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217

TOO MUCH, TOO SOON? POLYTECHNIC GRADUATE PLACEMENT IN FINNISH MANUFACTURING*

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ABSTRACT

This paper investigates polytechnic graduate placement in Finnish manufacturing. The paper uses a register-based data source covering white-collar manufacturing workers over the period 1995-2004. The results reveal that graduates from polytechnics have placed quite well in terms of salaries and job quality in comparision with workers with corresponding vocational degrees after the relevant covariates have been taken into account. Despite this, almost 20% of graduates from polytechnics have been forced to take a position in manufacturing in which they can be considered to be 'overeducated'. Interestingly, not all degrees from polytechnics are equal. Bachelors of Business Administration are not as well placed as Bachelors of Engineering in terms of job quality in manufacturing.

JEL Codes: A23, I21

TIIVISTELMÄ

Tutkimuksessa tarkastellaan ammattikorkeakouluista valmistuneiden sijoittumista teollisuudessa. Tutkimuksessa käytetään EK:n palkka-aineistoa, joka kattaa kuukausipalkkaiset toimihenkilöt vuosilta 1995-2004. Tulosten mukaan ammattikorkeakouluista valmistuneet ovat sijoittuneet varsin hyvin palkka- ja tehtävävaativuusluokissa verrattaessa heitä vastaavan opistotasoisen tutkinnon suorittaneisiin henkilöihin vakioitaessa samalla muita vaikuttavia tekijöitä. Tästä huolimatta lähes 20 prosenttia ammattikorkeakoulututkinnon suorittaneista on tehtävässä, jossa heidän voidaan katsoa olevan 'ylikoulutettuja'. AMK-tutkintojen suorittaneiden välillä on eroja sijoittumisessa. Tulosten valossa tradenomit ovat amk-insinöörejä huomattavasti huonommin sijoittuneita teollisuuden tehtävävaativuusluokissa.

Introduction

Changes in education systems provide valuable information about the way in which labour markets are able to cope with a large influx of entrants with new qualifications. Major reforms in education systems are not very common, because they require a lot of resources. This paper looks at the polytechnic education reform that took place in Finland in the early 1990s. It was a reform of great importance that involved the transformation of the whole secondary education system. Hence, it was the largest single education reform in Finland since the reform of the comprehensive school system in the early 1970s.

The very first students from the newly established polytechnics (*ammattikorkeakoulut,* in Finnish) graduated in 1994. Despite the apparent importance of the reform, there have been no empirical evaluations that look at the placement of these new entrants in the labour market by using register-based data sources. This paper aims to fill a part of that gap by focusing on the situation in the Finnish manufacturing sector, which is an important employer sector for students that have graduated from polytechnics.

The Finnish case is interesting for several reasons. First, the general education level of Finns has improved rapidly. This means that the gap in the education level between the youngest and oldest generations in Finland is nowadays among the highest within the OECD countries (e.g. OECD, 2004a). Graduates from polytechnics have contributed to this dramatic change in the labour market. Thus, a problem of overeducation may emerge or more highly educated young people may simply crowd out less educated aged workers and push them into unemployment in large numbers. In this case, increasing the educational level of employees by introducing polytechnic education would not have been a sensible policy change. In particular, it is a possible scenario that a substantial number of employees that have graduated from polytechnics end up in jobs where the tasks do not require their level of skills. This issue has recently been a subject of public debate in Finland. For these reasons, it is interesting to look at the level of salaries and the level of job quality in positions in which polytechnic graduates end up compared with employees that have traditionally been in such jobs in the manufacturing sector. Second, there has been high unemployment in Finland since the great depression of the early 1990s. This may have seriously hampered the placement of graduates from polytechnics, because the number of available vacancies has been limited in the labour market. These are important policy questions that are able to reveal something about the success of this major reform. In addition, the placement of graduates from polytechnics is interesting, because there are some early indications that the employment situation of graduates from polytechnics is

worsening despite the relatively robust macroeconomic growth.[1] This may suggest that the placement of employed persons that have graduated from polytechnics has worsened, too.

The paper is organised as follows. Section 2 provides a brief description of the Finnish polytechnic education reform. Section 3 introduces the data set that is used to address the issues at hand. Section 4 reports the results on the placement of graduates from polytechnics in terms of salaries and job quality in manufacturing. The last section concludes.

Polytechnic education reform

The education system in Finland consists of pre-school education, comprehensive school, post-comprehensive general and vocational education, higher education and adult education (OECD, 2003). As a result of the polytechnic education reform, the higher education system comprises two parallel sectors, which are traditional universities and polytechnics.[2] Thus, as an outcome of the reform, a completely new network of schools was established. The aim of polytechnic reform was to raise the general educational standard of Finns, to diversify higher education and to respond to new demands of vocational skills that were seen to arise in the labour market.[3]

The reform process started in 1991 with 22 temporary polytechnics introduced in order to gain experience about the system. The first permanent polytechnics went into operation in August 1996. Since August 2000 all polytechnics have been permanent.

The total number of polytechnics is currently 31. Most of them are multidisciplinary and the network of polytechnics covers the whole country. Polytechnic degrees are Bachelor-level higher education degrees with a professional emphasis.[4] These degrees take around 3.5 to 4 years to complete.[5] There were around 33 000 new study places in polytechnics in 2004, for which around 110 000 young people applied.

[1] All individuals in the data that we are using in this paper are employed in manufacturing. Therefore, it is not possible to investigate unemployment among graduates from polytechnics.

[2] Polytechnic schools are not engaged in academic research like traditional universities. Interestingly, OECD (2004b) recommends that there should be more research at polytechnics.

[3] The Ministry of Education (1990), among others, has stated these objectives. An additional reason for the introduction of polytechnic education was the large number of undergraduates who did not have a student place in higher education (Lampinen, 2000). This was caused by the rapid increase of graduates from upper secondary schools.

