DISCUSSION PAPER SERIES

IZA DP No. 2491

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December 2006

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

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ABSTRACT

Which Factors Determine the Grades of Undergraduate Students in Economics? Some Evidence from Spain*

This paper analyses the determinants of grades achieved in three core subjects by first-year Economics undergraduate students at Universidad Carlos III de Madrid, over the period 2001-2005. Gender, nationality, type of school, specialization track at high school and the grades at the university entry exam are the key factors we examine. Our main findings are that those students who did a technical track at high school tend to do better in mathematics than those who followed a social sciences degree and, that the latter do not perform significantly better than the former in subjects with less degree of formalism and more economic content. Moreover, students from public schools are predominant in the lower (with social sciences or humanities tracks) and upper (with a technical track) parts of the grade distribution, and females tend to perform better than males.

JEL Classification: I21, I29

Keywords: grade achievement, school type, gender, multinomial logit, quantile regressions

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* We are grateful to Marisol Somolinos for help with the students' records at UC3M and to Antonio Cabrales for insightful comments on preliminary drafts of this paper. The second author is currently a first-year student in the Economics Ph. D. program at Harvard. Financial support from the European Commission (Dolado) under the project *The Economics of Education and Education Policy in Europe* (MRTN-CT-2003-50496) and Consejería de Educación de la Comunidad de Madrid (Morales) is gratefully acknowledged.

1. Introduction

A reasonable knowledge of Mathematics is considered to be a key input in the training of economists since, as is often claimed, Economics is the discipline with the highest need for formalism in theory-building among the social sciences. Thus, modern undergraduate courses in Economics place a lot of emphasis on students acquiring a good mathematical background. In this paper, we examine the role of a few pre-college determinants of the grades achieved by first-year undergraduate students in Economics in the exams of three subjects ordered according to a decreasing level of mathematical content: Mathematics-I, Introductory Economics and Economic History (henceforth, *Maths*, *Introecon* and *Econhist*, respectively).[1] Our main goal is to analyze whether the pre-college factors determining sucess in *Maths* differ from those affecting the performance in the other two subjects. Our evidence relies upon Spanish data which consists of a sample of undergraduates at Universidad Carlos III de Madrid (UC3M) during four recent academic years (2002/03 to 2005/06). The sample provides information on a limited number of variables yet, as will be argued below, it constitutes an interesting dataset for the goal of this paper.

The students in our sample are slightly below 400 and took lectures in the above-mentioned subjects during the first semester in the first year of their four-year BA degree (*Licenciatura*). All these students were taught *Maths* by the same lecturer (one of us) during the four courses, though the other two subjects were taught by different lecturers. This facilitated obtaining the information used in this study, most of which is not available from the university records. Students provided information to us about the type of high school (public, charter and private)[2] they attended during their upper-secondary education (two years of *Bachillerato*), the type of training they got during this period (i.e., the *bachillerato* specialization track; see below) and the grade they obtained in the national entry- exam to the university (*Selectividad* exam) which is bound to control for unobserved skills.[3] These variables, together with gender, nationality and cohort dummies, are the controls we use to explain outcomes (grades awarded in the final examination of the three subjects) using an achievement production-function approach. We lack parental background but

[1] The subjects taught in *Maths* are limits, differentiation and integrals. *Introecon* is a basic Microecomics course (consumer theory and theory of the firm) and *Econhist* deals with the long-run development process in Western Europe.

[2] A charter school (*concertado*) is a school subsidized by the public sector, typically run by religious orders.

[3] The overall grade is a weighted average of the school grade (with a weight of 60%) and the centralized exam grade (40%). Because school grades can be inflated, we only use the exam grade in this paper.

the entry-exam grade and type of school are bound to be highly correlated with this missing information (see Calero, 2006).

Grades in the Spanish education system are numerical, ranging from 0 to 10. A grade below 5 implies a *Suspenso* (Failure or D in the anglosaxon system), between 5 and 7 is an *Aprobado* (Pass or C), between 7 and 9 is a *Notable* (B), between 9 and 10 is a *Sobresaliente* (or A) and 10 (or very close to that grade) is a *Matrícula de Honor* (A+ or distinction). However, the only grades appearing in the official records delivered by the university to the students at the end of each course are the categorical ones discussed above. To simplify notation in the sequel, they will be labeled with the acronyms SUS, AP, NOT, SOB and MH, respectively.

