SCHOOLING EFFECTS ON
SUBSEQUENT UNIVERSITY PERFORMANCE:
EVIDENCE FOR THE UK UNIVERSITY POPULATION

Robin Naylor
And
Jeremy Smith

No 657

WARWICK ECONOMIC RESEARCH PAPERS

DEPARTMENT OF ECONOMICS

THE UNIVERSITY OF
WARWICK

Schooling effects on subsequent university performance: evidence for the UK university population.

Robin Naylor and Jeremy Smith [*]

Department of Economics

University of Warwick

Coventry CV4 7AL, UK

November 11, 2002

Abstract

From a unique data-set identifying the school attended prior to university for a full cohort of UK university students, we examine the determinants of final degree classification. We exploit the detailed school-level information and focus on the influence of school characteristics, such as school type, on subsequent performance of students at university. We estimate that, on average, a male (female) graduate who attended an Independent school is 6.5 (5.4) percentage points less likely to obtain a 'good' degree than is a student who attended an LEA (that is, state-sector) school, *ceteris paribus*. We also find considerable variation around this average figure across different Independent schools. We find that, for males, the variation in the probability of attaining a 'good' degree across schools can largely be explained by the level of school fees.

Keywords: Independent schools, Degree Performance, School fees.

JEL Classification numbers: J4, I2

1 Introduction

The analysis of the academic performance of undergraduate university students has a long tradition in the UK. Historically, analysis has focused on the influence of factors such as age, gender and prior educational attainment of students on university degree performance.[1] One motivation for analysing student outcomes is to inform the development of higher educational practice, including the design of university admissions policies. One shortcoming of previous analysis, however, is that typically it has not controlled for a wide range of potentially confounding factors and, related to this, has been based either on aggregate data or on individual-level data covering relatively small samples of students. Recent exceptions to this are the studies of McNabb, Sarmistha and Sloane (1998) and Smith and Naylor (2001) which exploit recently available administrative data for full cohorts of UK university students leaving university on or prior to 1993.[2] These papers have established that the type of school attended prior to university has a significant effect on the student's level of performance at university.

In particular, McNabb *et al.* (1998) and Smith and Naylor (2001) both find that students who attended private fee-paying 'Independent' schools prior to university are significantly less likely to perform well at university than are students who had attended public (local education authority) schools. This evidence itself has been influential in the re-design of some universities' admissions policies: with a trend towards admissions criteria which require a higher level of achievement for those from private, rather than state, schools. Such positive discrimination represents a controversial policy and is under current threat of legal challenge. Part of our aim in the current paper is to explore the statistical basis for the policy in more detail.

The general aim of the current paper is to analyse the effects of prior schooling on the subsequent academic performance of undergraduate students in UK universities. The analysis is based on a unique data-set comprising the administrative records of the full cohort of students. The data identify the particular school attended by each student prior to university entrance and this has enabled us to match into the basic data-set school-specific information published by organisations, including the UK Government's education department (DfES), as well as by the schools themselves. The data also include other pre-university information such as the students' prior educational qualifications and their social class background.

The literature on schooling has found no overall consistent effects of school characteristics

---

[1]See, for example, Johnes and Taylor (1990), Hoskins, Newstead and Dennis (1997), Rudd (1984), Chapman (1996a), Chapman (1996b), Bee and Dolton (1985), Sear (1983), and Peers and Johnston (1994).

[2]Bratti (2002) used a subset of the dataset exploited in the current paper, analysing degree performance for life science students only.

on pupils' later achievements (see for example, Eide and Showalter (1998), Krueger (1999) and more recently Betts and Morell (1999) for the US and, for the UK, Dearden, Ferri and Meghir (1997)). In the light of this, the finding that previous school type has a significant effect on subsequent degree performance in the UK is a surprising one. And the effect is large: Smith and Naylor (2001) estimate that a UK university student who attended an Independent school is more than 5 percentage points less likely to obtain a 'good' degree compared to an otherwise observationally identical student who had attended an LEA school.[3] In the current paper, our major concern is to examine in detail this subsequent university degree 'performance gap' between former Independent and state-educated pupils. In particular, we examine the extent to which there is variation around the average gap reported in previous work and analyse school characteristics associated with any such variation, relating the evidence to hypotheses which are consistent with the existence of the estimated performance gap.

A further motivation for our analysis stems from the ongoing reforms in the UK to the traditional structure of secondary education qualifications: that is, the 'A level' public examination system. A levels are the final (nationally-assessed) school examinations taken prior to university entry. Recent reforms have required pupils to study a broader range of subjects in the first year of their two-year A level program. Additional reform to broaden this range further in the direction of the International Baccalaureate model are under discussion. Related to this, Dolton and Vignoles (1999) argue that there is a specific case for encouraging wider participation in mathematics courses in school. Behind much of the discussion lies the belief that A levels provide poor information about university student potential. Bekhradnia and Thompson (2002), however, report a very strong and significant relationship between A level performance and degree class outcomes. In this context, we also examine the association between prior qualifications and university student degree performance. We also supplement this by looking at the effect of the actual subject studied by the student.

The structure of the rest of this paper is as follows. Section 2 describes the data and the structure of our statistical analysis. Section 3 presents estimates from a degree performance equation and focusses on the difference in the probability of a 'good' degree according to the type of school attended prior to university. Section 4 then examines the extent of variation across Independent schools in the size of the Independent school effect in degree performance. In Section 5, we examine the extent to which the variation across schools in university students' degree performance can be explained by the characteristics of the previous school attended.

---

[3]A UK university undergraduate degree is classified into the following categories: . . . list A good degree is traditionally defined by the first two categories.

Section 6 closes the paper with conclusions and further remarks.