[4] These degrees are equivalent to the Bachelor of Arts (Hon) or Bachelor of Science (Hon) Degrees in the UK, the French Licence, the German Diplom Fachhochschule and the Dutch HBO Diploma.

Graduates from polytechnics have increased their number rapidly. Cumulatively, around 120 000 degrees were taken at the polytechnics by the end of the year 2004. The composition of graduates from polytechnics is shown in Fig. 1. The study fields of technology and transport, and business and administration cover a major part of all degrees.[6]

Fig. 1 around here

An important feature of the reform from the point of view of this paper is that new polytechnic degrees partly replaced some of the older vocational degrees, because they were designed to meet the increasing demand for more highly skilled workers in the same segments of the labour market. These corresponding vocational degrees take about two or three years to complete.

Therefore, it is interesting to measure the inherent "value-added" that graduates from polytechnics may obtain from their degrees in comparison with workers with corresponding vocational degrees. For the manufacturing sector, these corresponding vocational education degrees are Diplomas in business and administration (vocational college) (*merkonomit,* in Finnish) and Engineer's qualifications from a vocational college (*opistoinsinöörit,* in Finnish). It is reasonable to expect that graduates from polytechnics are able to obtain some amount of positive "value-added" from their degrees, because these degrees take more time to complete than the corresponding vocational degrees. This comparison can be made in terms of salaries and job quality in manufacturing.[7]

Surprisingly, there have not been that many evaluations of polytechnic graduate placement beyond the ones summarized by OECD (2003). Importantly, those studies do not contain an analysis of the placement of graduates from polytechnics based on register-based data sources. In contrast, the studies summarized and discussed by OECD (2003) are almost exclusively based on various surveys conducted among graduates from polytechnics that reflect the graduates' own subjective views about the content of their jobs and overall placement in the labour market.[8]

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[5] The average actual complementation time was 3.9 years in 2004. The figures reported in this section of the paper on polytechnics are based on the so-called AMKOTA database maintained by the Ministry of Education to document the performance of polytechnic schools.

[6] Most of the 'other degrees' in Fig. 1 are in the study fields of health and social services, but those degrees are not relevant for the manufacturing sector. This is shown later.

[7] Card (1999) provides a survey of the economic literature on the return on education.

[8] Stenström, Laine and Valkonen (2005) provide a recent study based on a postal survey on the issue along these lines. The study covers the study fields of administration and business, technology and transport, and health and social services. The postal survey was conducted among those graduates that had left their polytechnics about three years earlier, in 2000. In addition, there have been some studies

Thus, it is important to complement these subjective measures with objective measures that are based on register-based data sources. In particular, the empirical studies that use subjective measures do not typically include salary, which is an important attribute of the employment contract. In addition, it is quite possible that polytechnic graduate placement has improved somewhat over time, because employers were not familiar with these new degrees at the start of the influx of graduates from polytechnics. Therefore, it is interesting to look at the possible changes in the placement of graduates from polytechnics by using a comprehensive register-based data source.

The data

The data for this paper comes from the wage survey of the Finnish employers' association. The survey is from TT (*Teollisuus ja työnantajat,* in Finnish) covering non-manual workers in the manufacturing sector.[9] There are separate wage surveys for manual (hourly paid) workers and non-manual (salaried) workers by TT. This paper uses the data for non-manual workers, because it is the sector that hires students from polytechnics. The wage information in this survey originates directly from the payroll records of companies, so it can be characterized as administrative or register-based data. Therefore, the data is usually considered to be very accurate by its nature, and the sources of measurement error in surveys of individual workers are not expected to be a great problem.

The data is not identical to the whole of manufacturing. It covers the members of TT, but the coverage of TT members in manufacturing is high, because manufacturing firms are large and well-organised. It is compulsory for the member firms of TT to provide information on the salaries and the characteristics of workers employed for collective bargaining purposes. The number of salaried workers in the data is around 190 000 for the year 2004.[10]

The data provides information about salaries and working time, and some information about employees' individual characteristics (such as age and gender) that are relevant covariates for

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that look at the placement of graduates from certain polytechnic schools, but those studies do not provide an overall picture of the placement of graduates from polytechnics in the Finnish labour market.

[9] TT (the central organization for the manufacturing sector employers) and PT (the central organization for the service sector employers) merged in spring 2004. The new employers' association is called the Confederation of Finnish Industries (*Elinkeinoelämän keskusliitto,* in Finnish). However, these wage surveys are still conducted separately for each sector. Unfortunately, the wage survey by PT does not include an education code that would be detailed enough to identify graduates from polytechnics. For this reason, it is not possible to study the placement of graduates from polytechnics in the service sector. In addition, the service sector data does not contain information about job quality categories that is unique for manufacturing.

[10] This is around 9% of all salaried workers in the Finnish labour market.

our purposes. Importantly, the data includes an education code by using classification by Statistics Finland. This enables us to identify employees that have a polytechnic degree or a corresponding vocational degree.[11] The data covers one month of each year for non-manual (salaried) manufacturing workers (September before 1993 and December in and after 1993). This paper uses the data for the years 1995-2004.

The wage measure that is used in this paper is the monthly rate (salary) for non-manual workers. The monthly rate for non-manual workers in manufacturing is defined as 'the fixed basic monthly salary paid for regular working time'. This fixed salary is based on the 'demands' of jobs or tasks performed that are stipulated by employers and employees by means of collective bargaining and the contract-based wages determined for these 'demand classes' of jobs, and on a person-specific component which is based on personal competence.[12]

Placement of graduates from polytechnics

Basic facts

The first non-manual manufacturing workers that have graduated from polytechnic schools appeared in the data for 1997. Thus, it took only three years for manufacturing firms to start hiring graduates from polytechnics. Surpassing other degrees by a wide margin, the two most important degrees from polytechnics that appear in the data are Bachelors of Business Administration (*tradenomit*, in Finnish) and Bachelors of Engineering (*AMK-insinöörit,* in Finnish).[13] These two degrees cover around 90% of all degrees from polytechnics that appear in the data. This ratio has been almost constant over time.

