Corporate job ladders in Europe: wage premia for university vs. high school level positions

Erik Mellander and Per Skedinger*

Summary

Investment in human capital is a central issue in the literature on economic growth. The purpose of this study is to shed light on the economic incentives for investment in university education across countries. An empirical investigation of earnings for private-sector engineers and business administrators in seven European countries - Belgium, Denmark, France, Germany, Italy, Sweden and the United Kingdom - is presented. The analysis is based on a large micro-data set that is ideally suited for international comparisons. It contains information on earnings, age, occupation, responsibility level, industry and firm size. Standardized wage premia for university vs. high school level positions are computed for each country and field of work. The results indicate that the wage premia are higher for business administrators than for engineers in all the countries considered and that the premia for engineers are remarkably similar across countries. Aggregation over fields of work, which is not uncommon in studies on the returns to education, therefore seems to be questionable practice when comparing the returns in different countries.

Keywords: Returns to education; Company wage policies

JEL-Codes: J31; J44

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This paper presents an empirical investigation of earnings for private-sector engineers and business administrators in seven European countries - Belgium, Denmark, France, Germany, Italy, Sweden and the United Kingdom. The analysis is based on a large micro-data set, containing more than 32,000 observations over the period 1993-96, that is ideally suited for international comparisons. It has been collected by *Watson Wyatt,* a worldwide consulting firm specializing in cross-country analyses of wage and employment conditions. There is information on earnings, age, occupation, level of responsibility, firm size and industry for every individual. Human capital earnings functions are estimated for each of the countries in the sample.[1] To the best of our knowledge, this is the first empirical study on labor market earnings in various countries based on internationally comparable micro-data of this kind.

For both engineers and business administrators we have information about several high and low-level positions. The high-level positions roughly correspond to jobs requiring a university degree, while the low-level positions have been chosen so as to require approximately high school education. This enables us to run within-country wage regressions by means of which we can compute standardized wage premia similar to wage premia computed for university as opposed to high school education. However, while most studies of the returns to education are highly aggregated over fields of work and occupations we analyze engineers and business administrators separately and, moreover, control for different occupations within the two categories.

Previous analyses of the returns to education - see e.g. Psacharopoulos (1993) for an extensive review - make use of single-country data bases. Comparability of these estimates across countries is often limited, due to the different wage measures and time periods typically being used. Like the aggregational issues, these comparability problems are well known, but rarely addressed in the literature. Our multi-country data set offers an opportunity to overcome them.

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[1] A standard reference on human capital earnings functions is Mincer (1974).

The purpose of this study is to shed light on the economic incentives for investment in university education across countries. Investment in human capital is a central issue in the literature on economic growth. Changes over time in the quality of labor has been put forward as an explanation for the residual in growth accounting studies. (See, e.g. Denison, 1962, or Griliches,1970.) The growth perspective provides another rationale for not lumping together educational categories in the analysis and for focusing on engineering and business administration. It is argued that an increased supply of graduates in engineering or business administration is more important for growth than an increase in, say, theoretical philosophy or the fine arts. Indeed, Murphy et al. (1991) find evidence that countries with a large share of students in engineering grow faster than other countries.

A graduate in engineering (or business administration) may, however, not necessarily remain in the country of origin. As a result of the integration of labor markets within the European Union (EU), the earnings differentials that will induce labor flows between countries are smaller today than, say, a decade ago and will probably decrease even further. Although labor migration among EU countries is still negligible, the migration that occurs seems to be concentrated to well-educated people and to be growing.[2] There is thus a potential for growth-reducing "brain drain" from countries that turn out to be less successful in competing for key segments of the labor force.

A discussion of the brain-drain problem is beyond the scope of this paper; such a discussion would require an explicit analysis of wage differentials *between* countries. However, in addition to cross-country wage differentials, migration decisions are likely also to be influenced by the relative wage structure *within* countries. To this extent our analysis should be of relevance for the debate on the driving forces behind the brain-drain phenomenon.[3]

The paper is organized as follows. Section 1 describes the data. In Section 2, a number of aggregational issues that arise in the empirical analysis are considered. Section 3 specifies the wage premia computations and the underlying wage equations. The empirical results are reported in Section 4. Section 5 contains concluding comments and suggestions for further research.

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[2] See NorBo Economics (1998) for Swedish evidence on international migration of highly skilled labor.

[3] The present study concerns relative wages across European countries in the recent past. Other studies deal with the development of relative wages over longer time periods. For instance, while OECD (1996) reports that in the UK the relative wages of high-skilled workers have risen sharply since the mid-1980s, Gunnarsson and Mellander (1998) show that in Sweden relative wages have been almost constant during the same period.

1. The data

Our data come from yearly surveys conducted by *Watson Wyatt*. The responding firms are not sampled (but possibly contacted) by *Watson Wyatt*; the firms decide themselves whether they want to participate, in exchange for access to reports on the results. Firms operating internationally are overrepresented because by participating they get updated information about employment terms and conditions in countries where they are operating or planning to set up a business. The large majority of firms are foreign-owned, with parent companies based predominantly in the United States.[4]

The non-random nature of the data of course limits the population for which we can make inferences. However, there are quite a few individuals working in internationally active firms in the private sector. Moreover, by confining our attention to individuals in competitive labor markets, we can be confident that the wages that we observe are outcomes of the interplay between supply and demand forces, in accordance with the assumptions underlying human capital theory. In nationally representative surveys, this presumption is not likely to hold for all individuals; some may be working in, e.g., highly regulated labor markets. And, to extend this comparison, national surveys generally differ across countries. This is not the case here; the same questionnaire has been used in all countries. Furthermore, great care is taken in the data collection to ascertain that the responses be directly comparable across individuals, firms and countries. For instance, a *Watson Wyatt* representative will always assist the firm the first time it participates in the survey. Thus, while we will not be able to draw general conclusions, the population for which we can make inference is both substantial in magnitude and of considerable interest, and the data upon which our inference is to be based is of unusual quality.

The data consist of annual cross-sections, for engineers and business administrators, respectively, over the years 1993-96. The cross-sections partly overlap in the sense that the same individuals may be included for several years. Unfortunately, we lack employee identifications and thus cannot construct a panel data set. However, firm identifications are available and this makes it possible for us to do better than just treat our data as repeated cross-sections.

As a complement to the four cross-sections, we have used the firm identifications to construct two-year overlapping panels of firms for 1993-94, 1994-95, and 1995-96, respectively, for each country.[5] In this way we can avoid noise due to entry and exit of firms when we compare wage

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[4] Information about the nationality of the parent company was not collected by Watson Wyatt until the 1998 survey, and is thus not available for the period of our study (1993-96). In 1998, the share of firms with foreign parent company was the following: Belgium 89, Denmark 98, France 91, Germany 91, Italy 93, Sweden 83, and the UK 95 percent. In the seven countries, between 47 and 70 percent of the firms were associated with a US parent company. According to Watson Wyatt, the figures for the 1993-96 sample are not likely to be very different.

[5] In principle, we could go further and construct data sets containing observations from the same set of firms for all of the four years. That would however result in data sets with too few observations to permit meaningful statistical analyses.

premia between the years t and $t+1$. Together, the three panels yield six different wage premia (1993, 1994:I, 1994:II, 1995:I, 1995:II, and 1996).

Our data set covers altogether 15 different positions, 8 engineering positions and 7 positions in business administration. In Table 1, we have classified the positions by field of work and educational level.

[Table 1 about here]

In Watson Wyatt's survey, positions are specified in great detail. In Appendix A we have reproduced four examples of these job specifications, one for each of the four categories in Table 1. Watson Wyatt also devotes considerable effort to ensure that the classification of employees into various jobs is comparable across firms and countries.

The classification by educational level in Table 1 is not based on explicit information about the employees' education, because this information is not collected by Watson Wyatt. However, the positions that we consider have been chosen because, *on average* they are likely to require either a university level education (the graduate positions) or an education corresponding to high school or upper secondary school (the non-graduate positions). In order to examine the validity of the cross-classifications in Table 1, we have performed a number of validity checks, based on complementary information. These checks, which are reported in Appendix B, largely support the educational categories specified in Table 1.[6]

Table 2 presents the number of observations broken down by country, Graduate/Non-graduate positions, and year.

[Tables 2a and 2b about here.]

Some countries, in particular Denmark and Sweden, exhibit considerable changes in the number of observations over time. For Denmark, the numbers of observations decrease over time while the opposite is true for Sweden. Regarding Denmark, it should also be noted that the numbers of

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[6] The validity checks indicate, however, that our data are likely to contain some observations on individuals occupying graduate positions without having university degrees. Also, while not indicated by our checks, it is theoretically possible that there are observations where university educated workers are holding non-graduate positions. To the extent that these "anomalies" are the results of workers sorting themselves into positions based on unobserved characteristics, such as e.g. productivity, this is not a problem. It just goes to show that competence and education are not necessarily one and the same thing. The labor market primarily rewards competences, at least in the long run. It is natural, therefore, to define the university wage premium as the relative wage difference between competences that *normally* require university and high school degrees, respectively, within a given field of work. If a high school educated individual has been able to acquire the competence usually associated with a university education, then it is appropriate in this context to treat her/him as if university educated. And the fact that an individual with a university degree is holding a high school level position may be due, e.g., to he/she having a degree in another field of work - history, for example - or simply that he/she has gone through university without increasing his/her competence (very much). In either case, there is no reason to treat this individual as university educated *with respect to the work for which he/she is employed.*

observations are quite small; except for engineering graduates and business administration non-graduates in 1993 and 1994 there are less than 100 observations on the aggregates of graduate level and non-graduate level positions.