Given these characteristics of the grade scale in the Spanish university system, we will rely empirically on three different econometric approaches. First, we use the continuous support of the dependent variable (grades) to run OLS regressions. Secondly, we measure the impact of the determinants on the dependent variable at different points in its conditional distribution, by means of quantile regressions (QR). In this fashion, we will be able to provide a sense of how the impact of the explanatory variables may differ throughout the grade distribution. For example, one may find that attending a certain type private school or having completed a particular type of *Bachillerato*, while seemingly important at the mean as a determinant of the outcome, may in fact have different impacts across students with high or low grades. Finally, we use the categorical nature of the grades to estimate multinomial logit models distinguishing among three grade categories which broadly signal pre-labour market human capital achievements.

The rest of the paper is structured as follows. Section 2 discusses the data used for the estimation. In Section 3, we present the econometric results. Section 4 contains a discussion about how representative is the sample at hand and checks for some potential selection biases. Finally, Section 5 concludes.

2. Data and Descriptive Statistics

The data we have is made up of a survey conducted by us among the four cohorts of students enrolled in the bilingual group of Economics (and Business Administration) during the academic courses from 2002/03 to 2005/06.[4] All

[4] The "bilingual" group means that, except for a few subjects (e.g. those related to Law), all the teaching takes place in English. Admission to this group is conditional on passing an English exam. Students in the Economics and Business Administration (LADE) have the same subjects in their first course. Courses are organized on a semester basis and there are ten subjects in their first year (five each semester), with exams taking place in February and June.

these students were taught *Maths* by one of us in classrooms with a maximum enrollment rate size of 100 students per group. We solicited information from them, on voluntary basis, about the type of school (public, charter and private) they attended during high school (two years of *Bachillerato*), the kind of training they received during this period (there are four types of *Bachilleratos*: technical, natural sciences & health, social sciences and humanities which are chosen by high-school students in the year when they become 16, i.e., in *Primero de Bachillerato*) and the grade they obtained in the entry exam to the university (*Selectividad*) at 18. This last information was cross-checked with the university records in order to avoid measurement errors. All this extra information was willfully provided by the students, yielding 386 observations on all the variables to be correlated with the grades in the three subjects. The response rate to the survey was almost one-hundred percent (96.5%).

A brief overview of the relevant variables is provided in the sequel. Tables 1a and 1b below present the conditional distribution of student and school characteristics given grades and the converse conditional distribution, respectively. For expository purposes, we have grouped these grades into three broad categories: S (SUS; category 0), AN (AP+NOT; category 1) and SM (SOB+MH; category 2). Thus, the frequencies in the relevant rows of Table 1a add up to 100 whereas the corresponding columns in Table 1b do so. Overall, 49.2% are male students and 89.3% are Spanish. By type of school, 42% come from a public school, 21% from charter schools and 37% from private schools. By type of *bachillerato* track, 67% have done social sciences, 26% the technical one and the remaining 7% did natural sciences & health (3%) and humanities (4%). It should be noticed that the high school training in *Maths* is more intense in the technical and natural sciences & and health *bachilleratos* than in social sciences and humanities, even though all students in the sample confirmed that they took a course in *Maths* either as a compulsory or an optional subject in high school. Likewise, education quality (student/teacher ratios, computer facilities, foreign languages) in non-public schools is considered to be higher that in most public schools, in exchange for annual tuition fees of about € 6,000 in private schools and around € 2,000 in charter schools.

This descriptive information shows that male students are less successful in passing the subject than female students (except in *Introecon*) as it is the case of students coming from public schools with a social sciences or humanities *bachilleratos*. Interestingly, however, students from public schools (mostly with a technical track) do well in achieving the highest grade categories (SM=2) in all the subjects. Thus, public schools seem to have a U-shaped distribution across grades. The lower tail contains those students who did social sciences whilst those in the upper tail did a more scientific-oriented *bachillerato*. Given that a significant majority of high-school students (66%) are enrolled into the public education system, the latter effect could be explained by higher competition among the best students in public schools. Being the ones with the highest skills they seem to select themselves into the toughest specialization, i.e., the technical option. It is also worth noticing that foreign students exhibit a much higher variability in grades than natives. Finally, the last row in Table 1a presents the correlations between the numerical grades in each of the subjects and the grades in the *Selectividad* exam. These correlations range between 0.5 and 0.67, being largest in the case of *Maths*.

Figure 1 depicts the (kernel) densities of the (numerical) grades in the three subjects. As can be inspected, the distributions of grades in *Econhist* and *Introecon* are unimodal with the latter being the one more shifted to the right (i.e., lower probability of a failure). By constrast, the density of *Maths* is bimodal and not too different from a uniform distribution, being the one more shifted to the right (i.e,. higher probability of failure).[5] To achieve comparability across subjects in the estimation of the effects of the different pre-college determinants, we use the standarized grades in the econometric approaches described below, so that the effects are measured in terms of the corrresponding standard deviations (henceforth, s.d.´s). To convert them into numerical grades, one should multiply these effects by the latter. Figure 2, in turn, displays the density of the university entry-exam grades which is truncated at 5.0 since this is the lowest grade giving access to college.