2 Data and Modelling

The data-set exploited in this paper is based on administrative records of all university students.[4] These data were held by the Universities Statistical Record (USR), which was replaced when the Higher Education Statistical Agency (HESA) was formed in 1994-95. In the current paper, we analyse the record for the cohort of undergraduates who left university in the academic year 1992/1993. This is the most recent cohort for which the USR information is available. HESA data of comparable quality for more recent cohorts are not yet available. University student record data are very rich in the quality of information they provide on the academic characteristics of individuals, their course and their institution of study. There are four categories of principal variables held in the USR undergraduate records. Personal Information includes date of birth, sex, marital status, county of prior residence, and occupation of parent or guardian. Academic History Information includes last full-time school attended, other education, GCE A-level record, and course for which admitted. Annual Information includes university, subject, type and duration of course, enrolment date, qualification aimed for and type of term-time accommodation. Finally, Leavers Information records qualification obtained and class of degree.

Summary statistics

Given our focus on the prior schooling of university students, we restrict our attention to non-overseas students who had attended school in England prior to university. The sample is restricted to students who attended an English school , because the match of school data from the DfES and the USR data are most complete for these students. The DfES schools data pertain to school characteristics in 1991-92: earlier data are not available. The majority of the 1993 university leavers had left school in 1990 and thus there is a small interval between the point at which the students had left school and our DfES-based observation of their characteristics. To reduce the potential for significant measurement error, we focus on students who left school not significantly prior to the point at which DfES school information is gathered. That is, we analyse only those full-time non-medical students aiming at an undergraduate degree who were aged 23 or less when they left university, giving a population sample of 48,281 students (21,477

---

[4]We consider only those universities which pre-dated the abolition of the binary divide between universities and polytechnics in 1992.

females and 26,804 males).[5]

Table 1 contains summary statistics on the key variables of interest. Table 1a shows that, on average, university students who had attended Independent schools have better A-level performance in their best 3 A-levels, which are scored out of 30 points.[6] Looking at the proportion of students in various A-level points categories, we note that 16.6% of all students who attended Independent schools achieved the maximum 30 points in their best 3 A-levels, compared with only 13.2% of all students. Similarly 41.6% of students who attended Independent schools achieved a score in excess of 26 points (ABB or AAC), compared with 35.9% of all students. Additionally, students from the Independent school sector are less likely to have studied science A-levels. Overall, 33% of students attended an LEA school prior to university and 31% an Independent school.

Table 1b reports the proportion of students obtaining a 'good' degree by various key characteristics. We see that the proportion of students obtaining a 'good' degree from the Independent sector is about 2.5% (2.0%) lower (higher) than that for students from an LEA school, for men (women). Given the superior A level performance of students from the Independent school sector, the relatively low proportion of these students obtaining a 'good' degree is a little surprising: especially in view of the steepness of the gradient of degree performance by A level score. The proportion of students obtaining a good degree increases markedly with A-level points. We find that 82.9% (85.7%) of male (female) students with 30 A-level points obtain a 'good' degree, compared with only 54.4% (66.4%) of students with between 22 and 25 A-level points. That is, an average male (female) student with 30 points is approximately 50% (30%) more likely to get a 'good' degree than an average student with between 22 and 25 A-level points. Degree performance varies with social class background and is highest for students from Social Class I (SCI). On average, male students are some 8.5% less likely to get a 'good' degree than female students.

3 Determinants of degree performance

In this section we present the results of an ordered probit regression of the individual's degree class. The dependent variable is the individual student's degree classification, which is a discrete ordered dependent variable categorised into one of six response codes: first class honours degree,

---

[5]Medical students are excluded from the analysis as the over-whelming majority of these students do not obtain a classified degree.

[6]A-levels are graded as A through to E, with A being the top grade worth 10 points, B=8 points, C=6 points, D=4 points, and E=2 points.

upper second class honours degree, lower second class honours degree, third class honours degree, other qualification,[7] failure to obtain a degree level qualification. Table 2 reports the main results separately for male and female students. The table shows the estimated coefficients on the key variables of interest. It also shows for each variable the marginal effect on the predicted probabilities of (a) obtaining a 'good' degree (i.e., at least an upper second class honours degree) and (b) falling below the threshold for the award of an honours degree. The analysis includes a number of controls whose estimated effects are not reported in Table 2. These include variables controlling for the course of study, course characteristics, and university attended. In presenting the results, we group the explanatory variables into distinct categories and describe in turn their effects on degree performance.

Personal characteristics

Personal characteristics include age, marital status, and type of accommodation while at university. Table 2 shows that, for female students, degree performance increases with age, whereas for men degree performance seems to be unrelated to age. The table also shows that, for both men and women, married individuals do better than non-married students although these effects are not significant. Lastly, we note that in contrast to the result reported by Johnes and Taylor (1990), better performance for males is associated with living at home: i.e., at the parental address.

Table 2 also shows the estimated effects of parental occupation background on degree performance. For both men and women, there is a slight monotonic positive effect defined over Social Classes I to V. With students from lower social class background around 3-4 percentage points less likely to get a 'good' degree compared to a student from SC I for both males and females.

Academic background

Table 2 reports the effect of A level points on degree performance and shows that, for both women and men, an extra two points (i.e. one grade) raises the probability of a good degree by around 5 percentage points. The table also shows that this effect is not linear, in that a student increasing their A level score from 28 points to a maximum of 30 points increases the probability of a 'good' degree by 17.2 (11.5) percentage points for males (females). Taking additional A levels over and above the best 3 A levels actually lowers the probability of a good

---

[7]The other qualification consists of: unclassified honours degree, pass degree, aegrotat degree, and other degree level qualification. The results are robust to re-specifications of the dependent variable in which each of these categories is included separately or grouped differently.

degree by around 0.5 percentage points for every extra 2 points (1 grade) scored. There are also some notable effects on the subject of study. For women, there are significant and sizeable benefits associated with the prior study of Mathematics and Chemistry, whereas English confers no such benefit. For men, a significant advantage of having previously studied Mathematics is again evident, together with evidence of a positive effect of having studied English and Biology. The premium on Mathematics is consistent with findings reported by Dolton and Vignoles (1999). The estimated equations also included dummy variables for other types of pre-university qualifications studied.