In addition to position and country, we have the following data for each individual in every year: wage, age, level of responsibility, the number of employees at the worksite, and an industry code.

The wage corresponds to full-time employment and is the sum of three components: i) the fixed (base) salary plus guaranteed additional payments, such as legal vacation and extra contractual months[7], and variable rewards in the form of ii) bonuses, such as profit-sharing schemes, and iii) sales commissions, to the extent that these are related to sales performance. The real wages, denominated in local currencies and expressed in 1996 prices, are given in Table 3, broken down by country and graduate vs non-graduate positions.

[Tables 3a and 3b about here.]

It can be seen that within the four categories of employees - graduate and non-graduate positions in engineering and business administration, respectively - real wages have been quite stable over the four year period in all of the countries. Another observation is that graduate positions in business administration appear to be better paid than graduate engineering positions. This holds in particular for Belgium, France, the UK and Germany. Denmark constitutes an exception in this context - the averages wages of the Danish business administration graduate positions are consistently *lower* than the average wages of the Danish engineering graduate positions. For the non-graduate positions the relationship between engineers and business administrators is reversed: the average wages of the engineers are always higher than the average wages of the business administrators.

Given these observed wage levels for the graduate and undergraduate positions, the "raw" wage premia - i.e. the premia unadjusted for age, position, responsibility, firm size, and industry - should be markedly higher in business administration than in engineering. This is also what we see in Table 4.

[Tables 4a and 4b about here.]

For instance, the largest of the average wage premia for engineers is found in Germany and amounts to 50 percent. This is only slightly higher than the *lowest* of the raw premia for business administrators - 45 percent in Denmark. The spread among the countries is also much larger with

[7] Cf. the system of an extra month’s pays for Christmas, which is common in, e.g., Germany.

respect to the business administrators; the premia vary from the 45 percent in Denmark to 96 percent in the UK. The corresponding spread with respect to engineers is from 33 percent in the UK to 50 percent in Germany. It should also be noted that the rankings over countries with respect to the raw wage premia look quite different for engineers and business administrators. In particular, for engineers the UK wage premia are ranked last, while for business administrators the UK premia are the highest.

Table 5 provides information about age, level of responsibility, and size of the respondent's workplace, by educational level and country. To save space, only the mean values, averaged over the four-year period 1993-96 are given.

[Tables 5a and 5b about here.]

It can be seen that the mean ages are very similar, across countries, between graduate and non-graduate level positions, and across fields of work (i.e., engineering and business administration). The corresponding averages all lie between 36 and 43 years.

The individual's level of responsibility is measured on an ordinal scale, containing three levels: A (highest), B, and C (lowest). These are relative concepts, defined in relation to the respective positions; cf. Appendix A. In general, the level of responsibility tends to increase with age, which lends support to the interpretation of this variable as defining "career ladders".[8] The second columns of Tables 5a and 5b show the average shares of the employees at the responsibility levels A and B. For instance, the entry 31/53 for German non-graduate level positions in Table 5a means that, of the German non-graduate engineers, 31 percent have A level responsibility and 53 percent B level, implying that 16 percent of the German non-graduate engineers have the lowest level of responsibility (the C level).

With respect to responsibility levels there is considerable variation. For engineers, there are large differences between countries among both graduates and non-graduates. The shares of graduate level positions with A level responsibility range from 23 percent in Italy to 1/3 in Denmark and for the non-graduate level positions the corresponding spread is even larger. The distributions over responsibility level differ between the graduate and the non-graduate level positions, however. The shares of A and B level responsibilities are higher for the non-graduates than for the graduates. This difference between the graduate and undergraduate level positions does not prevail for the business administrators. However, for these the variation across countries is even larger than for the engineers. For instance, the shares of graduates with A level responsibility range from 27 percent in Sweden down to 15 percent in Italy.

Regarding the size of the respondent's workplace, measured in terms of the number of employees, the most striking observation is that the size of workplace for the average individual is

[8] A simple test of the null hypothesis that the age distributions and the responsibility level distributions are uncorrelated is rejected for engineers as well as for business administrators.

quite large.[9] Given the above noted overrepresentation of multinational firms this comes as no surprise. It should be emphasized, however, that not all firms are large; small firms are represented in the samples of all the countries. Disaggregating with respect to graduate and non-graduate level positions, we see that, on average, the workplaces of the latter are smaller than the workplaces of those with graduate level jobs. This holds for every country, albeit to highly varying degrees. Sweden stands out: for engineers the average size of the workplace for individuals in graduate level positions is almost ten times the size of the workplace for their non-graduate counterparts. For business administrators the differences in workplace sizes between graduates and non-graduates are much smaller. Again, the difference is largest for Sweden where the average size of the workplace for those in graduate positions is about twice that of the individuals in non-graduate level positions.

The keen reader might have observed that we lack data on sex. This is further discussed in Section 3.2.

2. Aggregational issues

Given our data we can, in principle, compute a very large number of (standardized) wage premia for university level jobs vs high school level jobs: by fields of work, by country, by time period, and by positions. Already the first three dimensions yield 2 x 7 x 4 = 56 premia altogether. Moreover, within the two fields of work a large number of pair-wise comparisons can be made between university and high-school level positions, yielding altogether more than 700 possible wage premia. To compute these would, however, be both impractical and, in some cases, infeasible. Impractical, because the sheer number of results would not submit itself to a meaningful discussion. Infeasible, because the number of observations in some cells, e.g. for Denmark, would be too small to yield sufficient degrees of freedom. For practical purposes we thus have to limit the number of possible combinations. This amounts to consider the following four aggregational issues.

1. Aggregation over fields of work

2. Aggregation over countries.

3. Aggregation over time.

4. Aggregation over positions.

Regarding the first issue, the discussion in the previous section strongly indicates that separate analyses should be conducted for engineering and business administration. The data also point to

[9] In the survey, the participating companies are asked to report on the total number of employees "....at the local unit only". The employment figures thus pertain to workplaces rather than firms.

some important cross-country differences, making it worthwhile to treat the seven countries separately, as well. More importantly, aggregation over countries requires that the wages be expressed in a common currency. Exchange rate fluctuations would then tend to produce considerable noise in the measurement of cross-country wage differentials.

Aggregation over time does not seem to impose overly strong constraints on the data, however. First of all, the time period considered is very short. Secondly, it is not necessary to impose the constraint that the relationships studied should be identical over time; it is sufficient to that some of the parameters in the underlying model are constant over time.

As mentioned above, aggregation over positions is necessary if we want to be able to estimate identical models for all the seven countries. Just like in the case of aggregation over time, aggregation over positions does not necessarily require that all university (high school) level positions have to be assumed to be identical; position-specific effects of varying degrees of complexity can be taken into account.

In the empirical section, we impose aggregational constraints with respect to time and positions. These restrictions imply that we take a large number of parameters to be constant over time and, within the four categories in Table 1, across positions.

3. Estimation of wage equations and standardized wage premia

3.1 The wage equations

For each country we estimate separate wage equations for the four categories in Table 1. Log wages are explained by age, age squared, dummy variables for responsibility levels and for positions, the size of the workplace in terms of number of employees, industry dummies and time dummies. The estimations are carried out on two types of data sets, corresponding to two different schemes of aggregations over time.

In the first case, we simply pool data over the entire period 1993-96, i.e. we make use of the full sample. The assumption made with respect to time aggregation is that changes over time can be accounted for by simply allowing for time-varying intercepts in the wage equations.

In the second case, we make the same assumption, but for given sets of firms. As explained in Section 1, we have access to firm identifiers that enable us to construct two-year overlapping firm panels. This yields three sets of data for 1993-94, 1994-95, and 1995-96, respectively, for each of the four categories in Table 1. Altogether, we thus estimate 3 x 4 = 12 wage equations for each country. The explanatory variables are the same as under the first specification and so is the assumption made with respect to time changes, *within* the two-year periods.

Conceptually, the two specifications are fundamentally different. Under the first specification we assume that unobserved firm-specific effects can be treated as purely random. That firms enter and exit our database thus has no effect whatsoever on our parameter estimates. In the second case we assume that unobserved firm-specific effects are systematic. This assumption implies that changes in the set of firms will affect our estimates because of changes in the unobserved firm-specific effects, even if the observed characteristics are unchanged. To eliminate this possibility as far as possible we base our estimations on observations corresponding to given sets of firms. And when the set of firms changes - for instance, when go from the 1993-94 data for engineers with university level positions to the corresponding 1994-95 data - we allow the parameters in the wage regression to change, too.