Therefore the role of other degrees is minor. For this reason, it is convenient and relatively straightforward to compare graduates from polytechnic schools with workers with corresponding vocational degrees. As noted earlier, these corresponding vocational degrees are

[11] However, the education code in the data is not detailed enough to identify the individual polytechnic schools from which the workers with polytechnic degrees have graduated. Graduation dates are not fully recorded. For instance, in the data for the year 2004, information on graduation dates is missing for around 20% of all non-manual workers in the data. In addition, the data contains information only on most recent degree taken.

[12] One of the fundamental features of the Finnish wage formation is that the collective labour contracts contain a set of minimum wages for different job-complexity levels. Thus, there is no general minimum wage in the country. It is important to note that the collective labour contracts put only an effective floor to wage levels in particular occupations (or jobs). This means that there are no upper limits for wages as such. Pekkarinen and Vartiainen (2005) provide a description of the system.

[13] OECD (2004b) notes that the introduction of polytechnic education has led to a higher share of graduates in engineering-related fields in Finland compared with the other OECD countries.

Diplomas in business and administration (vocational college) and Engineer's qualifications from a vocational college.

The total number of employees with Bachelor of Business Administration and Bachelor of Engineering degrees is around 15 000 in the data in 2004. This figure represents about 25% of all graduates from polytechnics with these particular degrees over the period 1994-2004.[14] This confirms that manufacturing has been an important employer sector for graduates from polytechnics.[15]

The proportion of workers with polytechnic education of the total salaried non-manual workforce in the sector shows a rapid increase over the period (Fig. 2). The share of graduates from polytechnics was almost 8% in 2004. At the same time, the share of employees with corresponding vocational degrees that were partly replaced by polytechnic degrees shows a steady decline up to 2001. However, their share has been almost constant for the years 2001-2004. The share of the corresponding vocational degrees was 20% in 2004. Interestingly, it seems that there has been an almost one-to-one change in these shares.

Fig. 2 around here

The number of salaried workers with polytechnic education among new entrants to companies in manufacturing shows a similar increase (Fig. 3).[16] This share was almost 11% in 2004. The share of employees with vocational degrees that were partly replaced by the degrees from polytechnics shows a substantial decline at the same time. The share of employees with corresponding vocational degrees was around 13% in 2004. It is interesting to note that there has been an almost one-to-one change also in these shares.

Fig. 3 around here

Based on these figures, it seems that the demand for labour has shifted from employees with corresponding vocational degrees to employees that have graduated from polytechnic schools after the introduction of polytechnic education. This is in line with the thinking that employees with these degrees have been relatively close substitutes for each other for manufacturing

[14] The total number of degrees for the years 1994-2004 is obtained from the AMKOTA database.

[15] OECD (2003) reports that around 74% of employed polytechnics graduates had positions in the private sector.

[16] There is a measure of tenure in the data (i.e. time that employees have spent with their current employer). However, the fact that a person is classified as 'new recruit' by this criterion does not necessary mean that one is at his/her first job in manufacturing. This is a problem, because by focusing on new recruits, we want to study the placement in terms of starting salaries. Therefore, we define 'new recruits' in this paper as those employees that are in the data for their first year. The results that follow are qualitatively the same when 'new recruits' are defined based on a measure of tenure.

companies. In a sense, this pattern is what should be expected, taken that polytechnic degrees were introduced to meet the demand for more skilled workers in the same segments of the labour market that have traditionally been occupied by employees with corresponding vocational education.

Descriptive evidence

Table I documents the placement of graduates from polytechnics in terms of salaries in comparison with the placement of employees with corresponding vocational degrees for the year 2004. Graduates from polytechnics are not as well placed as employees with corresponding vocational degrees. In particular, it seems that graduates from polytechnics are overpresented in salary deciles 4-7 in the year 2004. Based on the data, around 25% of all workers in these particular salary categories in 1995, before the influx of graduates from polytechnics into manufacturing firms, were graduates from vocational schools with corresponding degrees.

Interestingly, there have been no major changes in the placement of graduates from polytechnics in the overall salary categories in the years 2000-2004 (Fig. 4). However, there is some evidence that the share of graduates from polytechnics has slightly increased in the two lowest categories and in the three highest categories.

Fig. 4 around here

Starting salaries are able to reveal information about how employers in the labour market appreciate various degrees. Table I suggests that graduates from polytechnics seem not to be particularly well-placed in terms of starting salaries in comparison with employees with corresponding vocational degrees. For instance, around 14% of graduates from polytechnics start from the lowest salary decile.

Table I around here

Firm-specific factors are of great importance for the level of salaries. This applies to the Finnish labour markets. For this reason, it is interesting to analyse the placement of graduates from polytechnics in salary deciles within firms, because in this way we are able to control for firm-specific factors by construction.[17] It turns out that employees with corresponding vocational degrees are better placed by this measure than graduates from polytechnics.

[17] We have dropped manufacturing firms that have fewer than 25 employees. The number of employees in these firms is 9348 over the period 1995-2004. The data that we are using is not a linked employer-employee data set in the sense that there is not much information about firm characteristics in the data.

An attractive feature of the data for the purposes of this paper is that the 'demands' of various jobs or tasks are classified and stipulated by means of collective bargaining in manufacturing. Thus, the classification of jobs and tasks is jointly agreed by the representatives of employees and employers. The same procedure is executed in all firms that are members of TT.

This classification is particularly useful for our purposes, because the classification is based on the real content of each job, not on occupation, job title nor the level of an employee's education in the particular position. Thus, an employee's high education does not necessary imply a high-level job in this classification. In other words, there are no *a priori* obstacles whatsoever, for instance, for a case in which a white-collar worker without any degrees could not be in the highest job quality category ('manager').