3. Econometric approaches

Our modeling point of departure is based on an extensive literature analyzing schooling outcomes in developing and developed countries using a production function approach; cf. Hanushek (1995), Case and Deaton (1999), Bjorklund et al. (2003), and Glewwe and Kremer (2005). According to this approach, grades are explained as a function of several inputs in the following manner:

$$A = f(x) = f\ (G, N, UG, ST, BT, T) \qquad (1)$$

where x is a vector of determinants which in our consists of the following variables: A represents some metric of grade achievement (continuous or categorical); G and N are gender and nationality dummy variables; UG is the grade at the university entry exam (continuous); ST represents school type dummies; BT denotes *bachillerato* type dummies and T are time/cohort dummies pertaining to the fours academic courses considered in the sample.

In order to estimate (1), we adopt three econometric approaches discussed in each of the three subsections below.

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[5] The moments (mean and s.d.) of the three distributions are as follows: *Maths* (5.17, 2.50), *Introecon* (5.70, 1.57) and *Econhist* (6.48, 1.44)

3.1 Least-Squares

The dependent variable is the numerical grade of individual *i* in a pooled regression model where the controls are the variables alluded to before. Specifically, the model estimated by OLS has the following generic form:

$$A_{is} = a + \beta' x_{is} + u_{is} \quad (2)$$

where A_{is} is the grade of student I in subject s and x_{is} is a vector of controls formed by a G_i dummy (female=1), N_i is a nationality dummy (foreigner=1), UG_i (numerical), ST_i (dummies for charter and private schools), BT_i (dummies for natural sciences & health, technical and humanities) and T_i are three dummies for cohorts. Thus, the reference group is formed by male students from public schools with a high school track in social sciences who took the (February) exams in the 2002/03 course. The constant and the (*i.i.d.*) disturbance terms are captured by *a* and u_{is}, respectively.

In the first columns of each subject in Table 2, the OLS estimates of the coefficients in (2) are reported together with their robust standard errors. The largest effects are those from the entry-exam grade and the technical degree. An extra point in the entry-exam to university gives rise to about 0.60 extra s.d.´s (1,50, 0.85 and 0,85 points, respectively) relative to the reference group in each subject, with slightly larger coefficients in *Maths* and *Introecon*. Likewise, having completed the technical track in *bachillerato* leads to 0.68 extra s.d.´s (1.7 points) in Maths and 0.45 s.d.´s (0.7 points) in *Introecon*, without any gain in *Econhist*, whereas 0.5 extra s.d.´s (0.75 points) in *Maths* are achieved by those who followed the natural sciences & health track. By contrast, the humanities track has a penalty of 0.6 s.d´s (1.5 points) in that subject. As regards gender, female students get 0.15 s.d.´s (0.38 points) more than their male classmates in *Maths*, without significant differences in the remaining subjects. Finally, with the exception of the 2004/05 course, the cohort dummies are significantly negative. Despite the short sample period, this gives some support to the extended opinion among several education pundits in Spain that training in high schools has been deteriorating over time although this effect might be contaminated by the presence of different lectures in the three subjects.

Next, in order to analyze the impact on grades of having followed a certain type of *bachillerato* in a given school, the second columns of each field in Table 2 present the estimated coefficients of a similar regression this time augmented with interaction terms between school type and high-school track. The results are similar to those discussed above with the only significant coefficients being the ones on the interactions between the *nshlth* track and both private and charter schools. For example, the students who come from private schools and followed this type of track get 0.33 s.d.´s (=1.09-0.76; 0.82 points) more than those who did that degree in a public school.

3.2 Quantile Regressions

The fact discussed earlier that we may not have well-behaved distributions in the outcome and in other variables, implies that least-squares coefficients may yield partial information. Accordingly, in line with a growing literature on the application of this technique to achievement production functions, we use quantile regressions (QR).[6] Following the well-known methodology first proposed in Koenker and Bassett (1978), the model of QR in the setup of the achievement production function described in (2) can be described as follows. Let (A_i, z_i) be a random sample, where z_i =(1, x_i) and $Q_\theta(A_i\,|\,z_i)$ is the conditional θ^{th} quantile of the distribution of A_i given z_i. Then, under the assumption of a linear specification, the model can be defined as

$$A_i = z_i'\beta_\theta + u_{\theta i}\,, \qquad Q_\theta(A_i\,|\,x_i) = z_i'\beta_\theta \tag{3}$$

where the distribution of the error term $u_{\theta i}$, $F_{u\theta}(\cdot)$, is left unspecified, just assuming that $u_{\theta i}$ satisfies $Q_\theta(u_{\theta i}\,|\,z_i) = 0$. The estimated vector of QR coefficients, $\hat{\beta}_\theta$, is interpreted as the marginal change in the conditional quantile θ due to a marginal change in the corresponding element of the vector of coefficients on z, and can be obtained using the optimization techniques described in Koenker and Bassett (1982).