3.2 Missing control variables and methods of estimation

We lack three pieces of information which are generally held to be important in earnings regressions: gender, innate ability and family background. To assess how this might affect our analysis, we have to consider two issues. The first concerns the possibilities to get around these omissions, by, e.g., using other variables carrying similar information or by accounting for them by choice of estimation method. The second issue has to do with the likely econometric consequences of the problems that we cannot deal with by means of either of these approaches. In particular, what might be the effects on the standardized wage premia that we ultimately want to estimate?

Regarding gender, the first issue is highly relevant. As noted in other contexts, gender wage differences tend to become very small when occupation and responsibilty are controlled for. This finding is especially prominent with respect to white-collar workers, i.e. the kind of workers that we study here. [10] Since our data contain very detailed information about these dimensions, the fact that we lack data on gender is likely to be a minor problem.

With respect to family background and innate ability there are no proxy variables in our data. In a context where individuals can be repeatedly observed the natural solution is to assume that these characteristics are constant over time, in which case they can be controlled for by means of the so called fixed-effects estimator; see, e.g., Hsiao (1986). But the fact that we cannot follow individuals over time makes this approach infeasible. Instead, we have to let family background and ability become part of the residual disturbances in our earnings regressions.

With respect to the earnings regressions, this has two effects. The first is that by leaving out potentially important information we will be able to explain less of the variation in (log) wages than

[10] Cf. Petersen and Morgan (1995), Petersen et al. (1996), and Petersen et al. (1997) for studies using very detailed data for the US, Sweden, and Norway, respectively.

if this information was available. However, in our case, this should be much less of a problem than when wage equations are estimated using nationally representative samples, as is usually the case. In such situations, the individuals observed represent all kinds of occupations and educations etc and so are extremely heterogeneous compared to the individuals which make up our data sets. Accordingly, the loss in explanatory power should be comparatively small in the present context. Still, including individual-specific characteristics in the residual will tend to make the residual individual-specific, too. A natural way to account for this is to allow for heteroskedastic residuals, i.e. residuals with non-constant variance over individuals. We do so by complementing our OLS estimates by White's (1980) procedure for computing heteroskedasticity-consistent standard errors.

The other effect arises if the residuals including family background and ability are correlated with some of the observed variables. This is likely to be the case concerning, e.g., the dummy variables for occupation and level of responsibility. Such correlations will yield biased estimates of the coefficients for the occupational categories and the responsibility levels.

However, we are not primarily interested in the wage regressions *per se*, but in the corresponding wage premia, and these are not necessarily biased. The reason is that the wage premium, in principle, is given by the difference between the predicted log wage for university level positions and the predicted log wage for high school level positions.[11] Thus, the wage premium will be (almost) unbiased if the two equations suffer from (almost) the same bias and this might actually not be a wholly unreasonable assumption. Consider, e.g., the dummy variable for responsibility level A, which is equal to 1 for the highest level of responsibility and 0 otherwise. This variable is likely to be positively correlated with the residual in the wage equation. But this true for both wage equations. We can thus safely assume that the biases in the two wage equations will have the same sign. Of course, there is no reason to believe that they are of exactly the same magnitude but there is no obvious reason to believe them to be very different in size, either.

For Sweden, there is actually a study which lends some empirical support to this argument, namely Kjellström (1999). He estimates the returns to education, with as well as without controls for ability and family background, for two cohorts (born 1948 and 1953, respectively) and various educational categories in Sweden. Ability is measured by scores from intelligence tests, achievement tests and school marks when the respondents were 12-13 years old. Family background is captured by the parents´ education and occupation. Based on these estimates, we have computed wage premia for university (at least three years, but no doctoral degree) vs high school (more than two years) education. It turns out that the premia for the two cohorts without such

[11] Computing the wage premium as the difference in log wages is a strictly valid procedure only for small differences. However, for the sake of the argument here, this qualification is immaterial.

controls are both 26 percent, whereas the premia vary between 20 and 24 percent when the controls are included, depending on cohort and the ability measure used. Controlling for ability and family background thus leads to a reduction of the wage premia, but the magnitude of the bias is small.

3.3 Computation of wage premia

Given the estimated wage equations, we compute predicted log wages by country, field of work, and positional level, evaluated at the mean values of the explanatory variables across the seven countries. The predicted log wages are thus standardized in the sense that they are computed for hypothetical individuals with "average European characteristics". Accordingly, for a given category in Table 1, cross-country differences in predicted wages are solely attributable to differences in parameter estimates.

For a given country and field of work, the estimated wage premium is computed by dividing the anti-log of the predicted log wage for the university level positions with the anti-log of the predicted log wage for the high school level positions.[12] Subtracting 1 from the resulting number and multiplying by 100, we get the wage premium in percent.

[12] Actually, to obtain unbiased estimates of the wages in levels we add a term to the predicted log wages before they are anti-logged, namely the estimated residual variance of the corresponding wage equation, divided by 2. For a discussion of this procedure, cf. Miller (1984).

4. Results

4.1 The wage regressions

The model considered in Section 3 can be implemented by means of OLS. The parameter estimates for each country, using the full sample, are reported in Table 6. Table 6.a presents the regressions for engineers with graduate positions. The estimates pertain to personal characteristics (age, level of responsibility, and position), firm characteristics (number of employees), year and type of industry.

[Table 6.a about here]

Regarding the personal characteristics, we find that earnings rise with age, at a diminishing rate. This result is in accordance with human capital theory. In Belgium, an additional year, evaluated at 40 years of age, increases wages by 0.9 percent. The estimates for the six other countries are of similar magnitudes. These are rather low estimates compared to other studies. Presumably, it reflects the fact that our regressions are augmented with level of responsibility, which tends to increase with age. The indicators of responsibility are highly significant. Employees at the highest level (A) receive a wage premium ranging from 40 per cent (Denmark) to 70 (Italy), compared to employees at the lowest level of responsibility (C).[13] B level workers receive a premium of around half that size.

Not surprisingly, the type of position seems to matter a great deal for earnings. According to the estimates, the most highly paid position in all of the countries is Head of Research & Development. With the exception of Sweden, Laboratory Specialist is everywhere the lowest paid position. Although the ranking of positions within each country is quite similar, there are notable differences in the relative size of the wage premia across countries. The premium for Heads of Research & Development, in relation to Industrial Engineers (the reference position), ranges from 52 per cent, in Denmark, to 133 percent, in the UK.

Turning to the company characteristics, we find that wages are increasing in firm size. This is in line with many other studies (see e.g. Brown and Medoff, 1989). An increase in the number of employees by 1 percent causes earnings to go up by roughly 0.01 - 0.05 percent. The year dummies, finally, capture variations in the real wage for the typical engineer as well as effects of changing

[13]Note that the coefficient estimates (c) of dummy variables in semilogarithmic equations cannot readily be interpreted as percentage effects (p), unless c is small. An approximation, used throughout in this study, is p = [exp (c) - 1] x 100. See Halvorsen and Palmquist (1980) and Kennedy (1981) for further details.

the compositions of the samples over time. In most cases the dummies are insignificant.[14]

The regressions for engineers with non-graduate positions are presented in Table 6.b, which retains the basic format of the previous table. Some of the results are similar, but there are also a few differences. The payoff for achieving a higher level of responsibility is lower among non-graduate engineers. An employee at the A level receives a salary that is between 29 and 44 percent higher than that of a C employee, depending on country. Also, some of the countries in which additional responsibility pays well for graduate level engineers, show rather modest rewards for high responsibilities taken on by non-graduate level engineers. Italy is the most striking example; while for graduate level engineers Italy values an A level responsibility higher than all of the other countries, the extra pay according to non-graduate A level engineers is smallest in Italy among the seven countries.

The position-specific wage differentials among the non-graduates are not large; the most highly paid position is Field Service Engineer, with coefficient estimates around 0.10 to 0.20. Firm size does not seem to matter much for earnings and in most cases the coefficients are insignificant. In one country, Sweden, the estimate turns out to be negative and significant.

The overall impression of Tables 6.a and 6.b is otherwise that the regressions perform quite well in terms of explanatory power. For the graduate positions, the regressions explain 2/3 of the variations in (log) wages and with respect to the non-graduate positions the corresponding figure is 1/2. The main reason for this high explanatory power is our information about responsibility, the indicators of which are the most important variables in the wage regressions.

[Table 6.b about here]

In Tables 6.c and 6.d, wage equations are presented for the business administrators. The regressions look quite similar to the regressions for the corresponding categories of engineers. One difference, however, is that increases in firm size tend to increase earnings for both categories of business administrators, i.e., also for those with non-graduate positions, Italy and Sweden being the only exceptions. In Table 6.d it is notable that the estimate for Accountants in the UK regression is much higher than in the other countries.

[14] For brevity, we do not report the estimates of the industry dummies.

This result is in line with the findings regarding the non-standardized wage levels in the Section 2.[15]

[Tables 6.c and 6.d about here]

We have also performed various regressions in order to test for robustness. First, the basic model in Section 3 has been extended to include various interactions. The position dummies were interacted with the responsibility level dummies. The rationale behind this formulation is that the responsibility levels are defined separately for each position (see Appendix A) and thus also may yield different payoffs depending on position.We find, however, that the hypothesis that wage premia for a given responsibility level are equal across positions cannot be rejected in the majority of cases.