There is a five-category classification; 'managers' (meaning overall management of a firm or product line), 'specialist' (demanding development and planning tasks), 'experts' (application of procedures and more standard planning tasks), 'performers' (e.g. standard office work and customer service) and 'manual worker' (e.g. construction and repairing). Graduates from polytechnics are considered to be 'overeducated' in this paper when they are located as 'performers' or 'manual workers', because those particular tasks clearly do not require their education level.[18] The job quality classification is available in the data for white-collar manufacturing workers for the years 2002-2004.

These results are reported in Table II. It turns out that graduates from polytechnics are better placed overall than graduates from vocational schools with corresponding degrees even without taking into account the relevant covariates. Thus, the share of graduates from polytechnics that are located in 'performers' positions is 18%, but this same figure is 23% for employees with corresponding vocational degrees. The number of graduates from polytechnics that are employed as 'manual workers' is almost zero. This suggests the fact that the wage survey for (hourly paid) manual manufacturing workers by TT is largely not relevant in the investigation of the placement of graduates from polytechnics.[19] Most of them are positioned as 'experts'. The placement, however, is not perfect, because there is quite a large share (almost 20%) of

[18] A comprehensive report by the Ministry of Education (1990) for the Finnish parliament on the reform of education system clearly states (p. 93) that the aim of polytechnic schools will be to educate 'experts' for the needs of business. We follow this practical definition of overeducation that originates directly from the policy goals set for the introduction of polytechnic education. McGuinness (2004) provides a survey of different ways to define and measure overeducation in the literature.

[19] We have looked at this data source. The number of graduates from polytechnics is 1325 in the wage survey for manual (hourly paid) manufacturing workers for the year 2004. This figure is less than 0.5% of the total manual manufacturing workforce. Around 70% of graduates from polytechnics that appear in the data are Bachelors of Business Administration or Bachelors of Engineering.

graduates from polytechnics that are in tasks and jobs that are classified as 'performer' tasks and jobs.[20]

Table II around here

As expected, new recruits are worse placed. This applies to graduates from polytechnics and employees with corresponding vocational degrees. Accordingly, of new recruits to companies, the share of graduates from polytechnics that are in 'performer' jobs is nearly 30%. In this sense, there are some signs of the emergence of 'overeducation' in the labour market for graduates from polytechnics in manufacturing. It is important to note that the low number of 'managers' is most likely due to the low average age of graduates from polytechnic schools.

Owing to the fact that this classification is available in the data for three years, we can say something about the changes in the placement of graduates from polytechnics. It turns out that there have been no overall changes in the placement of graduates from polytechnics in terms of job quality categories in 2002-2004 beyond the fact that there has been a very marginal decrease in the share of graduates from polytechnics in performer tasks. In addition to this, it is interesting to look at the transitions of individual graduates from polytechnics between these job quality classes. The amount of mobility is non-trivial. For instance, it turns out that around 60% of graduates from polytechnics who had in 'performer' tasks and jobs in 2002 were at this same level in 2003 and around 10% of them have moved up to 'experts'.[21] The downside is that these figures mean that a large proportion of the graduates from polytechnic schools are stuck in tasks and jobs that do not require their skill level.

Not all degrees from polytechnics are equal in terms of job quality. Interestingly, the results show that Bachelors of Business Administration are not as well placed as Bachelors of Engineering in terms of job quality in manufacturing (Table III). Thus, around 38% of Bachelors of Business Administration are located in 'performer' jobs. This same figure is merely around 8% for Bachelors of Engineering. Thus, the difference is substantial.

Table III around here

Non-parametric evaluation

Descriptive evidence that was discussed in the previous section does not take into account any relevant covariates that have a substantial influence on the placement of employees in terms of

[20] Stenström, Laine and Valkonen (2005) report that 22% of graduates from polytechnics have 'performer' tasks or jobs three years after graduation. This figure is based on the respondents' subjective valuation.

[21] These figures are almost similar for changes in the years 2003-2004.

salaries and job quality categories. An obvious covariate is the employee's age, owing to the fact that employees with corresponding vocational degrees are, on average, much older than employees that have graduated from polytechnic schools. This originates from the fact is that the first students graduated from polytechnics in 1994. Fig. 5 provides an illustration of the substantial age differences between graduates from polytechnics and employees with corresponding vocational degrees.[22] These age differences are important for the placement, because salaries rise very fast during the early years in the labour market. This applies to Finland.

Fig. 5 around here

Accordingly, it is possible to re-calculate the measures of the placement for employees with corresponding vocational degrees by using the number of employees with polytechnic education divided by the number of employees with corresponding vocational education at each age as weights. By this method, it is possible to take into account the large prevailing age differences between these groups of the labour force. The advantage of this method over regression-based approaches is that it does not impose parametric restrictions on the data nor specific linear assumptions about the effects.

The results based on this procedure are reported in Tables I-III labelled as 'corrected'. The correction for age differences surely goes in the right direction in the sense that the placement of employees with corresponding vocational degrees is not as good as that without correction for the prevailing age differencies. This applies to results for salaries and job quality categories as well. However, it is important to take into account all revelant covariates that have a potential impact on the placement of employees in terms of salaries and job quality categories. In this way, it is possible to compare 'likes with likes'.

Next we extend this non-parametric evaluation by taking into account all other relevant covariates beyond age. Importantly, we are able to take interaction effects between the key variables of interest into account. The relevant covariates that are available in the data are gender, age, hours of work (an indicator for those that work less than 35 hours weekly to capture part-time workers), size of firm (five categories), province of residence (seven categories) and an indicator for urban areas.[23] These factors that are included are the 'usual suspects' from the literature that should matter for the placement of employees in terms of salaries and job quality categories.