In order to facilitate comparison of the results across subjects, we choose different quantiles for each subject in such a way that the centiles become similar in terms of both numerical and categorical grades. These happened to be: θ=0.25 (grades: 2.8, SUS), 0.75 (7.0 NOT) and 0.95 (9.5, SOB) for *Maths*, θ= 0.10 (3.8, SUS), 0.80 (7, NOT) and 0.98 (10, MH) for *Introecon*, and θ= 0.10 (4.5, SUS), 0.70 (7.2, NOT) and 0.98 (9.3, SOB) for *Econhist*. Tables 3a, b and c report the estimated coefficients at the relevant quantiles (w/o intereraction terms), where the regression at the median- i.e., at θ= 0.50- has also been added.[7] Further, for convenience, we reproduce the OLS estimates in the first column (*average*) in order to compare the coefficients at the mean as opposed to the coefficients at the chosen quantiles of the conditional distribution of (numerical) grades.

The key result in *Maths* is that the impact of private and charter schools (in the range of 0.2 to 0.4 extra s.d.´s or 0.5 to 1 points relative to public schools) is stronger up to the 75th -90th quantiles, particularly for the latter, in line with the

[6] For examples of the use of QRs in the literature on schooling outcomes, see, e.g., Eide and Showalter (1998), Levin (2001) and Bhorat and Oosthuizen (2006)

[7] For the sake of brevity, we do not report the estimated coefficients on the cohort dummies. However, the pattern of negative coefficients for the 2003/04 and 2005/06 cohorts remains across quantiles.

predominance of students coming from public schools at the top of the distribution. A similar effect is observed for the entry-exam grades, whose effect decreases throughout the distribution though it is always the most significant variable, together with the technical track. The opposite effect takes place with the humanities track. As regards *Introecon* and *Econhist*, the most salient difference with respect to *Maths* is that private schools seem to matter a lot, whereas having completed a technical track only seems to matter in the case of *Introecon* at the upper part of the distribution. [8]

3.3 Multinomial Logits

Finally, we use the categorical grades to estimate two multinomial logit models determining the odds-ratios of obtaining a grade in a certain category relative to a comparison one.[9] We distinguish among the three grade categories defined in the Introduction, denoted as Cat_*i* (3) with *i*=1 (AN), 2 (SM). Category 0 (S) is the base category with the following dummies omitted: male, Spanish, public school, social sciences, and 2002/03. The columns of estimates in Table 4 report the corresponding odd-ratios. Thus, each estimate represents the odds of obtaining a grade in a given category with respect to the base one.[10]. In line with the evidence above, it is found that that the highest (and significant) odds ratios are those of a technical *bachillerato*, females and private and charter schools whereas humanities have the lowest. In particular, the technical track and the entry-exam grades present increasing odds ratios in all subjects as we move up from category 1 to 2, and the opposite happens with the natural sciences & health track. Having attended a charter/private school seems to help a lot in obtaining AN in all subjects and even SM in *Introecon* and *Econhist* (with the exception of charter schools in the latter subject). It should be noticed that some of the estimated odd-ratios are very large- either with large s.d.´s, like e.g., the coefficient on the natural sciences & health track in Cat_1(3) of two of the subjects, or better determined as the coefficient on the technical track in Cat_2(3) of all subjects. This is due to the fact that a very large fraction of those students fell in the above-mentioned categories, blowing up the corresponding odds-ratios.

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[8] An F(19,375) test on the joint equality of all the coefficients across the chosen quantiles yields a value of 8.74 (p-value=0.00).

[9] Given that our dependent variable has a natural ordering, we also used a Wald chi-squared test for the "parallel regression assumption" to check whether an ordered logit was a more appropriate model. In both multinomial logits the assumption was strongly rejected with p-values very close to zero.

[10] Thus, for example, the coefficient on Female in the first column indicates that the odds of a female getting a grade in category 1 compared to category 0 is about 2 times (1.985) the odds of male students doing the same.