Second, we have constructed a sub-sample with two-year overlapping panels of firms. (See the discussion in Section 3.) Separate regressions were run for the periods 1993-94, 1994-95 and 1995-96, with a time dummy for the last year of the period and otherwise using the same variables as in Table 6. The number of firms in the full sample, i.e., the sample used in Table 6, and the number of firms (and observations) in the sub-sample of firm panels is shown in Appendix C.

There is a notable increase in the explanatory power of the panel regressions, as compared to the full-sample regressions in Table 6. For example, the regressions for engineers with graduate positions now explain around 3/4 of the variations in (log) wages and in the regressions for engineers with non-graduate positions the corresponding figure is 2/3.The estimates are basically robust across years as well as in comparison to the estimates in Table 6.

Since the results are very space consuming, we do not present the regressions of the extended model and the panels of firms here.[16]

4.2. Standardized wage premia

For each country and field of work we have computed standardized wage premia, as described in Section 3.The set of results in Table 7 pertains to the predicted wage levels derived from the basic model, applied to the full sample, in Table 6.

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[15]This may possibly be due to a high educational level among UK accountants compared to the other countries, cf. Appendix B.

[16]The results are available from the authors on request.

Tables 7.a and 7.b show the wage premia for engineers and business administrators, respectively.

[Table 7 about here]

It turns out that the wage premia for engineers do not, on average, differ greatly across countries. The estimates are around 31 to 38 percent, although Denmark seems to have consistently lower premia at approximately 24 percent. For some countries, there are quite large fluctuations over years, which must be interpreted as noise. This is particularly true for Denmark, where the premium in 1996 is only a third of the size of the premium the previous year, and for Sweden, where the premium in 1995 is about ten percentage points smaller than in 1994.

It is interesting to note that these standardized wage premia produce a ranking across countries which is partly different from the ranking according to the raw, non-standardized, wage premia, in Table 4.a. For instance, in terms of the average standardized wage premia, Germany´s rank is 3. A ranking based on the raw wage premia puts Germany on 1st place. British engineers, on the other hand, rank much higher in terms of the standardized wage premia than in terms of the raw wage premia. However, the range of the standardized wage premia is smaller than the range of the raw wage premia. Accordingly, the changes in the relative positions of the countries correspond to rather small differences in standardized wage premia.

The corresponding results for business administrators indicate that the standardized wage premia are much larger for this group as a whole, but there is also more variation across countries. The estimates range from, on average, 42 percent (Denmark) to 90 percent (UK). Among business administrators, the wage premia tend to be less unstable across years in most countries. In contrast to the results obtained for engineers, the rankings based on the estimated wage premia agree quite well with the rankings based on the raw wage premia in Table 4.b. The main exception is Belgium, which ranks only in 6th place regarding the standardized wage premia, whereas it attains a rank of 3 in the raw premia.

The result that wage premia are larger for business administrators than for engineers is, technically speaking, due to two factors. On the one hand, predicted wages for graduate positions are higher among business administrators. On the other hand, predicted wages for non-graduates are lower in this job category. This of course says nothing about the economic forces behind the results.

Comparing Tables 7.a and 7.b, we see that the estimated wage premia for engineers and business administrators not only differ with respect to magnitude.

The relative positions of the countries differ a lot, too. The most remarkable examples are Italy and the UK, which rank as number 1 with respect to one of the fields of work (engineering and business administration, respectively) but rank quite poorly with respect to the other field of work. Thus, how the countries compare in terms of wage premia for university level positions depends, in general, heavily on the line of work considered. The exception to this rule is Denmark, which ranks last with respect to both engineering and business administration.

For comparison, we also provide the wage premia obtained using the sub-sample with panels of firms in Table 8.[17] The results are based on separate regressions for the periods 1993-94, 1994-95 and 1995-96. Since the periods overlap there are two wage premia computed for 1994 (1994:I and 1994:II) and 1995 (1995:I and 1995:II) for each country and field of work. As can be seen, the average premia for engineers and business administrators are not very different from those presented in Table 7, with Sweden as the one exception.[18] The wage premia for Swedish engineers are larger in Table 8 than in Table 7 (42 vs. 35 percent on average), whereas the premia for business administrators are smaller (59 vs. 65 percent). The rankings based on the panels of firms puts Swedish engineers on 1st place instead of 5th. In general, however, the changes in the relative positions of countries are rather small.

Firm turnover may cause noise in the estimates across subsequent years. If this is true, subsequent wage premia based on one and the same panel of firms in Table 8 should differ less than the corresponding premia not based on the same set of firms. Thus, e.g., the 1993 and 1994:I premia should differ less than the 1993 and 1994:II premia and so forth. This is also largely what is observed. However, it can also be noted in Table 8 that some of the pairs of premia, e.g. for Italian engineers (1993-1994:I) and business administrators (1994:II-1995:I) and for Swedish engineers (1993-1994:I), are not robust across years. These results indicate that entry and exit of individuals in the sample, which we have not been able to control for, also may contribute to the observed noise.

[Table 8 about here]

[17] The wage premia obtained under the extended model, with position and level of responsibility interacted, are similar to those presented in Table 7 and are available on request.

[18] The results for Denmark are based on a relatively small sample and should be interpreted with care.

5. Concluding comments

In this study we have estimated wage regressions for engineers and business administrators in internationally active firms, for employees with graduate and non-graduate level positions, respectively, in seven European countries over the period 1993-96. Based on these estimates, we have computed directly comparable standardized wage premia for engineers and business administrators in each country. In order to test for robustness, two different samples have been used. The first sample contains all observations, while the second one is a sub-sample of overlapping panels of firms. The results generated by the two samples turned out to be similar.

When computing the wage premia, we find that business administrators generally receive larger premia than engineers. As regards the ranking of the countries, the field of work seems to matter a great deal. In engineering , Germany, Italy and Sweden (panels sample only) rank highly, while the UK and France come out on top in business administration. Denmark ranks at the bottom in both lines of work, however. Aggregation over fields of work, which is not uncommon in studies on the returns to education, therefore seems to be a questionable practice when comparing the returns in different countries. In this paper, we have not set out to explain the differences in the returns across fields of work. We have simply aimed at measuring the returns as carefully as possible. An understanding of the mechanisms behind the observed differences requires the development of a structural model and is subject to further research. The wage premia for engineers are quite similar across countries. This may be surprising, since it is not difficult to think of important differences in e.g. the educational systems. For instance, the length of a typical university education for engineers varies across the countries in our sample.[19] There may of course also be quality differences, which are more difficult to observe.

Our results regarding wage premia are merely suggestive of the actual incentives for undertaking higher education in engineering and business administration across the countries. For a number of reasons, the numbers should not be regarded as final evidence. For instance, we have not taken income taxes into account. Since the tax system is progressive in all of the countries, net-of-tax wage premia would in all countries be lower than the gross wage premia in Tables 7 and 8. How the inclusion of taxes would affect the ranking of countries is, however, less certain. We have also abstracted from non-pecuniary benefits,

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[19] See e.g. Kowalewska (1994).

which tend to be frequent among highly skilled workers, and the costs of higher education. Some of these issues we intend to also endeavor upon in future research.

References

Brown, C. and J. Medoff (1989), The Employer Size Effect, Journal of Political Economy 97, 1027-1059.

Denison, E. F. (1962), Sources of Economic Growth in the U.S., (New York: Committee for Economic Development).

Griliches, Z. (1970), Notes on the Role of Education in Production Functions and Growth Accounting, in W.L. Hansen (ed.), Education, Income and Human Capital: Studies in Income and Wealth 35 (New York: Columbia University Press for the National Bureau of Economic Research).

Gunnarsson, G. and E. Mellander (1998), Sensitivity of Total Factor Productivity Indexes to Aggregation over Inputs: Evidence from the Swedish Manufacturing Sector 1985-1995. Paper presented at the conference "Methodological Issues in Official Statistics" organized by Statistics Sweden in Stockholm, October 1998.

Halvorsen, R. and R. Palmquist (1980), The Interpretation of Dummy Variables in Semilogarithmic Equations, American Economic Review 70, 474-475.

Hemström, M. (1998), Salary Determination in Professional Labour Markets. Doctoral dissertation. Economic Studies 36, Department of Economics, Uppsala University.

Hsiao , C. (1986), Analysis of Panel Data (Cambridge University Press).

Kennedy, P. (1981), Estimation with Correctly Interpreted Dummy Variables in Semilogarithmic Equations, American Economic Review 71, 801.

Kjellström, C. (1999), Essays on Investment in Human Capital. Doctoral dissertation. Dissertation Series 36, Swedish Institute for Social Research, Stockholm University.

Kowalewska, N. (1994), Utländska tekniska utbildningar. Sammanställning och utvärdering (Verket för högskoleservice, Stockholm).

Miller, D.M. (1984), Reducing Transformation Bias in Curve Fitting, The American Statistician 38, 124-126.

Mincer, J. (1974), Schooling, Experience and Earnings (National Bureau of Economic Research, New York).

Murphy, K. M., A. Shleifer and R.W. Vishny (1991), The Allocation of Talent: Implications for Growth, Quarterly Journal of Economics 106, 503-550.