Pre-university schooling

Table 2 shows the estimated coefficients on the dummy variables for the type of school attended prior to university entry. The default case is that of attending a state school: that is, a Local Education Authority (LEA) school. The most striking result is that, compared to the default case of a student having attended an LEA school, attendance at an Independent school is associated with a statistically significantly lower level of degree performance. This is shown in Table 2. The effects are similar for both female and male students. A male (female) student who previously attended an Independent school is about 6.5 (5.4) percentage points less likely to obtain a good degree than is an otherwise equivalent student who had attended an LEA school.

It is important to underline that the estimated effect of previous school type occurs even though the student's own prior academic performance is controlled for through the inclusion of degree class and A level results in the regression equation. Thus, the school effect is picking up some influence over and above that associated with the individual's own prior academic attainment. This point must be emphasised as the estimated Independent school effect is markedly more negative than that observed in the raw figures reported in Table 1b.

There are two leading hypotheses to explain the difference by school type in the subsequent degree performance of students. First, there is evidence that Independent schools have a positive effect on pupils' A-level scores, other things equal.[8] Thus, comparing two students with identical A-level scores and equivalent in all other observable characteristics but with different school backgrounds, on average the former LEA pupil is likely to be drawn from a higher point in the underlying ability distribution. To see this, assume that a pupil's A level outcome is a function of two inputs, ability and school characteristics and that Independent schools are better endowed with the latter. Then if we compare two pupils - one from each school type -

---

[8]See, for example, Blundell, Dearden, Goodman and Reed (1997).

with equal A level scores, we must infer that the pupil from the LEA school is of greater ability. Once at university the LEA-educated student is on average likely to perform better, *ceteris paribus*: unless it is the case that the school effects on A level scores fully live on and enhance subsequent degree performance.

A second hypothesis to explain the difference by school type in subsequent degree performance is that students' effort levels at university may differ by previous school background. In related work, we have examined the occupational earnings of university leavers and have found that earnings of graduates are higher if the previous school attended was an Independent school, *ceteris paribus*. Furthermore, we have shown that the occupational earnings differential increases the higher are the fees at the Independent school, see Naylor, Smith and McKnight (2002). This suggests that there may be a reduced incentive for Independent-educated students to work hard for a good degree: that is, having attended an expensive Independent school may confer sufficient post-university labour market advantages as to diminish the incentive to perform well at university. However, a better test of this effort-incentive argument would be to test whether the marginal earnings premium from a good degree were lower for a student who had previously attended an Independent school.

We have examined this by regressing graduates' occupational earnings against a standard set of control variables including degree performance, school type and also a multiplicative term for the interaction between degree performance and school type. The results show that the coefficient on the interaction term is insignificant. This suggests that the incentive to perform well at university, in terms of the effect of performance on the quality of the occupational outcome, does not differ on average according to previous school background. Thus, we do not find the evidence to be consistent with the second hypothesis that the degree performance gap by previous school type reflects differential effort resulting from differential incentives.

In order to gain further insights into the relationship between school type and subsequent educational performance, we exploit the richness of the data-set to explore any variation in the average performance gap between Independent schools and the LEA benchmark. Developing further the first hypothesis above, it is conceivable that the capacity of Independent schools to raise pupils' A level performance in part is driven by the fees that the school charges. Higher fees may enable schools to spend greater resources and thereby enhance the A level points score of their pupils. Alternatively, schools which - for whatever reason - are successful in augmenting their pupils' A level performance will, in a market equilibrium, be able to charge high fees. Under the first hypothesis above, then, we might expect it to be the case that students who had previously attended the more expensive Independent schools would perform

relatively poorly at university. Thus, the performance gap is likely to grow with the extent of Independent school fees.

Under the second hypothesis, students who had attended the more expensive Independent schools might be expected to have a lower effort level at university if it is the case that post-university labour market outcomes are better for students from such schools relative to others. There is strong evidence of this from the results reported in Naylor *et al.* (2002). However, as we argued above, the real test should be whether the premium to a good university degree performance is lower for students from more expensive Independent schools. We return to evidence on this in the next two sections of the paper, where we examine the nature of any variation in the degree performance premium.

4 Variation in the Independent school effect

In order to investigate the issue of the constancy across Independent schools in the average estimated Independent school effect on degree performance, we re-estimate the degree perform-ance equation replacing the single dummy variable for attendance at an Independent school with dummy variables for each of 113 individual Independent schools. These schools are se-lected on the criterion of having at least 10 students within the gender-specific samples of university students on whom the analysis is conducted. The tail of smaller schools not meeting this criterion are amalgamated and included in the regression equation as an extra dummy variable. The default case is attendance at an LEA school, as before. Thus, from the estimated coefficient on each individual Independent school dummy, we can derive the marginal effect on the probability of a 'good' degree associated with each school relative an otherwise identical graduate who had attended an LEA school. We can then investigate the distribution of the estimated school-specific degree performance marginal effects.

Figure 1 (2) plots the estimated marginal effect on the probability of a 'good' degree of male (female) students from each of the Independent schools relative to the probability for otherwise identical students from the LEA sector. It is immediately obvious from Figures 1 and 2 that there is substantial variation in the probability of a 'good' degree across the different Independent schools. The results are summarised in Table 3.

- In the case of 24 (30) Independent schools, there is a positive effect for male (female) students implying that, on average, these students who had previously attended these schools are more likely to get a 'good' degree than otherwise comparable students who had attended LEA schools. However, in only 3 (6) of these cases is the estimated effect

statistically significant at the 10% level.

- For a further 21 (26) of the Independent schools, there is a small reduction in the probability of a 'good' degree in the region of 0-5 percentage points. However, for none of these individual schools is the estimated effect statistically significant.

- There are 32 (26) Independent schools for which ex-pupils' probabilities of a 'good' degree are 5-10 percentage points lower than the probability of comparable ex-LEA educated university students: in only 10 (0) of these cases is the estimated coefficient significant at the 10% level.

