaurant	0,94	0,91	0,90	1,06	4,35*	8,08*
Transport etc.	0,63*	0,27*	0,79	0,94	6,32*	9,93*
Banking, insurance	0,84	1,09	1,33*	1,59*	2,86*	3,41*
Public administration	0,73	0,65	1,20	1,04	3,05*	3,39*
Education/care services	1,00	1,00	1,00	1,00	1,00	1,00
Other private services	0,73	0,58	1,10	1,25	1,78*	3,20*
Upper secondary school	1,74*	1,37*	-	-	0,99	0,75*
Short tertiary education	1,00	1,00	1,00	1,00	1,00	1,00
Long tertiary education	0,45*	0,34*	2,50*	2,67*	0,61*	0,61*
White-collar workersf	3,81*	6,17*	0,49*	0,37*	0,18*	0,20*
Blue-collar workers	1,00	1,00	1,00	1,00	1,00	1,00
N	7 295	2372	7 295	2372	7 295	2372
Wald chi^2	4348	1419	4348	1419	4348	1419
Pseudo R^2	0,240	0,245	0,240	0,245	0,240	0,245

Note: (a) * = Significant difference (on 5%-level) from 1 compared to reference category.
(b) Upper secondary school, short and long tertiary education includes 2-3, 4-5 and 6 or more years of schooling respectively, in addition to compulsory/primary school.
Part-time: < 35 hours ordinary working time per week.
Blue-collar workers include SEI = 11-22, and white- collar workers include other employees.

Table 6. Changes over time in relative risk ratios for over- and under-education among employees with at least two years education in addition to compulsory school. Multinomial logit regression analysis. Reference category is group UKm, i.e. education = educational requirements.

	Model (a)			Model (b)		
	(UKu)	(UKo)	(UL)	(UKu)	(UKo)	(UL)
	Under-educated, skilled jobs	Over-educated, skilled jobs	Over-educated, unskilled jobs	Under-educated, skilled jobs	Over-educated, skilled jobs	Over-educated, unskilled jobs
1974	2,01*	0,65*	1,32*	2,09*	1,02	1,48*
1981	1,37*	0,99	1,19*	1,35*	1,36*	1,29*
1991	0,98	1,04	1,10	1,08	1,31*	1,08
2000	1,00	1,00	1,00	1,00	1,00	1,00
N		7 295			7 295	
Wald chi^2		92,4			4414,0	
Pseudo R^2		0,005			0,244	

Notes: (a) * = Significant difference (5%-level) compared to reference category.
(b) In model (b) the following control variables are included: three levels of educational groups; blue collar/white collar workers; eight industries, part-time/full-time; women/men; three age groups (see notes below Table 5).

Table 7. Proportions within educational groups and proportions within match categories within educational groups 1981–2000. Per cent.

	Upper secondary school	Short tertiary education	Long tertiary education
	Proportions in each educational group (row percent)		
1981	49,9	25,5	24,6
1991	48,6	23,1	28,3
2000	43,0	23,1	33,9
	Proportions in each matched category (column percent)		
Under-educated			
1981	11,6	9,0	4,8
1991	9,0	7,2	3,3
2000	9,4	8,7	3,6
Matched			
1981	44,5	45,7	37,4
1991	49,1	44,4	38,8
2000	51,6	44,2	41,7
Over-educated, skilled jobs			
1981	-	25,6	48,4
1991	-	27,1	49,6
2000	-	20,7	45,1
Over-educated, unskilled jobs			
1981	43,9	19,6	9,4
1991	42,0	21,4	8,3
2000	39,1	26,5	9,6

Notes: Only employees with at least two years of schooling above compulsory school are included.
Per definition, workers with upper secondary school and with a skilled job cannot be over-educated.

Table 8. The relationship between workers' level (Un) and type of education (Ui) and the educational requirements of the job with regard to level (Chn) and type (Ki) 1981–2000 among employees with (at least two years) education in addition to compulsory school in jobs with demands for (at least two years) education after compulsory school. Per cent.

	1981	1991	2000
Correctly matched on type of educ. Ui = Ki)			
Total	77	75	73
Of whom under-educated on level (Un<Kn)	9 *	7	7
Matched on level (Un = Kn)	48	50	49
Over-educated on level (Un>Kn)	19	19	18
Mismatched on type of educ. (Ui ≠ Ki)			
Total	23	25	27
Of whom under-educated on level (Un<Kn)	4	2	3
Matched on level (Un = Kn)	13 *	14	16
Over-educated on level (Un>Kn)	7	8	7
Grand total	100	100	100
N	1099	1253	1462

Note: * = Significant difference (5%-level), compared to year 2000.