NorBo Economics (1998), Utflyttning av högutbildade. NorBo Economics, Stockholm.

OECD (1996), Employment Outlook, OECD, Paris.

Petersen, T. and L. Morgan (1995), Separate and Unequal: Occupation-Establishment Sex Segregation and the Gender Wage Gap. American Journal of Sociology 101, 329-365.

Petersen, T., E. M. Meyerson and V. Snartland (1996), The Within-Job Gender Wage Gap: The Case of Sweden, Working Paper No. 470, The Industrial Institute for Economic and Social Research, Stockholm.

Petersen, T., V. Snartland, L.-E. Becken and K. Modesta Olsen (1997), Within-Job Wage Discrimination and the Gender Wage Gap, The Case of Norway. European Sociological Review 13.

Pierce-Brown, R. (1996), Human Capital Theory and Gender Related Differences in the Salaries of Qualified Accountants in the UK, Warwick Business School Research Papers, no. 233 (University of Warwick).

Psacharopoulos, G. (1993), Returns to Investment in Education. A Global Update, Policy Research Working Papers (The World Bank).

White, H. (1980), A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity, Econometrica 48, 817-838.

Appendix A: Some examples of the positions considered

To illustrate how the positions that we are considering are specified in Watson Wyatt's annual Compensation Survey we here reproduce, *in extenso*, four of the job specifications, one for each of the categories in Table 1, i.e. Engineering / Graduate Position, Engineering / Non-graduate position, Business administration / Graduate Position, and Business administration / Non-graduate position. The examples we have chosen are the positions *that we use as reference positions* in our four different earnings regressions, i.e. Industrial Engineer, Workshop Specialist, Financial Analyst, and Accounting Clerk.

INDUSTRIAL ENGINEER

Responsible for developing and designing new production processes to improve efficiency. Studies work flow, industrial systems and production methods as well as equipment layout, material handling, manpower and equipment utilization to improve operating performance. Recommends and introduces efficient work practices, organizations and possibly productivity payment systems to provide effective use of people, systems and equipment. Reports to the Head of Engineering or the Head of Manufacturing.
Alternative job titles: Manufacturing Systems Engineer, Works Engineer, Plant Engineer, Production Engineer, Process Engineer.

Level A (Middle Management)
Formulates and recommends industrial engineering policies to improve operating performance, reduce waste and delays, and promote cost reductions. Directs cost control programs, conducts organization studies and prepares operating manuals. Is likely to work in a highly complex environment which necessitates the expert application of advanced engineering knowledge. Typically a team leader or project leader with supervisory responsibility.

Level B (Employee)
Develops manufacturing methods for machines, tools and equipment. Establishes time and motion standards. Assists with cost control programs and recommends production control and scheduling methods to meet completion dates and technical specifications. Plans equipment layout, work flow and accident prevention measures. May liaise with other engineering disciplines to introduce CAD/CAM and robotics. Senior engineer with experience.

Level C (Employee)
Performs engineering assignments in work measurement for the establishment of standards, using standard company procedures. Carries out engineering assignments of specific parts, elements or phases of a major project, translating technical guidance received from senior levels into applicable engineering data. Final responsibility remains at a more senior level.

WORKSHOP SPECIALIST

Works on bench servicing, repairs, and/or testing of products. Duties involve diagnosis and rectification of faults, and use of test equipment. Reports to Field Service Manager or equivalent.

Level A (Employee)

Responsible for all in-house service requirements and maybe for warranty claims, spares and liaison with distribution centres and contractors. Is likely to have regular customer contact and supervise a team of technicians dealing with highly technical products. May be called *Workshop Supervisor*.

Level B (Employee)
As *Senior Repair Technician*, is responsible for some in-house service requirements with repairs likely to be restricted to key assembly faults and major problems being referred elsewhere. Technical and some experience are required.

Level C (Employee)
As *Repair Technician*, limited to simple board changes, works under constant supervision and handles routine maintenance issues on reasonably straightforward equipment.

FINANCIAL ANALYST

Provides a basis for management planning, operating controls and financial performance appraisal. Prepares forecasts and analyses trends in manufacturing, sales, finance and general business conditions. Conducts economic studies such as rate of return, depreciation, working capital, financial and expense performances, and assists other departments in the preparation of budgets. Responsible for the preparation, consolidation and distribution of company profit and loss and capital expenditure budgets. Reports to the Head of Finance & Administration or equivalent.
Alternative job titles: Economist, Budget Analyst.

Level A (Middle Management)
As *Budgetary Manager* or *Senior Economist*, recommends budgetary policies, develops methods and procedures for the preparation of budgets. Analyses products' profit and loss statements and consolidates inventory and capital expenditure budgets. Evaluates economic and business conditions and presents solutions to problems for which there is no established approach. Manages a team of support staff in larger companies.

Level B (Employee)
As *Budget Analyst* or *Economist*, analyses risk and economic trends. Prepares operating budgets based on previous budget figures or estimated revenue and expense reports. Reviews actual against budgeted performance and prepares reports explaining budget deviations. No supervisory responsibility but several years of experience are required. May give guidance to other financial staff.

Level C (Employee)
As *Junior Budget Analyst* or *Junior Economist*, provides under close supervision research data covering various economic fields. Maintains records of expenses, inventories and budget balances. Prepares display materials for presentations.

ACCOUNTING CLERK

Responsible for performing a variety of routine accounting activities in accordance with standard procedures. Reconciles bank accounts, posts and balances, general or subsidiary ledgers, processes payments and compiles segments of monthly closings. Reports to the Chief Accountant or equivalent.

Alternative job titles: Book-keeper, Accounts Assistant.

Level A (Employee)
As *Senior Accounting Clerk*, handles a wide variety of advanced accounting work including maintenance and preparing of reports on more complex budget and or income and expenditure records. May direct and check the work of more junior staff.

Level B (Employee)
As *Accounting Clerk*, performs a variety of routine accounting duties as directed. Verifies the accuracy, completeness and consistency of accounting information received. Reconciles accounts, balances ledgers, etc.

Level C (Employee)
As *Junior Accounting Clerk*, performs simple repetitive tasks under close supervision. Procedures are well-defined. Checks matching payments to accounts receivables, plus invoice and order items. Assists in preparing bank statements and journal vouchers.

Appendix B: The link between position and education

The classification of positions by educational level given in Table 1 is not based on explicit information about the employees' education, as information on education is not collected by Watson Wyatt. However, the positions considered have been chosen because, on average, they are likely to require either a university level education (the graduate positions) or an education corresponding to high school or upper secondary school (the non-graduate positions).

The educational requirements of the graduate positions were partly validated in a special survey conducted by *Watson Wyatt* in 1994. Random samples of companies in the seven countries considered in this study were asked about the levels of education associated with seven positions in Table 1, all of which were expected to require university level education. The positions considered were R&D Specialist, Laboratory Specialist, Manufacturing Engineering Engineer, Industrial Engineer, Internal Auditor, Financial Analyst, and Accountant. For each of these, the companies were asked to indicate one out of five alternative levels, namely, i) below university level, ii) less than 2 years of university education, iii) 2-3 years of university education, iv) 3-4 years of university education, and v) more than 4 years of university education.

Unfortunately, the response rates in this special survey were too low to allow any firm conclusions; in total only 34 companies responded. In particular, no inferences regarding individual countries were possible. Taken together, the results indicated, however, that with one exception these positions seem to require a college or university degree. The exception was the position Accountant, for which 50 percent of the companies indicated alternatives i) or ii). As can be seen in Table 1 this information has resulted in the Accountant position being classified among the non-graduate positions rather than in the graduate positions category.[20] For the six other positions investigated, at least 2/3 of the companies indicated that 2 or more years of university education were required [i.e., alternatives iii) - v)]. For four of these six positions - R&D Specialist, Manufacturing Engineering Engineer, Industrial Engineer, and Financial Analyst - a majority of the responding companies indicated that at least 3 years of university education were required.

For 1996 there is an additional possibility to check to the link between position and education. In this year *Watson Wyatt* added a section about starting salaries to their annual compensation survey. This section marked a change in the general outline of the survey in the sense that for the first time questions were included that explicitly related to the educational levels of the companies' employees. The companies were asked to provide data on the minimum (and maximum) starting salaries paid to employees in three educational categories: First Degree Graduates, MBAs, and PhDs. By itself, we cannot make much use of this information. However, for some of the countries that we study - Belgium, Denmark, Sweden, and the UK - there are also questions about starting salaries for a small number of job categories as well. Of interest to us are the positions "Engineer", "Research Analyst/Scientist", and "Accountant". The first category roughly corresponds to the positions "Industrial Engineer" and "Manufacturing Engineering Engineer" in Table 1. The category "Research Analyst/Scientist" can be taken to be equivalent to the position "Research and Development Specialist" in Table 1.[21] The category "Accountant", finally, is identical to the position with the same name in Table 1.