- There are 22 (16) Independent schools for which the reduction in probability of a 'good' degree over the LEA sector of 10-15 percentage points, and a further 14 (15) with a reduction in probability of 15-20 percentage points. These estimated effect are significant in 20 (7) and 14 (15) of these schools.

- On the whole, the distribution of Independent schools across these bands are quite similar for male and female students. The incidence of schools with statistically significant effects, however, is much higher in the case of males.

We conclude that for 66 (85) of the 113 individual Independent schools examined for male (female) students, degree performance is not statistically different from that associated with attendance at an LEA school. In the cases in which there are significant effects associated with attendance at an Independent school, the estimated effect tends to be large and negative: where negative, the effects show a reduction in the probability of a good degree of more than ten percentage points in all but ten of the cases. For males, these schools with large negative effects account for around 43% of the students in our sample educated at one of the 113 Independent schools.

As an alternative way of summarising the results of our analysis of variation in the estimated Independent school effects on the probability of a 'good' degree, we have identified four distinct groups of Independent schools.[9] We have then re-run the degree performance regressions, replacing the individual school dummies with dummy variables for the grouped schools. Table 4 presents the results, showing the implied performance gaps by Independent school groups relative to attendance at an LEA school. The results indicate that the groups can be defined as follows:

Group 1: Graduates who attended these schools prior to university are estimated to be more likely to obtain a 'good' degree than equivalent students from the LEA sector, with an effect

---

[9]A test for this level of aggregation by an chi-squared test is accepted at more than the 90% significance level.

over LEA students of 7.0 (13.3) percentage points, on average. Students from these schools account for about 7% (4%) of male (female) students from Independent schools.

Group 2: This group accounts for around 9% (4%) of male (female) students from Independent schools. On average, students from this group are at least as likely as students from an LEA school to obtain a 'good' degree.

Group 3: The modal group - consisting of about 73.3% of males and over four-fifths of females from the Independent sector - is associated with significantly lower probability of a 'good' degree relative to the LEA sector.

Group 4: This group consists of schools associated with the largest negative marginal effects on the probability of a 'good' degree relative to the LEA sector. They comprise about 11% (8%) of male (female) students who had attended an Independent school.

Our overall conclusion from the analysis reported in this section is that the effect on a student's probability of a 'good' degree associated with having attended an Independent school is not constant across Independent schools. About 85% (93%) of male (female) students educated at Independent schools have the probability of a 'good' degree substantially (that is, about more than 7 (5) percentage points) lower than those of comparable students educated in the LEA school sector. But for both males and females, a sizeable minority have either no or positive effects relative to those educated in LEA schools. We now turn to the question of whether we can identify the characteristics of Independent schools which are associated with generating these effects. In particular, we examine whether the performance gap varies either with the level of school fees or with measures of school quality (or with both). We also distinguish between the two hypotheses we have discussed by analysing in more detail evidence relevant to the effort-incentive argument.

5 Analysis of the effects of Independent school characteristics

From the results of the analysis presented in the previous section, we have concluded that the effect of having attended an Independent school on students' degree performance is not constant across schools. In this section of the paper, we re-estimate the degree performance regressions presented in Table 2, with the additional inclusion of variables controlling for various school characteristics. These characteristics include: school size, average A-level score over all students from that school, whether the school is single sex or is co-educational, the pupil-teacher ratio, age of school, and the level of school fees.

The results are reported in Table 5. With respect to the estimated coefficients on the school variables, we note that whether or not the graduate attended a single-sex school has no statistically significant effect on degree performance. Similarly, there is no significant effect associated with the variables on the teacher-pupil ratio, school size or the age of the school. For females, the only significant coefficient is on the variable for school A level points, which is positive and significant at the 7% significance level. The marginal effect of this suggests that if the average A level points score of students in the school rises by 2 points, this would raise the probability of a 'good' degree by only 0.2 percentage points. The results underline the result from Table 3, and confirms, for females, relatively little variation across the Independent sector. For males, however, the school fees variable has a significant negative effect on university degree performance.

The analysis finds no substantial evidence that the average educational performance of the school previously attended influences the student's subsequent success at degree level, after controlling for the individual's own A-level achievement and subject choice. In contrast, even after controlling for other school characteristics, the level of school fees has a negative and statistically significant effect on a student's probability of a good degree - though for males only. The estimated coefficient implies that at average school fees of £7,500 (£6,200), the Independent school effect is of the order of 6.2 percentage points for males. Increasing fees by £2000 leads to an approximate 1 percentage point reduction in the probability of a 'good' degree for males.

In terms of the magnitude of the marginal effect on the probability of a 'good' degree with respect to school fees, it is interesting to examine the extent of variation across Independent schools in the level of fees. Figure 3 shows the distribution of the level of school fees across Independent schools in England, for males and females separately. Interestingly, the distribution is approximately bi-modal, with a high concentration of schools charging fees in the range £4,500 to £5,000 per annum and a second smaller concentration charging fees between £9,500 to £10,000 per annum. A £2000 increase in the level of fees represents only half of the move from the lower to the higher modal group. Male students who attended the schools in the upper tail of the distribution of fees were paying approximately £10,000 more fees compared to those in the lower modal group and thus would be expected to receive about 5% lower probability of a 'good' degree.

Thus, the evidence is consistent with our first hypothesis we discussed above: namely, that more expensive Independent schools have better characteristics in the sense that they are better able to improve a pupil's A level performance. Thus, relative to an LEA-educated pupil with

the same A level score, the implicit ability deficit of the Independent-educated pupil is likely to be increasing in the magnitude of the fees. Accordingly, so long as the marginal productivity of the school effects on A levels exceed those on subsequent degree performance, we would expect to see the result we have obtained that the degree performance gap between LEA and Independent-educated students is growing in the size of fees.

But what of the second hypothesis concerning the effort-incentive effect? This hypothesis would also state that the degree performance gap between LEA and Independent-educated students should increase with fees if it is the case that the premium to a good university degree is diminishing in school fees. We have already reported the results of related work (see Naylor *et al.* (2002)) showing that graduates' occupational earnings are increasing in fees, but this should not affect effort decisions at the margin.