4. Selection bias

Our sample of students has two characteristics which could lead to (favourable) selection biases. The first one is that UC3M is considered to be one of the Spanish universities with the highest reputation in completing an Economics degree. [11] That, in principle, could lead to attracting better students than other universities with a lower ranking in this field. Unfortunately, we do not have any control group to test for selection. However, there is ample evidence that the mobility of students across regions is very low and the entry-exam grade requested by UC3M to get admission in the Economics degree is a low pass (5.0), despite being somewhat larger in LADE (6.0). Thus, we conjecture that biases are bound to be minor in this respect. The second one is that students belong to the bilingual group, which is taught in English. Given that Spain is one of the european countries with the lower share of the population speaking foreign languages (44%), the students enrolling in this group might be a (favourably) selected group relative to those following similar studies in Spanish. An indication that this could be the case is that the proportion of students coming from public schools (42%) in the bilingual group is lower than in the total population of students completing higher-secondary education (66%).

In order to check for potential selection biases, we have used information available for two groups of first-year students enrolled in the Economics/ LADE degrees at UC3M during the four courses analyzed in the previous sections. The pooled sample size for these groups is 572. Information is available from the university records on gender, nationality, grades at the *Selectividad* exam and on whether students completed high school in the region of Madrid (CM) or in other Spanish regions. Unfortunately, we lack the remaining individual information used before in analyzing the determinants of outcomes for the bilingual group.

To control for selection biases we estimate a participation equation in the bilingual group as a first step in the conventional two-stage Heckman approach for selection correction. We use the pooled sample of all students (both from the Spanish and bilingual groups) giving rise to 958 observations (=572+386). Given the scarce information available, we use the residence in CM (which is also available for the students in the bilingual group, but has not been used as a determinant in the previous sections) as the identifying variable. The insight for this choice is that, if the bilingual group is a positively selected group from the population of students enrolled in Economics/ LADE degrees at UC3M, it is

[11] According to the rankings published in the newspaper EL MUNDO (CAMPUS magazine) since 2003, UC3M is one of the two best universities in Spain to complete *licenciaturas* in Economics and LADE, together with UPF.

likely that a larger share of students from other Spanish regions will enrol in this group, given that there are few universities in Spain offering bilingual courses.[12] The first column in Table 5 presents the results from a first-stage probit model where the dependent variable equals 1 if a student belongs to the bilingual group and 0 in the Spanish groups, and the covariates are gender, nationality, a dummy variable on residence (CM=1), (numerical) grade at the *Selectividad* exam and the cohort dummies (not reported). Results indicate that being a foreigner and living outside CM increase the probability of belonging to the bilingual group whilst the other covariates do not have significant effects. The next three columns in Table 5 report the results the OLS estimation of the linear model in Table 2, this time augmented with the inverse Mills ratio (*lambda*). This last term turns out to be always insignificant and, despite some minor quantitative changes in the estimated coefficients, none of the qualitative results stressed above change with the selection correction. Hence, although we cannot discard selection biases with respect to the overall population of first-year students enrolled in Economics/LADE degrees in Spain, our results seem representative within the context of UC3M undergraduates and, possibly, in relation to the population of those studying in CM universities.

5. Conclusions

Our results in this paper point out that the most important factors in achieving a very good grade in *Maths*, controlling for pre-college skills through university entry-exam scores, is to have followed a technical track in high school, particularly at a public school. This is so since public schools seem to exert higher competition among the best students than non-public schools, and that the technical degree attracts this type of students. By contrast, a social sciences or humanities degree, especially at public schools, seems to lead to mediocre grades in that subject. Having completed a social science track is somewhat neutral vis-á-vis the technical track regarding grade performance in other two subjects with less (*Introecon*) o very little (*Econhist)* mathematical content. In general, females tend to do better than males. One possible education policy implication of the above results is that high- school students who intend to graduate in economics should take the *maths* courses of the technical *bachillerato* rather than the ones taught in the social sciences specialization.

[12] The fractions of students living outside the region of Madrid are 18.3% and 12.2% in the bilingual and Spanish groups, respectively. The means of the entry-exam grades are 6.8 and 6.2 respectively, though a test for equal means does not reject the null with a p-value of 0.13.