On the whole, the information on the starting salaries supports the cross-classification by positions and educational levels given in Table 1. The average minimum starting salary for the

[20] For one country, the UK, this might not be appropriate. In a survey of *qualified* accountants in the UK, reported by Pierce-Brown (1996), 65 percent of the males and 71 percent of the females held university degrees. To the extent that the UK Accountants in Watson Wyatt's survey are qualified they should be categorized in the graduate category. Unfortunately, we have no information about whether this is indeed the case.

[21] The correspondences between "Industrial Engineer" and "Manufacturing Engineering Engineer" and between "Research Analyst/Scientist" and "Research and Development Specialist" have been checked with Watson Wyatt representatives.

category "Engineer" exceeds the average starting salary of First Degree Graduates in each of the countries, except Sweden where its only marginally lower (about 0.5 percent).[22] Moreover, the "Research Analyst/Scientist" employees definitely seem to have a university degree; the starting salary for this category is always higher than for the "Engineer" category and thus, *a fortiori*, higher than that of First Degree Graduates. With respect to "Accountant" the findings are generally in line with those from the special survey discussed above. In Belgium, Denmark, and Sweden the average starting salaries are well below the average starting salaries for First Degree Graduates. In the UK the average starting salary for the "Accountant" category is surprisingly high, however. It exceeds the average starting salary of First Degree Graduates by 13 percent and is even slightly higher than the average starting salary of the UK "Engineer" category. Thus, for the UK information both educational levels (cf. footnote 20) and on starting salaries would motivate putting the Accountant position in Table 1 among the graduate positions instead of among the non-graduate positions. In the regression analyses we have not made this change, however, as we wanted to use the same specifications for all of the countries.[23]

Altogether, these validity checks indicate that the positions that we denote graduate positions do in fact seem to require university level education. Whether educational levels associated with the non-graduate positions correspond to high school or upper secondary school we have not been able to check, except for Sweden. For Sweden, we have aggregate data on wages for engineers and business administrators, with university or high school education, collected by *Statistics Sweden*. These data are not directly comparable to our *Watson Wyatt* data because, firstly, they cover males only and, secondly, the range of positions is broader; all male positions are included. Excluding females is likely to result in higher wage levels. The effect of broadening the coverage in terms of job categories is more uncertain but, to the extent that top level positions have a large influence on average wage levels, the fact that CEOs are excluded in our data might work in the same direction. Still, the differences are surprisingly large: for all four job categories in Table 1 the averages wages as measured by Statistics Sweden are around 15 percent higher.[24] A possible explanation could be that the average levels of education in all the positions in Table 1 are below the levels of education that they are supposed to represent. However, if so, the wage premia for university vs high school level jobs that we want to measure should not be much affected as the relative deviations are of the same magnitude for the graduate and the non-graduate positions alike.

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[22] This is in line with Hemström (1998), who finds support for the hypothesis that a group of large Swedish companies, by acting as a monopsonist, has been able to force the starting salaries of graduate engineers below the competitive level.

[23] The wage level for the aggregate of UK non-graduate positions will thus tend to be upwards biased. As a consequence, the wage differential between the graduate and the non-graduate positions is likely to be underestimated for the UK. Nevertheless, the wage premium for UK graduate positions in business administration, compared to non-graduate positions, is much higher than in all of the other countries studied. Reclassifying Accountant as graduate positions would probably increase the difference even further.

[24] In particular, these differentials seem large in view of the fact that the *Watson Wyatt* data are from large and internationally active companies, which can be expected to pay higher wages than small and/or domestic firms, cf the data section.

Appendix C: The number of firms in the data sets

Table C.1.
Number of firms in the full sample.

a. Engineers

Period	Belgium	Denmark	France	Germany	Italy	Sweden	UK
1993	122	34	85	72	73	33	80
1994	108	32	85	93	80	35	73
1995	129	22	104	109	83	68	78
1996	114	18	88	112	60	52	81

b. Business administrators

Period	Belgium	Denmark	France	Germany	Italy	Sweden	UK
1993	173	43	108	104	92	51	109
1994	163	39	110	128	101	62	104
1995	196	37	131	140	107	104	116
1996	155	31	112	142	75	84	104

Table C.2.
Number of firms and observations (in parentheses) in the panel data set.
Two-year overlapping panels of firms.

a. Engineers

Period	Belgium	Denmark	France	Germany	Italy	Sweden	UK
1993-94	74 (1,058)	22 (332)	63 (1,039)	46 (821)	49 (785)	14 (133)	43 (615)
1994-95	65 (819)	13 (218)	63 (949)	55 (982)	55 (753)	17 (291)	37 (492)
1995-96	76 (1,046)	13 (97)	54 (809)	64 (1,124)	44 (601)	25 (328)	37 (507)

b. Business administrators

Period	Belgium	Denmark	France	Germany	Italy	Sweden	UK
1993-94	111 (1,241)	30 (249)	82 (990)	67 (1,722)	64 (782)	28 (224)	57 (648)
1994-95	106 (1,130)	22 (146)	81 (908)	80 (1,160)	68 (878)	32 (347)	62 (669)
1995-96	110 (1,388)	21 (128)	68 (815)	81 (1,095)	55 (718)	48 (536)	57 (593)

Table 1.
Positions by field of work and educational level.

Educational Level	Engineering	Business Administration
Graduate positions	Industrial Engineer Manufacturing Engineering Engineer Head of Research & Development Research & Development Specialist Laboratory Specialist	Financial Analyst Chief Accountant Internal Auditor
Non-graduate positions	Workshop Specialist Field Service Engineer Quality Control Technician	Accounting Clerk Accountant Payroll Specialist

Table 2.
Number of observations, by country and educational level, 1993-96.
a. Engineers.

Country	1993	1994	1995	1996
	Non-Grad. Grad.	Non- Grad. grad.	Non- Grad. grad.	Non- Grad. grad.
Belgium	495 340	454 235	464 294	471 289
Denmark	143 94	126 85	64 70	30 48
France	297 449	323 366	317 377	397 290
Germany	284 335	452 383	450 416	470 432
Italy	220 319	293 344	241 253	193 200
Sweden	71 108	112 106	247 203	214 172
UK	231 426	206 298	215 269	242 274
Sum	1,741 2,071	1,966 1,817	1,998 1,882	2,017 1,705

b. Business administrators.

Country	1993		1994		1995		1996	
	Non-Grad.	Grad.	Non-Grad.	Grad.	Non-Grad.	Grad.	Non-Grad.	grad.
Belgium	292	678	253	584	318	770	318	663
Denmark	38	131	45	131	37	90	36	63
France	208	470	182	435	264	511	245	427
Germany	137	465	266	678	294	678	307	613
Italy	133	407	178	462	169	461	145	380
Sweden	77	154	104	179	183	414	133	335
UK	175	442	136	412	171	473	166	406
Sum	1,060	2,747	1,164	2,881	1,436	3,397	1,350	2,887

Table 3.Means of real annual salary, by country and educational level, 1993-96. Local currencies.

a. Engineers.

<table>
<tr><th rowspan="2">Country</th><th>1993</th><th>1994</th><th>1995</th><th>1996</th></tr>
<tr><th>Non- Grad.
Grad.</th><th>Non-
Grad. grad.</th><th>Non- Grad.
Grad.</th><th>Non- Grad.
grad.</th></tr>
<tr><td>Belgium (BFR)</td><td>17,320
13,007</td><td>17,551
13,690</td><td>18,411
13,072</td><td>18,801
12,739</td></tr>
<tr><td>Denmark(DKK)</td><td>435,445
317,151</td><td>414,506
336,741</td><td>448,345
319,255</td><td>500,046
343,105</td></tr>
<tr><td>France (FFR)</td><td>276,930
196,580</td><td>275,617
202,373</td><td>279,041
208,122</td><td>280,321
189,277</td></tr>
<tr><td>Germany (DEM)</td><td>111,089
78,901</td><td>117,898
82,226</td><td>117,250
78,656</td><td>125,142
75,640</td></tr>
<tr><td>Italy (ITL)</td><td>72,288
47,305</td><td>66,188
49,097</td><td>71,502
51,062</td><td>70,669
49,641</td></tr>
<tr><td>Sweden (SEK)</td><td>333,848
228,697</td><td>340,591
228,132</td><td>306,575
213,505</td><td>306,625
234,539</td></tr>
<tr><td>UK (GBP)</td><td>25,569
18,829</td><td>24,396
19,021</td><td>24,280
19,286</td><td>26,894
18,710</td></tr>
</table>

b. Business administrators.

Country	1993		1994		1995		1996	
	Non-grad.	Grad.	Non-grad.	Grad.	Non-Grad.	Grad.	Non-grad.	Grad.
Belgium (BFR)	20,612	12,470	20,980	12,736	20,412	12,472	20,487	12,607
Denmark (DKK)	392,607	264,398	389,967	262,794	365,458	263,736	385,624	270,073
France (FFR)	310,169	180,734	316,888	177,355	307,976	168,722	311,298	168,570
Germany (DEM)	123,095	70,928	122,765	73,536	118,553	74,151	122,014	78,950
Italy (ITL)	78,880	44,221	72,326	44,388	69,976	45,611	66,734	45,986
Sweden (SEK)	324,050	199,885	338,439	211,071	331,348	199,221	345,268	212,430
UK (GBP)	34,577	17,618	35,561	17,960	32,597	17,096	34,696	17,774

Notes: The salaries include bonus and commission and are in 1996 prices. The source for the consumer price index in the respective countries is OECD: *Main Economic Indicators.*
Belgian and Italian salaries are in BFR x 100 and ITL x 1,000, respectively.