In order to investigate decisions at the margin, we have regressed graduates' occupational earnings against the standard set of control variables including degree performance, school characteristics and also a multiplicative term for the interaction between degree performance and the level of school fees. Again, the results show that the coefficient on the interaction term is insignificant. This suggests that the incentive to perform well at university, in terms of the effect of performance on the quality of the occupational outcome, does not differ on average according to the level of fees charged in the previous school. As before, then, we do not find the evidence to be consistent with the second hypothesis that the degree performance gap by school fees reflects differential effort resulting from differential incentives.

6 Conclusions and further remarks

In this paper, we examine the extent to which a students' degree class is affected by the type of school the graduate attended prior to university entry. We estimate that, on average, a student who attended an Independent school is 6.9% to 5.4% less likely to be awarded a 'good' degree compared to a student who attended an LEA (state-sector) school, *ceteris paribus*. Amongst other results, we also show that university degree performance is sensitive to the student's previous educational qualifications (as measured by A level performance and A level subject) and to social class background.

Investigating the Independent school effect further, we find considerable and significant variation across Independent schools in the size of the reduction in the probability of a 'good' degree relative to comparable students educated in the LEA sector, especially in the case of male students. One measure of this is that for about 30% (19%) of male (female) students

educated at Independent schools their probability of a 'good' degree are more than 10% lower than those of comparable students educated in the LEA school sector. In addition, we find that the level of school fees is a highly significant determinant of the variation in the Independent school effect for males.

We have argued that the results are consistent with the hypothesis that attendance at an Independent school raises the level of the pupil's educational performance at school, as measured by A level scores. Thus, comparing two otherwise observationally equivalent university students (in particular, controlling for their A level scores), the student who attended an Independent school before university will be of lower ability than the student who had previously attended an LEA (state-sector) school. So long as the boost given to A level score by attendance at an Independent school is a short-run effect (so that it does not survive to enhance subsequent performance at university), then one would expect the university performance of students from LEA school backgrounds to exceed that of students from Independent schools, *ceteris paribus*: which is our finding. Furthermore, the evidence from the nature of the variation in the Independent school effect is also consistent with a version of the hypothesis predicting that if A level performance is correlated positively with fees charged by Independent schools, then the performance gap between the LEA-educated and the Independent-educated will be increasing in fees - which is our finding.

In terms of implications for university admissions policy, our results suggest that the positive discriminatory practice of asking for higher A level points scores for applicants educated at Independent schools has some justification, but might lack some subtlety. It is true that comparing two otherwise identical students educated in the different school sectors we would expect the student from the LEA (that is, public or state) sector to be of greater potential ability, on average. This could be the basis for an admissions policy with differential grade offers for applicants from the different sectors. Indeed, our analysis even provides a method for calculating the grade offer difference which would lead to candidates having the same *ex ante* predicted degree outcome. However, our analysis also suggests that there is considerable variation around the average degree performance difference between LEA and Independent-educated students, and that this variation is correlated positively with the magnitude of Independent school fees. Consequently, an admissions policy of requiring higher A level scores from applicants from less expensive Independent schools might not be justifiable in the light of our evidence. One way round these difficulties might be to move toward the system quite common in the US of cream-skimming the brightest applicants from each of a wide range of schools, thereby effectively controlling for the effects of school-related characteristics on pre- university

attainment.

There are a number of possible directions for further work. First, it would be interesting to examine the stability of our results over time. In this paper, we have exploited data on graduates leaving UK universities in 1993. Data for previous cohorts are available and provide a source for inter-temporal comparisons. Secondly, this paper has been concerned with comparing the degree performance of students who had previously attended Independent schools with the performance of otherwise comparable students educated in the local education authority sector. We investigate sources of variation in the Independent school effect relative to a benchmark level of degree performance associated with attendance at an average LEA school. Of course, just as we find variation around the average effect according to the particular Independent school attended, it is likely that degree performance will vary with the particular LEA school attended and with its characteristics. In future work, it will be informative to investigate the source of any variation within the LEA sector.

References

Bee, M., and Dolton, P. (1985). Degree class and pass rates: An inter-university comparison. *Higher Education Review*, **17**, 45–52.

Bekhradnia, B., and Thompson, J. (2002). Who does best at university?. Report, Higher Education Funding Council of England, Bristol.

Betts, J. R., and Morell, D. (1999). The deterinants of undergraduate grade point average: the relative importance of family background, high school resources, and peer group effects. *Journal of Human Resources*, **34**, 268–293.

Blundell, R., Dearden, L., Goodman, A., and Reed, H. (1997). *Higher education, employment and earnings in Britain*. London: Institute for Fiscal Studies.

Bratti, M. (2002). Does the choice of university matter? a study of the difference across UK universities in life science students' degree performance. *Economics of Education Review*, **21**, 431–443.

Chapman, K. (1996a). An analysis of degree results in geography by gender. *Assessment and Evaluation in Higher Education*, **21**, 293–311.

Chapman, K. (1996b). Entry qualifications, degree results and value-added in UK universities. *Oxford Review of Education*, **22**, 251–262.

Dearden, L., Ferri, J., and Meghir, C. (1997). The effect of school quality on educational

attainment and wages. Working paper no. w98/3, Institute for Fiscal Studies, London.

Dolton, P., and Vignoles, A. (1999). The labour market returns to different types of secondary school curricula. mimeo, London School of Economics.

Eide, and Showalter (1998). The effect of school quality on student performance: A quantile regression approach. *Economics Letters*, **58**, 345–350.

Hoskins, S. L., Newstead, S. E., and Dennis, I. (1997). Degree performance as a function of age, gender, prior qualifications and discipline studied. *Assessment and Evaluation in Higher Education*, **22**, 317–328.

Johnes, J., and Taylor, J. (eds.)(1990). *Performance indicators in higher education.* Oxford: SRHE/OUP.

Krueger, A. (1999). Experimental estimates of education production functions. *Quarterly Journal of Economics*, **114**, 497–532.