[22] Fig. 4 is based on the Kernel density estimate that is a non-parametric histogram presentation of the distribution.

We restrict the analysis to those new recruits to manufacturing companies that are aged 20-30, in order to facilitate a better comparability of workers with different degrees. In addition, the salary distributions are computed for the year 2000 in order to ensure that there are enough new graduates with Engineer's qualifications from a vocational college. The procedure is conducted as follows. First, we group the data by using the revelant covariates that were listed earlier. This produces 2800 cells for the data. Second, we calculate the share of graduates from polytechnics in each cell of the data. Third, we calculate the corrected distribution for employees with corresponding vocational degrees in salary and job quality categories by using the shares of graduates from polytechnics in each cell of the data as weights. This gives us the corrected distributions for employees with corresponding vocational degrees in which the prevailing differencies in the relevant covariates between these groups of the labour force have been taken into account as fully as is possible by using the data at hand.

The results are depicted in Figs. 6-8.[24] Graduates from polytechnics that are new recruits in manufacturing companies are well placed in terms of starting salaries in comparison with employees with corresponding vocational degrees after taking into account the relevant covariates (Fig. 6). For instance, the share of employees with corresponding vocational degrees in the lowest salary decile is around 20%, but the corresponding figure for employees with polytechnic degrees is around 9%. Interestingly, this same pattern applies to salary categories within firms (Fig. 7). Thus, graduates from polytechnics are better placed by using both of these salary criteria.

Figs. 6-7 around here

Importantly, we can calculate the average treatment effect of having a polytechnic education, because our measure for the wage rate is a continuous variable.[25] This treatment effect (on the treated) appears to be around 70 euros (for the monthly salary) for the year 2000. The average treatment effect is calculated by computing the average salary difference for employees with polytechnic education and those with corresponding vocational education in each cell of the data. Then we have used the shares of employees with polytechnic education in each cell of the

[23] We include an indicator for urban areas, because the collective agreements typically stipulate slightly higher pay in the urban areas where the costs of living (such as housing) are presumably higher.

[24] We have estimated ordered Probit models for salary categories and job quality categories in which we are able to control for the same relevant covariates that have an impact on the placement of employees in terms of salaries and job quality categories as in the non-parametric evaluation. These models convey the same overall picture about the placement of graduates from polytechnics. The disadvantage of ordered Probit models compared with non-parametric evaluation is that it is difficult to interpret the coefficients that are obtained from ordered Probit models.

[25] Thus, "having a polytechnic education" is considered to be the treatment.

data as weights. This is the same figure that could be recovered by using the so-called exact matching procedure.

Finally, in terms of job quality categories recorded for the manufacturing sector, it turns out that employees with corresponding vocational degrees are worse placed than graduates from polytechnics (Fig. 8). In particular, the share of new recruits with polytechnic degrees in 'performer' jobs is 33%. This same figure for employees with corresponding vocational degrees is 48%. The share of manual workers is almost zero for both of these groups. These facts confirm our earlier findings about the superiority of polytechnic degrees.

Fig. 8 around here

Conclusions

This paper investigated polytechnic graduate placement in Finnish manufacturing by using a register-based data source. The results reveal that graduates from polytechnics have placed quite well in terms of salaries and job quality in comparison with employees with corresponding vocational degrees after taking into account the relevant covariates. In this sense, the polytechnic education reform has been a success.

Despite this, almost 20% of polytechnic graduates have been forced to take a position in which they can be considered to be 'overeducated'. The most likely reason for this is the high unemployment that has persisted since the great depression of the early 1990s, which has limited the number of available vacancies for recently graduated students. Interestingly, not all degrees that originate from polytechnics are equal. By a wide margin, Bachelors of Business Administration are not as well placed as Bachelors of Engineering in terms of job quality in manufacturing. This calls for changes in education policy.

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Fig. 1. The total number and the composition of degrees taken from polytechnics (Source: the AMKOTA database by the Ministry of Education).

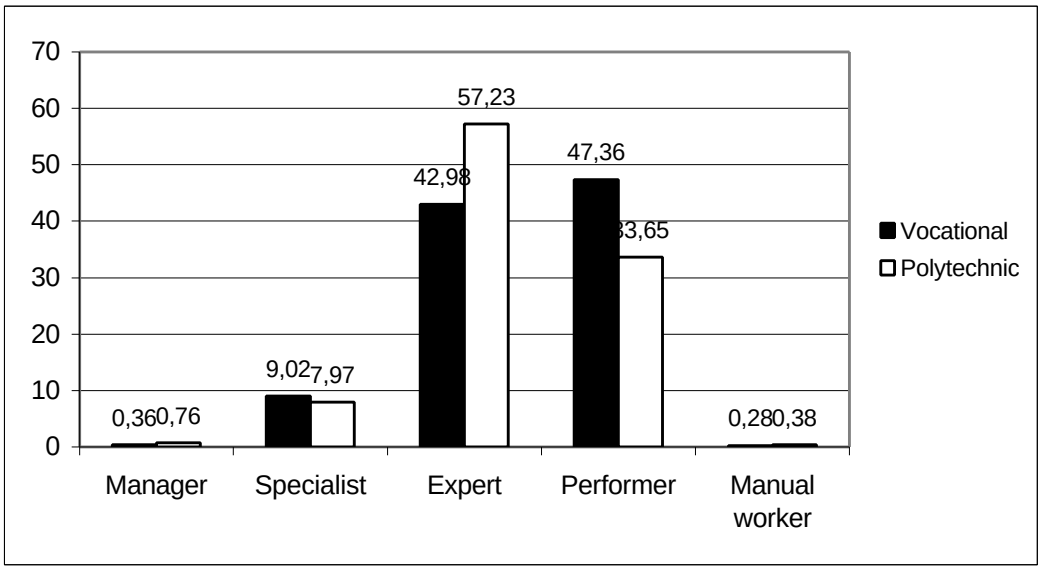

Fig. 2. The share of employees with polytechnic education and the share of employees that have corresponding vocational education of the total non-manual workforce in manufacturing (Source: Author's calculations from the TT microdata).