Table 4.
Raw wage premia for graduate vs. non-graduate positions, by country, 1993-96.
Percent.

a. Engineers.

Period	Belgium	Denmark	France	Germany	Italy	Sweden	UK
1993	33.2	37.3	40.9	40.8	52.8	46.0	35.8
1994	28.2	23.1	36.2	43.4	34.8	49.3	28.3
1995	40.8	40.4	34.1	49.1	40.0	43.6	25.9
1996	47.6	45.7	48.1	65.4	42.4	30.7	43.7
1993-96	37.5	36.6	39.8	49.7	42.6	42.4	33.4

b. Business administrators.

Period	Belgium	Denmark	France	Germany	Italy	Sweden	UK
1993	65.3	48.5	71.6	73.5	78.4	62.1	96.3
1994	64.7	48.4	78.7	66.9	62.9	60.3	98.0
1995	63.7	38.6	82.5	59.9	53.4	66.3	90.7
1996	62.5	42.8	84.7	54.5	45.1	62.5	95.2
1993-96	64.1	44.6	79.4	63.7	60.0	62.8	95.1

Note: The wage premium is computed by dividing the wage for the university level positions with the wage for the high school level positions (from Table 3), subtracting 1 from the resulting number and multiplying by 100.

Table 5.
Means of selected variables, by country and educational level, 1993-96.

a. Engineers.

Country	Age	Level of responsibility	No. of employees
	Non-Grad. Grad.	Non-Grad. Grad.	Non-Grad. grad.
Belgium	37.1 37.5	25/42 25/50	573 362
Denmark	42.5 39.4	33/36 36/49	616 172
France	38.3 36.6	31/41 26/52	1,071 432
Germany	40.6 38.7	30/40 31/53	2,571 1,109
Italy	40.0 36.8	23/39 27/48	622 329
Sweden	42.3 38.1	30/45 34/54	1,679 176
UK	40.6 37.4	30/50 38/49	626 385
All 7	39.5 37.6	28/42 30/51	1,194 509

b. Business administrators.

Country	Age	Level of responsibility	No. Of Employees
	Non-Grad. Grad.	Non-Grad. grad.	Non-Grad. grad.
Belgium	38.6 36.6	25/51 23/55	1,053 651
Denmark	40.2 40.2	16/66 17/59	391 281
France	38.4 37.8	23/47 24/53	1,185 802
Germany	40.0 38.8	19/52 23/56	2,979 1,916
Italy	38.8 37.8	15/50 28/47	526 501
Sweden	39.5 41.9	27/45 21/57	1,486 747
UK	36.6 35.9	24/52 24/51	1,405 849
All 7	38.7 37.9	22/50 24/53	1,465 936

Note: The two figures for level of responsibility refer to the share, in percent, of workers at ´A´ and ´B´ levels, respectively.

Table 6.a.
Estimated wage equations for engineers, graduate positions, 1993-96, by country. OLS.
Dependent variable: log of real annual salary, in local currency.

Variable	Belgium	Denmark	France	Germany	Italy	Sweden	UK
Intercept	12.933 (141.56)	11.266 (59.86)	10.983 (84.93)	10.157 (87.61)	9.593 (64.94)	11.015 (75.73)	8.721 (67.65)
Age	0.035 (7.32)	0.045 (5.04)	0.037 (5.55)	0.028 (4.79)	0.028 (3.72)	0.042 (6.08)	0.042 (6.89)
Age Squared x 1,000	-0.242 (4.04)	-0.448 (4.44)	-0.305 (3.74)	-0.214 (3.07)	-0.174 (1.88)	-0.412 (5.18)	-0.449 (6.24)
´A´ Level of Responsibility	0.398 (28.59)	0.338 (12.42)	0.482 (31.41)	0.430 (27.99)	0.531 (24.98)	0.447 (21.19)	0.452 (18.10)
´B´ Level of Responsibility	0.193 (18.49)	0.216 (8.82)	0.235 (16.70)	0.181 (14.42)	0.261 (16.10)	0.193 (10.28)	0.189 (9.15)
Manufacturing Engineering Engineer	0.115 (8.09)	0.043 (1.17)	0.025 (1.46)	0.103 (6.13)	0.109 (4.77)	0.061 (1.85)	0.102 (4.35)
Head of Research & Development	0.586 (23.47)	0.420 (12.16)	0.603 (26.95)	0.736 (30.76)	0.799 (27.68)	0.619 (17.66)	0.848 (17.90)
Research & Development Specialist	0.120 (8.44)	0.132 (4.35)	0.079 (4.99)	0.099 (6.41)	0.118 (5.89)	0.213 (7.42)	0.114 (5.44)
Laboratory Specialist	-0.137 (9.70)	-0.113 (3.34)	-0.119 (5.77)	-0.144 (7.22)	-0.109 (4.86)	0.071 (2.16)	-0.075 (2.62)
Log of no. of employees	0.031 (7.20)	0.051 (4.64)	0.034 (7.66)	0.048 (14.77)	0.041 (6.05)	0.038 (7.15)	0.012 (1.68)
Year 1994	0.018 (1.49)	-0.017 (0.80)	0.006 (0.35)	-0.029 (1.90)	-0.036 (1.82)	-0.018 (0.62)	-0.021 (0.89)
Year 1995	0.003 (0.26)	0.008 (0.31)	-0.020 (1.17)	-0.041 (2.67)	-0.022 (1.09)	-0.136 (5.21)	-0.030 (1.33)
Year 1996	-0.007 (0.54)	-0.107 (1.82)	-0.030 (1.79)	-0.019 (1.25)	-0.007 (0.34)	-0.041 (1.51)	0.013 (0.62)
No. of observations	1,884	362	1,334	1,656	947	644	893
Test for heteroskedasticity P^2, (p-value)	307.95 (0.000)	133.81 (0.054)	242.84 (0.000)	172.07 (0.007)	231.31 (0.000)	144.21 (0.364)	191.48 (0.011)
R^2 (adj.)	0.774	0.744	0.719	0.784	0.774	0.729	0.669

Notes: Absolute t-values in parentheses. T-values corrected for heteroskedasticity where indicated (see White, 1980). The references for the responsibility level, position and year dummies is ´C´ level, Industrial Engineer, and 1993, respectively. Industry dummies are included in all regressions, but not shown.

Table 6.b.
Estimated wage equations for engineers, non-graduate positions, 1993-96, by country. OLS.
Dependent variable: log of real annual salary, in local currency.

Variable	Belgium	Denmark	France	Germany	Italy	Sweden	UK
Intercept	12.742 (124.45)	11.214 (58.72)	10.972 (119.70)	10.182 (101.41)	9.047 (84.76)	11.317 (120.74)	8.697 (97.38)
Age	0.042 (8.05)	0.055 (5.65)	0.041 (8.71)	0.034 (6.61)	0.061 (10.73)	0.035 (6.90)	0.035 (8.31)
Age Squared x 1,000	-0.376 (5.66)	-0.625 (5.28)	-0.394 (6.91)	-0.329 (5.18)	-0.589 (8.10)	-0.350 (5.39)	-0.380 (7.44)
´A´ Level of Responsibility	0.300 (20.05)	0.315 (10.26)	0.363 (22.69)	0.345 (21.41)	0.253 (14.68)	0.296 (13.99)	0.353 (18.37)
´B´ Level of Responsibility	0.131 (11.51)	0.142 (5.32)	0.156 (11.61)	0.180 (13.91)	0.105 (7.49)	0.210 (11.43)	0.218 (12.28)
Field Service Engineer	0.090 (6.14)	0.129 (5.16)	0.191 (13.55)	0.085 (7.63)	0.185 (11.00)	0.090 (4.98)	0.144 (6.42)
Quality Control Technician	0.015 (0.86)	-0.037 (0.81)	-0.038 (1.98)	0.029 (1.93)	0.125 (5.94)	0.015 (0.61)	-0.118 (4.24)
Log of no. of employees	0.013 (2.61)	0.009 (1.17)	-0.004 (0.89)	-0.002 (0.45)	0.004 (0.74)	-0.031 (6.16)	0.002 (0.40)
Year 1994	0.047 (3.10)	0.026 (1.18)	-0.016 (1.18)	0.029 (2.08)	0.018 (1.30)	0.016 (0.74)	0.019 (1.35)
Year 1995	0.022 (1.57)	-0.014 (0.58)	-0.003 (0.21)	-0.019 (1.44)	0.006 (0.36)	-0.028 (1.56)	0.048 (3.44)
Year 1996	-0.002 (0.16)	0.053 (1.95)	-0.039 (2.61)	-0.037 (2.92)	-0.016 (0.99)	0.055 (2.92)	0.070 (4.75)
No. of observations	1,158	297	1,482	1,566	1,116	589	1,266
Test for heteroskedasticity P^2, (p-value)	202.20 (0.000)	98.68 (0.101)	187.68 (0.000)	180.45 (0.000)	149.05 (0.011)	186.02 (0.000)	203.47 (0.000)
R^2 (adj.)	0.565	0.578	0.573	0.489	0.561	0.558	0.597

Notes: The reference for the position dummies is Workshop Specialist. See also notes to Table 6.a.