McNabb, R., Sarmistha, P., and Sloane, P. (1998). Gender differences in student attainment: The case of university students in the UK. mimeo, University of Cardiff.

Naylor, R. A., Smith, J., and McKnight, A. (2002). Why is there a graduate earnings premium for students from independent schools?. *Bulletin of Economic Research*, **54**, 315–339.

Peers, I., and Johnston, M. (1994). Influence of learning context on the relationship between A-level attainment and final degree performance. *British Journal of Educational Psychology*, **64**, 1–18.

Rudd, E. (1984). A comparison between the results achieved by women and men studying for first degrees in British universities. *Studies in Higher Education*, **9**, 47–57.

Sear, K. (1983). The correlation between A-level grades and degree results in England and Wales. *Higher Education*, **12**, 609–619.

Smith, J., and Naylor, R. A. (2001). Determinants of degree performance in UK universities: a statistical analysis of the 1993 student cohort. *Oxford Bulletin of Economics and Statistics*, **63**, 29–60.

Table 1a: Summary statistics for All and for Independent school students

	ALL		Independent	
	Mean	Standard Deviation	Mean	Standard Deviation
Academic qualifications				
A-level information				
Best 3 A-levels score	22.371	5.515	23.161	5.301
Other A-level score	3.149	4.550	2.904	4.368
A-level scores				
30 A-level points	0.132	0.339	0.166	0.372
26-29 A-level points	0.227	0.419	0.250	0.433
22-25 A-level points	0.258	0.438	0.255	0.436
18-21 A-level points	0.211	0.408	0.192	0.394
14-17 A-level points	0.113	0.317	0.096	0.294
Below 14 points	0.058	0.234	0.041	0.199
A-level subjects				
Biology	0.196	0.397	0.181	0.385
Chemistry	0.326	0.469	0.287	0.452
English	0.308	0.462	0.345	0.475
Maths	0.493	0.500	0.447	0.497
Physics	0.336	0.472	0.282	0.450
Personal characteristics				
Sex (Males)	0.555	0.497	0.576	0.494
Age	21.705	0.710	21.778	0.719
Social Class				
SC I	0.206	0.405	0.285	0.451
SC II	0.456	0.498	0.495	0.500
SCIIINM	0.120	0.325	0.084	0.278
SCIIIM	0.094	0.292	0.040	0.196
SCIV	0.058	0.233	0.029	0.167
SCV	0.007	0.081	0.002	0.041
Unemployed	0.021	0.143	0.015	0.123
School type				
LEA school	0.330	0.470		
Independent school	0.310	0.463		
Further Education college	0.132	0.339		
Other school	0.228	0.419		
n	48281		14969	

Table 1b:Proportion of students with good degree by key characteristics and sex

	Males		Females	
	Mean	Standard Deviation	Mean	Standard Deviation
ALL	0.559	0.497	0.645	0.479
Academic qualifications				
A-level information				
A-level scores				
30 A-level points	0.829	0.377	0.857	0.350
26-29 A-level points	0.675	0.469	0.774	0.418
22-25 A-level points	0.544	0.498	0.664	0.472
18-21 A-level points	0.437	0.496	0.577	0.494
14-17 A-level points	0.368	0.482	0.450	0.498
Below 14 points	0.281	0.450	0.361	0.480
A-level subjects				
Biology	0.545	0.498	0.648	0.478
Chemistry	0.549	0.498	0.641	0.480
English	0.637	0.481	0.668	0.471
Maths	0.553	0.497	0.652	0.476
Physics	0.529	0.499	0.617	0.486
Personal characteristics				
Social Class				
SC I	0.587	0.492	0.662	0.473
SC II	0.568	0.495	0.652	0.476
SCIIINM	0.559	0.497	0.649	0.477
SCIIIM	0.527	0.499	0.618	0.486
SCIV	0.516	0.500	0.608	0.488
SCV	0.545	0.499	0.574	0.496
Unemployed	0.472	0.500	0.563	0.497
School type				
LEA school	0.551	0.497	0.654	0.476
Independent school	0.571	0.495	0.629	0.483
Further Education college	0.543	0.498	0.635	0.482
Other school	0.561	0.496	0.656	0.475

Table 2: Coefficients and marginal effects on degree performance

	Males			Females		
	Coeff	Good	Below 3rd	Coeff	Good	Below 3rd
Average		56.7	3.0		65.7	1.1
Personal characteristics						
Age	0.016	0.6	-0.1	0.027**	1.0	-0.1
Married	0.144	5.6	-0.9	0.153	5.4	-0.4
At home	0.078**	3.0	-0.5	0.046	1.7	-0.1
Social class (default SC II)						
SC I	0.044	1.7	-0.3	0.025	0.9	-0.1
SC IIINM	0.029	1.2	-0.2	-0.003	-0.1	0.0
SC IIIM	-0.021	-0.8	0.1	-0.064**	-2.4	0.2
SC IV	-0.057**	-2.3	0.4	-0.054	-2.0	0.2
SC V	0.065	2.5	-0.4	-0.117	-4.4	0.4
Unemployed	-0.069	-2.7	0.5	-0.160***	-6.0	0.6
Academic qualifications and schooling						
Topscore dummy	0.438***	17.2	-1.2	0.350***	11.5	-0.3
Best 3 A-levels score	0.061***	4.8	-0.9	0.068***	4.9	-0.4
Other A-level score	-0.008***	-0.6	0.1	-0.009***	-0.7	0.0
A-level subjects						
Biology	0.051**	2.0	-0.3	-0.021	-0.8	0.1
Chemistry	0.007	0.3	-0.1	0.063**	2.3	-0.2
English	0.061***	2.4	-0.4	0.016	0.6	0.0
Maths	0.061***	2.4	-0.4	0.113***	4.1	-0.3
Physics	-0.080***	-3.2	0.6	0.017	0.6	-0.1
School type (default LEA school)						
Independent school	-0.166***	-6.5	1.2	-0.146***	-5.4	0.5
Further Education college	-0.067***	-2.6	0.4	-0.093***	-3.4	0.3
Other school	-0.038**	-1.5	0.2	0.009	0.3	0.0