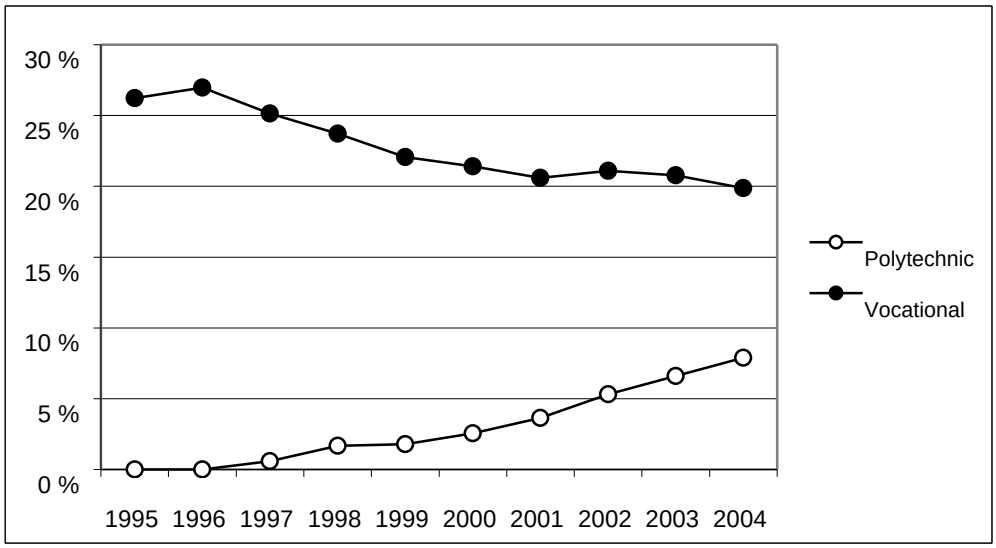

Fig. 3. The share of employees with polytechnic education and the share of employees that have corresponding vocational education of the new non-manual recruits in manufacturing (Source: Author's calculations from the TT microdata).

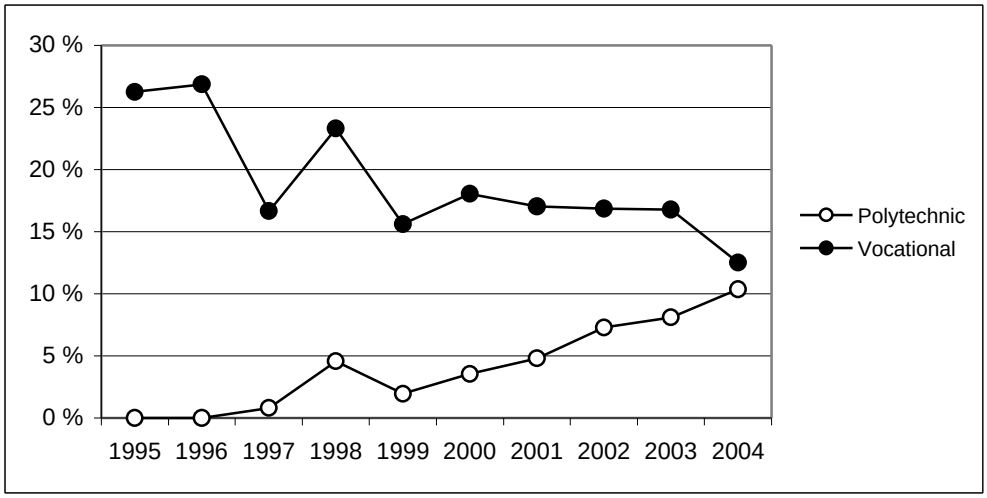

Fig. 4. The placement of graduates from polytechnics in overall salary deciles in the years 2000-2004 (Source: Author's calculations from the TT microdata).

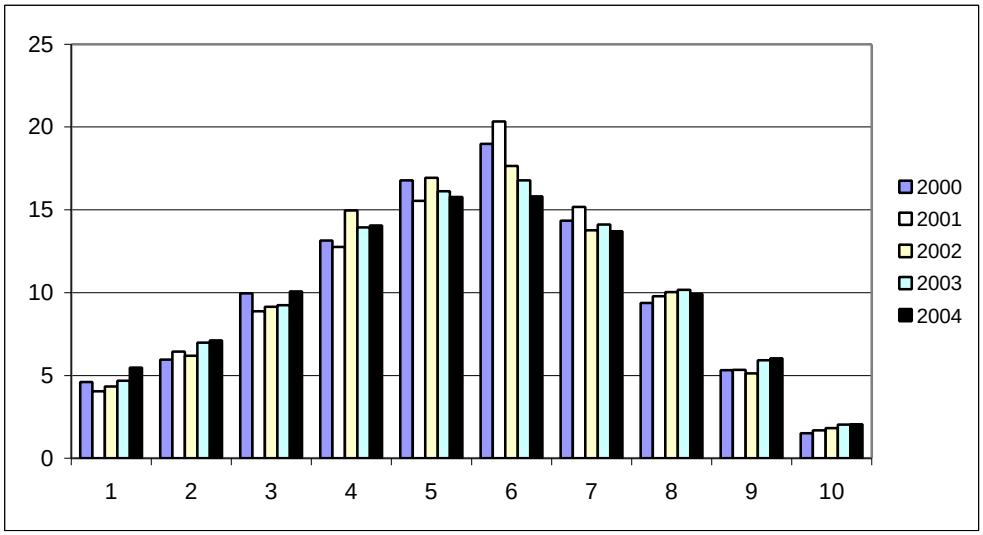

Fig. 5. The age distribution of employees with polytechnic degrees and corresponding vocational degrees. The figure is drawn for those aged 20-65 covering the years 1995-2004 (Source: Author's calculations from the TT microdata).