Table 6.c. Estimated wage equations for business administrators, graduate positions, 1993-96, by country. OLS.
Dependent variable: log of real annual salary, in local currency.

Variable	Belgium	Denmark	France	Germany	Italy	Sweden	UK
Intercept	12.682 (107.20)	11.635 (52.81)	10.985 (73.88)	9.783 (61.79)	9.134 (34.85)	10.932 (61.22)	8.191 (36.58)
Age	0.050 (8.40)	0.025 (2.53)	0.041 (5.46)	0.056 (6.96)	0.076 (5.70)	0.048 (5.53)	0.065 (5.46)
Age Squared x 1,000	-0.448 (6.21)	-0.221 (2.01)	-0.404 (4.41)	-0.549 (5.69)	-0.774 (4.72)	-0.511 (5.00)	-0.727 (4.96)
´A´ Level of Responsibility	0.420 (22.27)	0.252 (5.68)	0.499 (27.02)	0.423 (18.82)	0.646 (20.31)	0.425 (17.68)	0.463 (14.85)
´B´ Level of Responsibility	0.156 (10.39)	0.117 (3.59)	0.218 (13.60)	0.200 (12.92)	0.283 (14.42)	0.209 (10.38)	0.245 (9.63)
Chief Accountant	0.171 (11.31)	0.233 (7.74)	0.249 (15.09)	0.189 (11.63)	0.202 (9.59)	0.231 (11.88)	0.297 (11.65)
Internal Auditor	0.103 (5.09)	0.007 (0.11)	0.136 (5.90)	0.071 (3.40)	0.109 (3.02)	-0.036 (1.46)	0.019 (0.47)
Log of no. of employees	0.045 (9.67)	0.058 (6.36)	0.045 (9.06)	0.039 (9.04)	-0.016 (1.58)	0.040 (7.78)	0.065 (9.08)
Year 1994	0.010 (0.61)	0.057 (1.74)	0.024 (1.23)	-0.056 (2.88)	-0.047 (1.61)	0.054 (1.92)	-0.002 (0.08)
Year 1995	0.003 (0.19)	0.028 (0.78)	-0.012 (0.67)	-0.070 (3.55)	-0.084 (3.00)	0.026 (1.00)	-0.052 (1.87)
Year 1996	-0.010 (0.61)	0.057 (1.49)	-0.026 (1.40)	-0.039 (1.92)	-0.095 (3.20)	0.055 (2.06)	-0.007 (0.26)
No. of observations	1,181	156	899	1,004	625	497	648
Test for heteroskedasticity P^2, (p-value)	229.20 (0.000)	83.92 (0.763)	170.54 (0.018)	248.60 (0.000)	166.92 (0.028)	152.01 (0.196)	162.01 (0.256)
R^2 (adj.)	0.580	0.577	0.617	0.584	0.605	0.680	0.515

Notes: The reference for the position dummies is Financial Analyst. See also notes to Table 6.a.

Table 6.d.
Estimated wage equations for business administrators, non-graduate positions, 1993-96, by country. OLS.
Dependent variable: log of real annual salary, in local currency.

Variable	Belgium	Denmark	France	Germany	Italy	Sweden	UK
Intercept	12.877 (243.43)	11.364 (70.50)	11.159 (118.97)	9.932 (162.49)	9.726 (136.73)	11.488 (186.89)	8.525 (110.66)
Age	0.028 (10.28)	0.027 (3.64)	0.019 (3.76)	0.030 (9.12)	0.029 (7.41)	0.018 (6.14)	0.027 (6.73)
Age Squared x 1,000	-0.209 (6.03)	-0.261 (2.96)	-0.167 (2.55)	-0.271 (6.85)	-0.241 (4.90)	-0.154 (4.40)	-0.310 (6.30)
´A´ Level of Responsibility	0.299 (28.47)	0.274 (10.38)	0.426 (27.94)	0.374 (28.82)	0.279 (20.75)	0.302 (21.61)	0.429 (25.45)
´B´ Level of Responsibility	0.118 (14.84)	0.153 (8.36)	0.168 (15.47)	0.172 (15.87)	0.121 (12.01)	0.123 (12.30)	0.219 (16.26)
Accountant	0.153 (20.62)	0.142 (8.20)	0.184 (15.71)	0.128 (12.96)	0.104 (10.14)	0.092 (8.08)	0.488 (35.92)
Payroll Specialist	0.236 (16.67)	0.102 (4.36)	0.216 (13.80)	0.226 (18.63)	0.262 (16.53)	0.081 (6.17)	0.122 (5.99)
Buyer	0.150 (16.10)	0.134 (4.93)	0.235 (16.16)	0.153 (14.27)	0.125 (9.32)	0.139 (12.44)	0.220 (15.27)
Log of no. of employees	0.028 (9.09)	0.048 (7.56)	0.014 (3.75)	0.036 (12.50)	-0.005 (1.17)	0.002 (0.48)	0.036 (8.58)
Year 1994	0.012 (1.27)	-0.009 (0.49)	-0.016 (1.13)	-0.012 (1.04)	-0.001 (0.09)	0.030 (1.95)	-0.005 (0.31)
Year 1995	0.006 (0.65)	0.016 (0.74)	-0.056 (4.34)	-0.009 (0.81)	0.000 (0.03)	-0.006 (0.48)	-0.042 (2.73)
Year 1996	-0.013 (1.37)	0.038 (1.73)	-0.062 (4.45)	0.050 (4.13)	0.004 (0.29)	0.052 (3.73)	-0.027 (1.71)
No. Of observations	2,695	415	1,843	2,434	1,710	1,082	1,733
Test for heteroskedasticity χ^2, (p-value)	318.25 (0.000)	204.65 (0.000)	245.74 (0.000)	282.32 (0.000)	310.68 (0.000)	203.32 (0.023)	286.54 (0.000)
R^2 (adj.)	0.609	0.493	0.537	0.571	0.516	0.521	0.661

Notes: The reference for the position dummies is Accounting Clerk. See also notes to Table 6.a.

Table 7.
Standardized wage premia for graduate vs. non-graduate positions, by country, 1993-96. Percent.

a. Engineers.

Period	Belgium	Denmark	France	Germany	Italy	Sweden	UK
1993	38.7	29.7	30.8	38.7	40.7	43.5	41.7
1994	34.8	24.3	33.7	30.8	33.4	38.6	36.1
1995	36.2	32.6	28.5	35.7	36.9	28.8	31.0
1996	38.1	10.6	32.0	41.2	41.9	30.4	33.9
1993-96	37.0	24.0	31.0	36.4	38.1	35.1	35.8

Notes:The calculations are based on the estimates in Tables 6.a and 6.b. See text for further details.

b. Business administrators.

Period	Belgium	Denmark	France	Germany	Italy	Sweden	UK
1993	57.6	37.5	75.6	73.2	71.3	61.8	89.3
1994	57.4	46.9	82.9	65.7	63.6	65.7	89.8
1995	57.2	39.3	83.7	63.0	57.4	67.1	87.2
1996	58.0	40.1	82.2	58.4	55.1	62.3	93.1
1993-96	57.5	41.0	81.1	64.7	61.1	64.5	89.7

Notes: The calculations are based on the estimates in Tables 6.c and 6.d. See text for further details.

Table 8.Standardized wage premia for graduate vs. non-graduate positions, by country, 1993-96, based on regressions with two-year overlapping panels of firms. Percent.

a. Engineers.

Period	Belgium	Denmark	France	Germany	Italy	Sweden	UK
1993	36.9	23.2	31.2	35.1	43.5	29.9	33.1
1994:I	35.2	21.6	30.9	36.1	34.9	42.2	39.4
1994:II	32.8	12.6	30.0	35.3	35.3	44.3	35.2
1995:I	35.8	13.7	25.8	36.3	39.3	43.6	35.5
1995:II	39.7	-	30.9	37.3	39.1	45.2	40.4
1996	36.9	-	28.9	40.2	41.6	48.7	40.5
1993-96	36.4	-	29.7	37.0	39.9	41.6	37.2

b. Business administrators.

Period	Belgium	Denmark	France	Germany	Italy	Sweden	UK
1993	57.4	49.7	76.8	70.1	73.6	56.8	92.2
1994:I	56.4	48.8	74.3	67.3	73.2	62.0	91.5
1994:II	57.2	40.8	79.7	62.0	64.1	59.1	90.9
1995:I	58.1	42.8	76.9	62.2	56.9	60.2	95.7
1995:II	58.2	39.6	84.7	66.0	56.8	60.6	85.2
1996	55.7	36.2	84.9	60.8	52.8	58.3	82.1
1993-96	57.0	43.0	79.9	64.9	63.0	59.0	89.0

Notes: The calculations are based on unreported estimates. Wage premia could not be computed for Danish engineers 1995:II and 1996, due to too few degrees of freedom. See text for further details.