Table 3: Effect of attending an Independent school on the probability of a 'good' degree

		No. of schools		% of students	
Marginal effect (%)		Insignif	Signif	Insignif	Signif
Females	>0	24	6	21.7	6.0
	0 to –5	26	0	22.8	0.0
	-5 to -10	26	0	23.9	0.0
	-10 to -15	9	7	6.8	8.5
	<-15	0	15	0.0	10.2
	Total (%)	75.2	24.8	75.3	24.7
Males	>0	21	3	17.1	3.6
	0 to –5	21	0	17.6	0.0
	-5 to –10	22	10	16.4	14.8
	-10 to –15	2	20	1.1	19.3
	<-15	0	14	0.0	10.1
	Total (%)	58.4	41.6	52.2	47.8

Table 4: Increased probability of obtaining a 'good' degree for Independent schools by school group, relative to LEA school

	Males		Females	
	Marginals	% students	Marginals	% student
Group 1	7.0***	7.1	13.3***	3.7
Group 2	0.9	8.8	4.3**	3.7
Group 3	-7.1***	73.3	-5.8***	84.3
Group 4	-17.8***	10.8	-18.7***	8.4

Table 5: Coefficients and marginal effects on degree performance

	Males			Females		
	Coeff	Good	Below 3rd	Coeff	Good	Below 3rd
Average		56.7	3.0		65.7	1.1
Personal characteristics						
Age	0.018[*]	0.7	-0.1	0.029[**]	1.0	-0.1
Married	0.141	5.5	-0.8	0.153	5.4	-0.4
At home	0.077[**]	3.0	-0.5	0.051	1.9	-0.1
Social class (default SC II)						
SC I	0.044	1.7	-0.3	0.023	0.9	-0.1
SC IIINM	0.027	1.0	-0.2	-0.002	-0.1	0.0
SC IIIM	-0.024	-1.0	0.2	-0.062[**]	-2.3	0.2
SC IV	-0.061[**]	-2.4	0.4	-0.050	-1.9	0.2
SC V	0.062	2.4	-0.4	-0.113	-4.2	0.4
Unemployed	-0.070	-2.8	0.5	-0.157[***]	-5.9	0.6
Academic qualifications and schooling						
Topscore dummy	0.437[***]	17.1	-1.2	0.351[***]	11.5	-0.3
Best 3 A-levels score	0.061[***]	4.8	-0.9	0.068[***]	4.9	-0.4
Other A-level score	-0.008[***]	-0.6	0.1	-0.010[***]	-0.7	0.0
A-level subjects						
Biology	0.052[**]	2.0	-0.4	-0.022	-0.8	0.1
Chemistry	0.007	0.3	-0.1	0.062[**]	2.3	-0.2
English	0.061[***]	2.4	-0.4	0.015	0.6	0.0
Maths	0.061[***]	2.4	-0.4	0.113[***]	4.1	-0.3
Physics	-0.080[***]	-3.1	0.6	0.016	0.6	0.0
School type (default LEA school)						
Independent school	-	-6.2	1.1	-	-5.3	0.7
Further Education college	-0.073[**]	-2.9	0.5	-0.147[***]	-5.4	0.4
Other school	-0.039[**]	-1.5	0.2	0.003	0.1	0.0
School characteristics						
Fees	-0.026[**]	-1.0	0.2	-0.022	-0.8	-0.1
Age	0.007	0.3	0.0	0.010	0.4	0.0
Pupil-teacher ratio	-0.003	-0.1	0.0	-0.003	-0.1	0.0
School A-level points	-0.002	-0.1	0.0	0.006[*]	0.2	0.0
School size	-0.001	0.0	0.0	-0.004	-0.1	0.0
Single sex school	0.015	0.6	-0.1	-0.019	-0.7	0.1