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Table 1a: Distributions of Students and School Characteristics by Grade

	Maths			***Introecon***			***Econhist***		
Grades	*S=0*	*AN=1*	*SM=2*	*S=0*	*AN=1*	*SM=2*	*S=0*	*AN=1*	*SM=2*
Frequency	37.05	53.63	9.32	26.62	68.92	4.66	10.36	85.24	4.40
Male	42.63	49.47	7.89	24.74	71.05	4.21	11.58	85.79	2.63
Female	31.63	57.65	10.71	28.06	66.84	5.10	9.18	84.69	6.12
Public	55.21	35.58	9.21	41.10	52.76	6.14	13.50	85.23	4.40
Charter	25.93	65.43	8.64	16.05	81.48	2.47	7.41	90.12	2.47
Private	22.54	67.61	9.85	15.49	80.28	4.23	8.45	86.62	4.93
Social Sc.	45.53	50.97	3.50	31.52	66.54	1.95	12.06	84.82	3.12
Tech.	9.09	63.64	27.27	9.10	77.78	13.13	5.05	85.86	9.09
NSc &Health.	7.69	92.31	0.00	23.08	76.92	0.00	0.00	100.0	0.00
Hum.	94.12	5.88	0.00	52.94	47.06	0.00	23.53	76.47	0.00
Spanish	36.23	54.78	8.99	26.38	69.57	4.06	9.86	86.38	3.77
Foreigner	43.90	43.90	12.20	26.83	63.41	9.76	14.63	75.61	9.76
Entry Ex.*		0.668			0.610			0.498	

Note: (*) The figures in the last row correspond to the correlations between the (numerical) grades in each subject and the university entry-exam grades

Table 1b: Distributions of Grades by Students and School Characteristics

	Maths			***Introecon***			***Econhist***		
Grades	*S=0*	*AN=1*	*SM=2*	*S=0*	*AN=1*	*SM=2*	*S=0*	*AN=1*	*SM=2*
Male	56.64	45.41	41.67	46.08	50.75	44.44	55.00	49.54	29.41
Female	43.56	54.59	58.33	53.20	49.25	55.66	45.00	50.46	70.59
Public	62.94	28.02	41.68	65.69	32.33	55.56	55.0	40.43	47.07
Charter	14.70	25.60	19.44	12.75	24.81	11.11	15.00	22.19	11.76
Private	22.36	46.38	38.88	21.56	42.86	33.33	30.00	37.38	41.17
Social Sc.	81.81	63.28	25.00	79.41	64.28	27.77	77.50	66.26	47.05
Tech.	6.29	30.43	75.00	8.82	28.95	72.22	12.50	25.83	52.94
NSc&Health	0.70	5.81	0.00	0.30	3.75	0.00	0.00	3.95	0.00
Hum.	11.19	0.48	0.00	8.82	3.00	0.00	10.00	3.95	0.00
Spanish	87.41	91.30	86.11	89.22	90.22	77.77	85.00	90.57	76.47
Foreigner	12.59	8.70	13.89	10.78	9.78	22.23	15.00	9.43	23.53

Table 2: Grades Production Function Estimates

Dependent variable: Grades (numerical; tipified)

Variable	*Maths* Linear	*Maths* Int. Terms	*Intrecon* Linear	*Intrecon* Int. Terms	*Ecohist* Linear	*Ecohist* Int. Terms
Female	0.137** (0.066)	0.123* (0.067)	-0.079 (0.079)	-0.085 (0.080)	0.102 (0.089)	0.103 (0.090)
Foreigner	-0.068 (0.068)	-0.069 (0.111)	0.204 (0.130)	0.193 (0.132)	0.071 (0.147)	0.062 (0.149)
Charter	0.219*** (0.089)	0.322*** (0.113)	0.104 (0.107)	0.240* (0.136)	0.183 (0.121)	0.342** (0.154)
Private	0.290*** (0.077)	0.338*** (0.091)	0.240*** (0.091)	0.312*** (0.110)	0.118 (0.103)	0.259** (0.124)
Nat. Sc & Health	0.523*** (0.184)	1.088*** (0.326)	-0.044 (0.220)	0.082 (0..390)	0.031 (0.249)	0.460 (0.443)
Technical	0.676*** (0.081)	0.759*** (0.132)	0.449*** (0.097)	0.632*** (0.158)	-0.050 (0.110)	0.232 (0.180)
Humanities	-0.569*** (0.163)	-0.513*** (0.220)	-0.262 (0.194)	-0.113 (0.267)	-0.121 (0.220)	0.056 (0.301)
Entry grade	0.616*** (0.040)	0.615*** (0.042)	0.605*** (0.048)	0.590*** (0.050)	0.576*** (0.055)	0.553*** (0.056)
Course_0304	-0.469*** (0.099)	-0.490*** (0.102)	-0.234** (0.118)	-0.230* (0.121)	-0.251* (0.134)	-0.266* (0.137)
Course_0405	0.005 (0.095)	0.00 (0.096)	-0.155* (0.113)	-0.157 (0.115)	-0.226* (0.128)	-0.231* (0.130)
Course_0506	-0.375*** (0.100)	-0.390*** (0.102)	-0.302*** (0.120)	-0.302*** (0.122)	-0.384*** (0.136)	-0.747 (0.568)
Chart* N.Sc. & Hth..		-0.762* (0.432)		-0.288 (0.518)		-0.747 (0.587)
Chart*Tech.		-0.241 (0.202)		-0.412* (0.241)		-0.429 (0.273)
Chart*Hum.		0.012 (0.441)		0.048 (0.530)		-0.188 (0.600)
Priv.*N.Sc. & Hth.		-0.989** (0.449)		-0.102 (0.600)		-0.482 (0.6678)
Priv*Tech.		-0.069 (0.181)		-0.195 (0.121)		-0.447* (0.242)
Priv*Hum.		-0.196 (0..371)		-0.549 (0.445)		-0.494 (0.504)
Nº Obs.	386	386	386	386	386	386
R^2	0.607	0.614	0.435	0.443	0.275	0.287