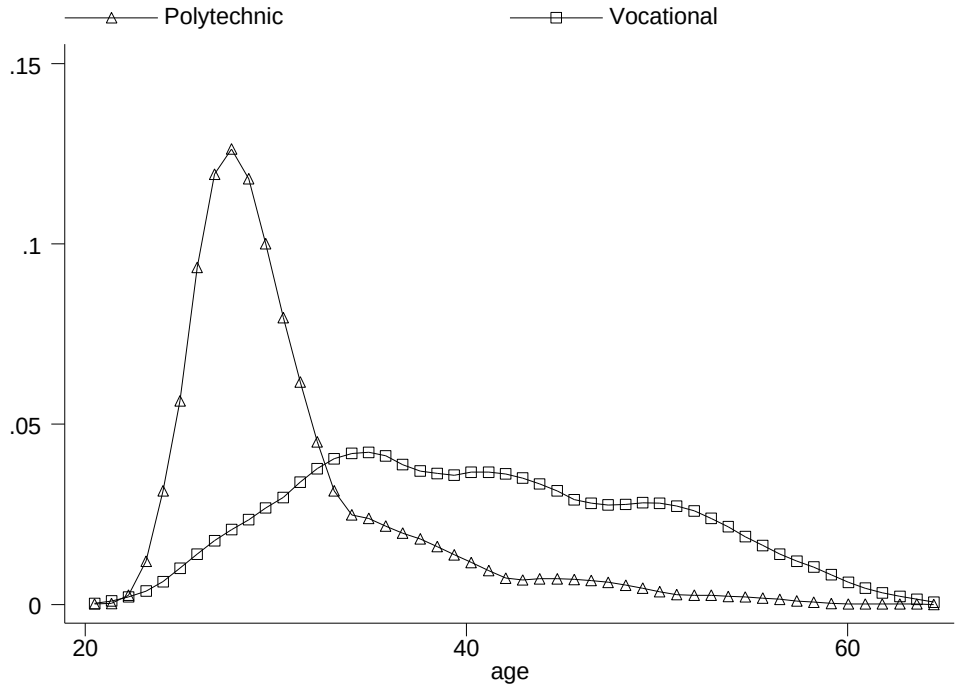

Fig. 6. The placement of new recruits with corresponding vocational degrees in salary deciles in comparison with the placement of graduates from polytechnics in 2000. The revelant covariates have been taken into account by using the non-parametric correction as explained in the text. The distribution is for those aged 20-30 (Source: Author's calculations from the TT microdata).

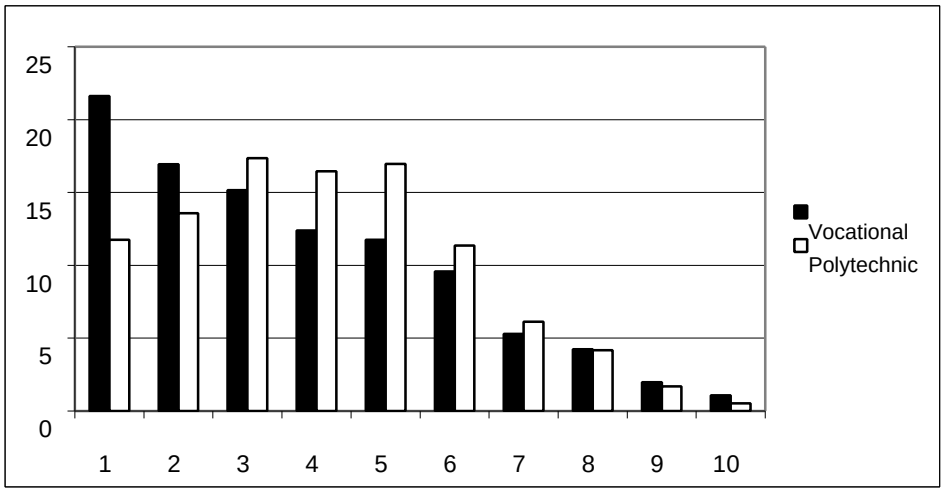

Fig. 7. The placement of new recruits with corresponding vocational degrees in salary deciles within firms in comparison with the placement of graduates from polytechnics in 2000. The revelant covariates have been taken into account by using the non-parametric correction as explained in the text. The distribution is for those aged 20-30 (Source: Author's calculations from the TT microdata).

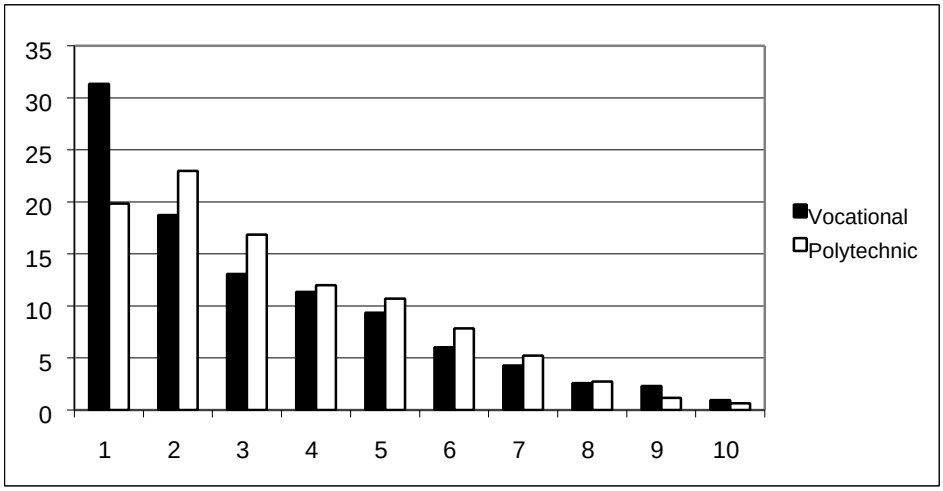

Fig. 8. The placement of new recruits with polytechnic degrees in comparison with new recruits with corresponding vocational degrees in various tasks and jobs in terms of job quality in manufacturing in 2004. The revelant covariates have been taken into account by using the non-parametric correction as explained in the text. The distribution is for those aged 20-30 (Source: Author's calculations from the TT microdata).