Figure 1: Marginal effect on the probability of a good degree: Independent vs LEA school (males)
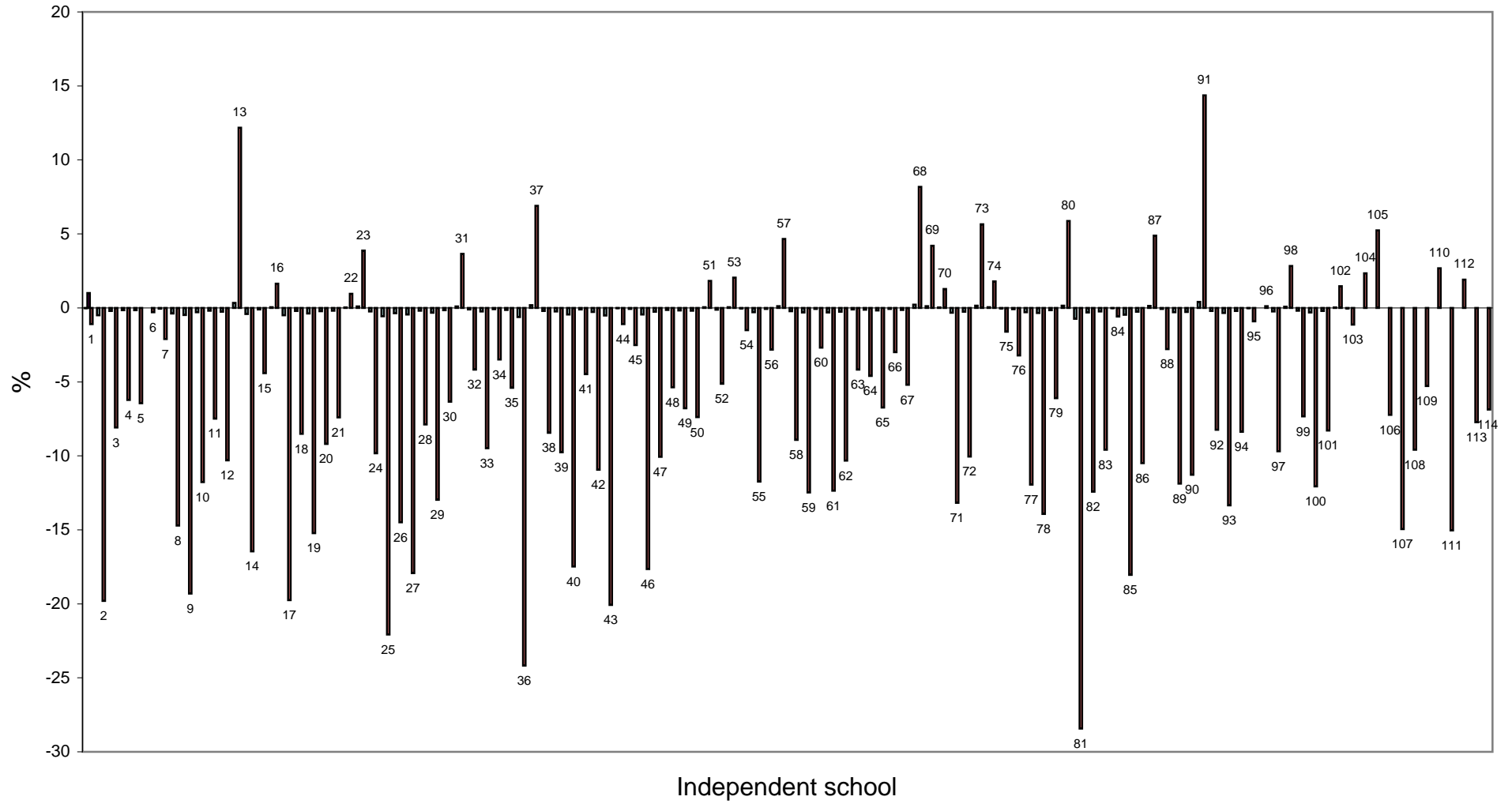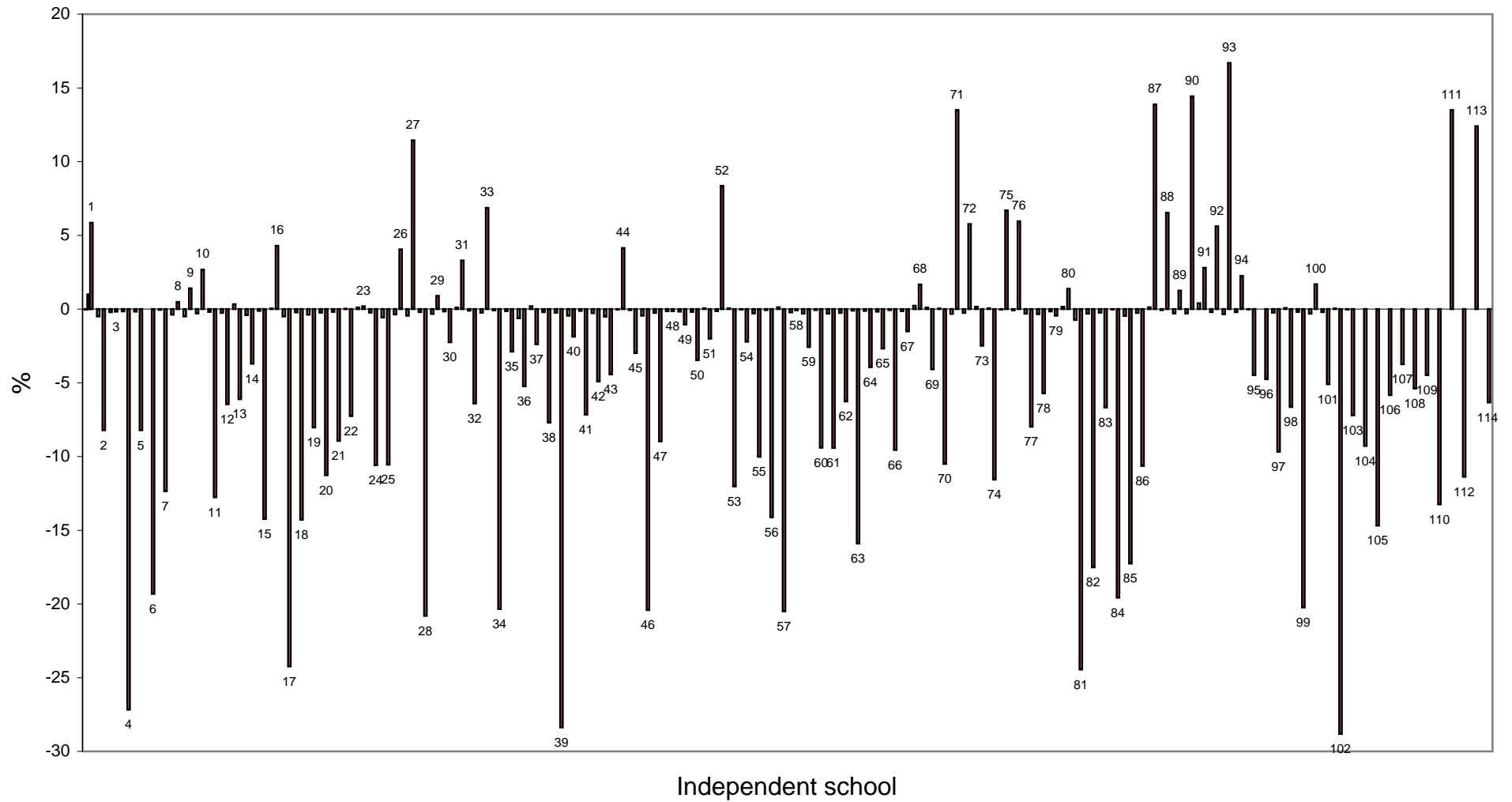
Figure 2: Marginal effect on the probability of a good degree: Independent vs LEA school (females)

Independent school

Figure 3: Distribution of fees across Independent schools