Note: ***, **, * represent significance at 99, 95 and 90% respectively.

A constant term is included. Omitted group: males, Spanish, public school, social sciences, cohort 2002/03.

Table 3a. QR (and OLS). Maths

Dependent variable: Grades (numerical; standarized)

Covariates	Average	θ=25	θ=50	θ=75	θ=95
Female	0.137***	0.176*	0.166	0.019	0.066
	(0.066)	(0.100)	(0.163)	(0.071)	(0.133)
Foreigner	-0.068	-0.305**	-0.042	0.007	0.187
	(0.068)	(0.145)	(0.163)	(0.175)	(0.204)
Charter	0.219***	0.170	0.286***	0.320***	0.234*
	(0.089)	(0.106)	(0.116)	(0.128)	(0.134)
Private	0.290***	0.260***	0.342***	0.337***	0.361***
	(0.077)	(0.082)	(0.106)	(0.116)	(0.096)
NSc. &Health	0.523***	0.597***	0.534	0.480	0.457*
	(0.184)	(0.129)	(0.217)	(0.345)	(0.273)
Technical	0.676***	0.680***	0.614***	0.520***	0.638***
	(0.081)	(0.111)	(0.1233)	(0.097)	(0.148)
Humanities	-0.569***	-0.366***	-0.634***	-0.746***	-0.796***
	(0.163)	(0.080)	(0.182)	(0.194)	(0.228)
Entry grade	0.616***	0.704***	0..637***	0.593***	0.444***
	(0.040)	(0.056)	(0.065)	(0.051)	(0.060)
Nº Obs.	386	386	386	386	386
Pseudo-R^2	0.607†	0.393	0.425	0.428	0.416

Note: As in Table 2. Cohort dummies have also been included.

Table 3b. QR (and OLS). Introecon

Dependent variable: Grades (numerical; standarized))

Covariates	Average	θ=10	θ=50	θ=80	θ=98
Female	-0.079***	0.027	0.166	0.020	-0.040
	(0.079)	(0.105)	(0.163)	(0.081)	(0.111)
Foreigner	0.204	0.039	0.175	0.188	1.187**
	(0.130)	(0.125)	(0.163)	(0.213)	(0.521)
Charter	0.104	0.178	0.213***	0.176*	0.183*
	(0.107)	(0.206)	(0.287)	(0.103)	(0.144)
Private	0.240***	0.357***	0.387***	0.181*	0.45***
	(0.091)	(0.143)	(0.156)	(0.106)	(0.154)
N Sc. &Health	-0.044	0.277	0.534	-0.268	-0.757*
	(0.220)	(0.229)	(0.678)	(0.245)	(0.143)
Technical	0.449***	0.231	1.413***	0.48***	0.538*
	(0.224)	(0.211)	(0.243)	(0.158)	(0.283)
Humanities	-1.412***	-0.536**	-1.684***	-0.17	-0.096
	(0.097)	(0.278)	(0.282)	(0.164)	(0.148)
Entry grade	0.605***	0.578***	1.637***	0.718***	0.753***
	(0.048)	(0.099)	(0.108)	(0.081)	(0.096)
Nº Obs.	386	386	386	386	386
Pseudo-R^2	0.435†	0.264	0.425	0.375	0.506

Note: As in Table 2. Cohort dummies have also been included.