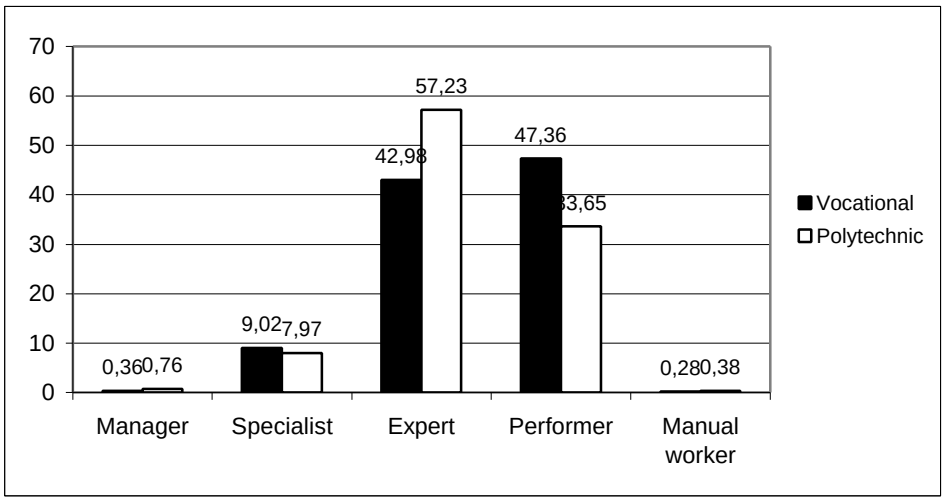

Table I. The placement of graduates from polytechnics and employees with corresponding vocational degrees in salary deciles in manufacturing in 2004. The 'corrected' figures for employees with corresponding vocational degrees are calculated by taking into account age differencies between groups. (Source: Author's calculations from the TT microdata).

	1	2	3	4	5	6	7	8	9	10
Overall salary deciles										
Polytechnic	5.41	6.98	10.03	14.1	15.81	15.96	13.8	9.93	5.97	2.02
Vocational	5.39	7.88	8.89	8.94	8.17	9.07	10.7	13.47	14.91	12.59
Vocational (corrected)	12.76	13.28	13.24	12.08	8.59	9.16	10.45	9.18	7.42	3.83
Salary deciles for new recruits										
Polytechnic	14.06	12.08	13.84	16.7	14.81	9.61	8.37	5.24	3.92	1.37
Vocational	12.25	9.65	8.46	9.26	8.65	6.47	8.65	10.03	13.71	12.86
Vocational (corrected)	23.84	16.52	12.44	10.39	8.25	8.04	6.45	4.5	5.45	4.12
Overall salary deciles within firms										
Polytechnic	10.3	15.69	15.73	14.34	11.42	10.28	8.33	6.63	4.74	2.54
Vocational	8.32	8.88	8.82	8.83	8.73	9.73	10.57	11.42	12.5	12.22
Vocational (corrected)	18.06	13.61	11.77	11.26	10.29	11.68	7.27	6.53	5.88	3.64
Salary deciles within firms for new recruits										
Polytechnic	22.57	21.2	13.35	13.09	8.33	7.23	5.46	3.75	3.35	1.67
Vocational	15.93	9.49	9.23	8	6.74	8.46	8.84	9.3	11.29	12.71
Vocational (corrected)	27.64	16.27	14.78	8.11	7.82	6.57	5.55	3.63	5.89	3.75

Table II. The placement of graduates from polytechnics and employees with corresponding vocational degrees in various tasks and jobs in terms of job quality in manufacturing in 2004. The 'corrected' figures for employees with corresponding vocational degrees are calculated by taking into account age differencies between groups. (Source: Author's calculations from the TT microdata).

	Manager ('johtaminen')	Specialist ('erityisasiantuntija')	Expert ('asiantuntija')	Performer ('asianhoitaja')	Manual worker ('työntekijä')
Overall					
Polytechnic	1.59	17.68	62.23	18.33	0.17
Vocational	6.13	30	40.43	23.02	0.43
Vocational (corrected)	2.16	17.11	43.71	36.76	0.26
New recruits					
Polytechnic	1.26	12.52	56.71	29.12	0.4
Vocational	6.95	25.92	40.18	26.79	0.16
Vocational (corrected)	1.34	12.81	39.76	45.98	0.12

Table III. The placement of graduates from polytechnics and employees with corresponding vocational degrees in various tasks and jobs in terms of job quality in manufacturing in 2004. The 'corrected' figures for employees with corresponding vocational degrees are calculated by taking into account age differencies between groups (Source: Author's calculations from the TT microdata).

	Manager ('johtaminen')	Specialist ('erityisasiantuntija')	Expert ('asiantuntija')	Performer ('asianhoitaja')	Manual worker ('työntekijä')
Business and administration					
Overall					
Polytechnic	0.91	12.72	48.19	38.17	0
Vocational	2.75	13.54	41.07	41.9	0.74
Vocational (corrected)	1.27	7.78	37.61	52.97	0.37
Engineering					
Overall					
Polytechnic	1.97	20.3	69.76	7.76	0.21
Vocational	9.8	47.92	39.72	2.47	0.08
Vocational (corrected)	3.95	35.96	56.06	4	0.03