Figure 1: Numberof years of education in addition to compulsory school (or comparable) and educational demands (years after compulsory school) of employees in Sweden 1974-2000

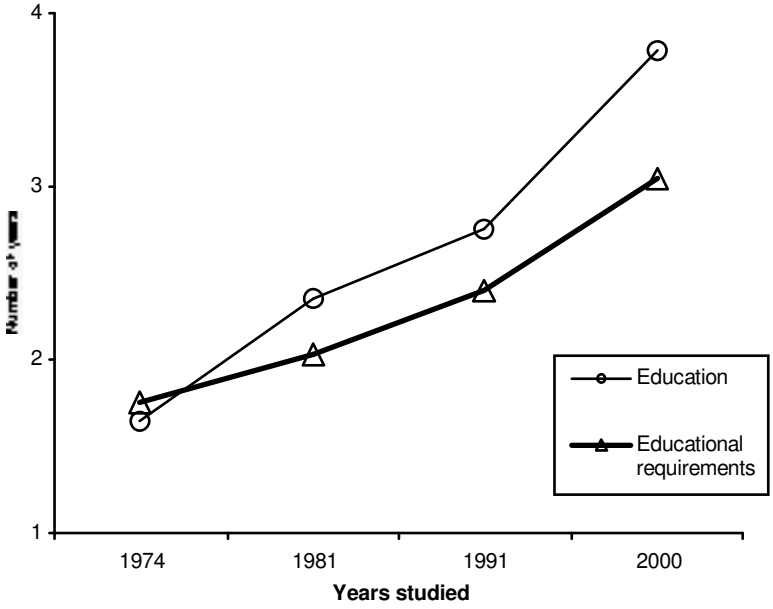


Figure. 2. Proportion of under-educated, correctly matched and over-educated. Employees 1974–2000.

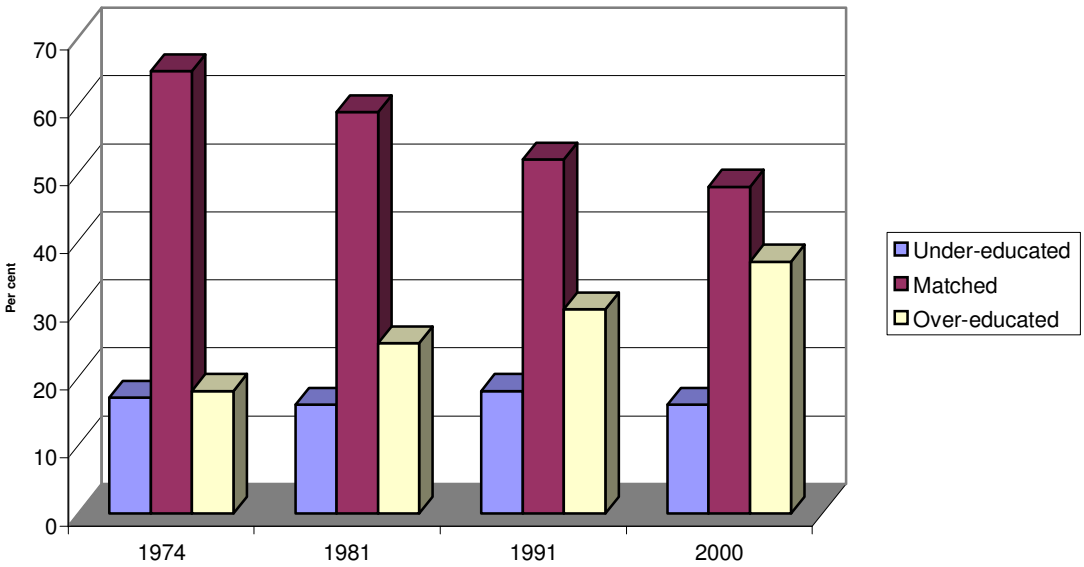


Figure 3. Proportion correctly matched on type of education by job sector 1981–2000.
(Employees with at least two years of schooling after compulsory school in jobs that require at least two years above compulsory school)

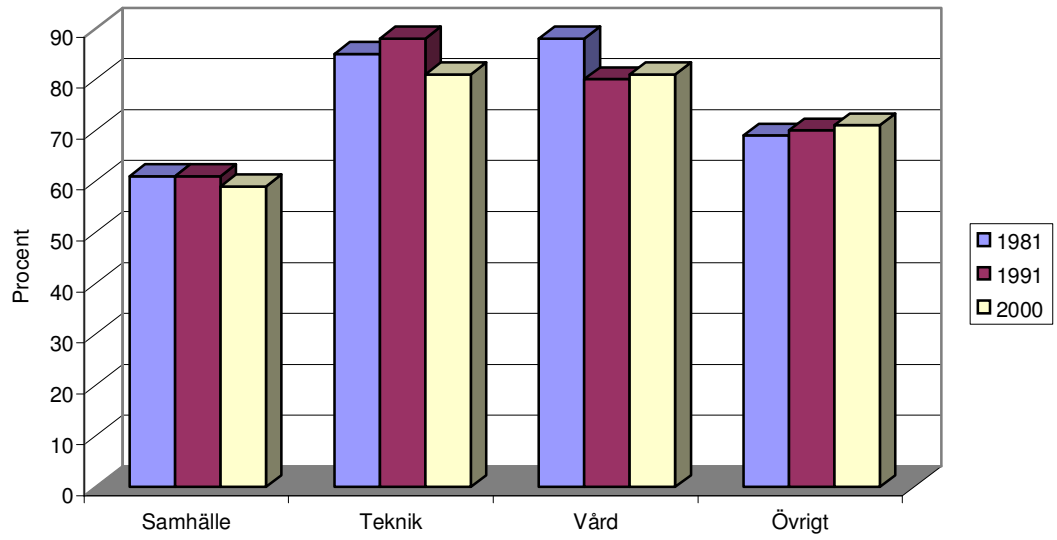


Figure 4. Proportion correctly matched on type of education by educational sector 1981–2000.
(Employees with at least two years of schooling after compulsory school in jobs that require at least two years above compulsory school)