Table 3c. QR (and OLS). Econhist

Dependent variable: Grades (numerical; standarized)

Covariates	Average	θ=10	θ=50	θ=70	θ=98
Female	0.102	0.089	0.126	0.061	0.084
	(0.089)	(0.165)	(0.163)	(0.0841	(0.211)
Foreigner	0.071	-0.035	0.102	0.217*	0.0187
	(0.147)	(0.225)	(0.163)	(0.125)	(0..201)
Charter	0.183	0.211	0.213	0.196	-0.169
	(0.121)	(0.306)	(0.187)	(0.133)	(0.214)
Private	0.118	0.363*	0.387***	0.111	0.405**
	(0.103)	(0.193)	(0.126)	(0.085)	(0.203)
NSc. &Health	0.031	0.257	0.193	0.097	-0.785***
	(0.249)	(0.442)	(0.378)	(0.214)	(0.243)
Technical	-0.050	0.133	0.014	-0.093*	0.048*
	(0.110)	(0.232)	(0.163)	(0.156)	(0.253)
Humanities	-0.121	-0.324**	-0.164*	-0.090	0.365
	(0.220)	(0.314)	(0.282)	(0.154)	(0.286)
Entry grade	0.576***	0.575***	0.637***	0.608***	0.581***
	(0.055)	(0.133)	(0.088)	(0.051)	(0.109)
Nº Obs.	386	386	386	386	386
Pseudo-R^2	0.275†	0.204	0.425	0.241	0.367

Note: As in Table 2. Cohort dummies have also been included.

Table 4: Multinomial Logit (Odds ratios)

Dependent variable: Grade category

Variable	**Cat_1(3) Maths**	**Cat_2(3) Maths**	**Cat_1(3) Introeco**	**Cat_2(3) Introeco**	**Cat_1(3) Econhist**	**Cat_2(3) Econhist**
Female	1.985***	1.881*	0.610***	0.564	1.033**	1.914**
	(0.582)	(1.143)	(0.169)	(0.383)	(0.373)	(1.409)
Foreigner	0.638**	0.820	1.427	2.268	0.522*	1.845
	(0.286)	(0.795)	(0.632)	(2.238)	(0.277)	(1.711)
Charter	2.757***	2.617	3.123***	1.030**	1.328*	0.706*
	(1.062)	(2.255)	(1.202)	(1.058)	(0.689)	(0.763)
Private	3.493***	5.731	2.849***	2.072**	1.290***	1.769***
	(1.187)	(4.119)	(0.936)	(1.623)	(0.542)	(1.413)
NSc. & Health	27.37	0.000	1.242*	0.000	13.90	0.006
	(33.82)	(0.001)	(0.984)	(0.015)	(21.34)	(0.012)
Technical	7.519***	73.67**	1.931**	13.94**	2.376*	3.173*
	(3.487)	(57.25)	(0.828)	(12.10)	(1.290)	(2.683)
Humanities	0.068	0.000	0.720	0.000	0.379	0.000
	(0.073)	(0.001)	(0.395)	(0.001)	(0.248)	(0.001)
Entry grade	4.550***	53.57***	5.429***	31.71**	2.316**	12.67**
	(1.258)	(26.41)	(1.630)	(15.51)	(0.673)	(5.636)
Nº Obs.	386		386		386	
Pseudo-R^2	0.430		0.293		0.219	
Log-lik	-203.24		-205.23		-153.38	

Note: As in Table 2. Cohort dummies have also been included.

Table 5: Probit and Grades Production Function Estimates (with selection correction)

Dependent variable: Grades (numerical; standarized)

Variable	Participation Probit (Bil=1)	Variable	*Maths* Linear	*Intrecon* Linear	*Ecohist* Linear
Female	0.024 (0.033)	Female	0.126* (0.069)	-0.081 (0.083)	0.098 (0.092)
Foreigner	0.094** (0.045)	Foreigner	-0.072 (0.0600)	0.195 (0.146)	0.076 (0.156)
Entry grade	0.125 (0.247)	Charter	0.189*** (0.089)	0.112 (0.107)	0.212 (0.145)
Residence (CM)	-0.168** (0.083)	Private	0.312*** (0.084)	0.274*** (0.102)	0.126 (0.112)
		N Sc & Health	0.496*** (0.195)	-0.041 (0.220)	0.027 (0.261)
		Technical	0.694*** (0.086)	0.473*** (0.106)	0.005 (0.131)
		Humanities	-0.554*** (0.181)	-0.293 (0.212)	-0.093 (0.242)
		Entry grade	0.592*** (0.046)	0.572*** (0.052)	0.556*** (0.059)
		Lambda	0.051 (0.047)	0.023 (0.062)	0.026 (0.075)
Nº Obs.	958	Nº Obs.	386	386	386
Pseudo- R^2	0.178	R^2	0.607	0.435	0.275

Note: As in Table 2. Cohort dummies have also been included.

Figure 1: Distributions of Grades

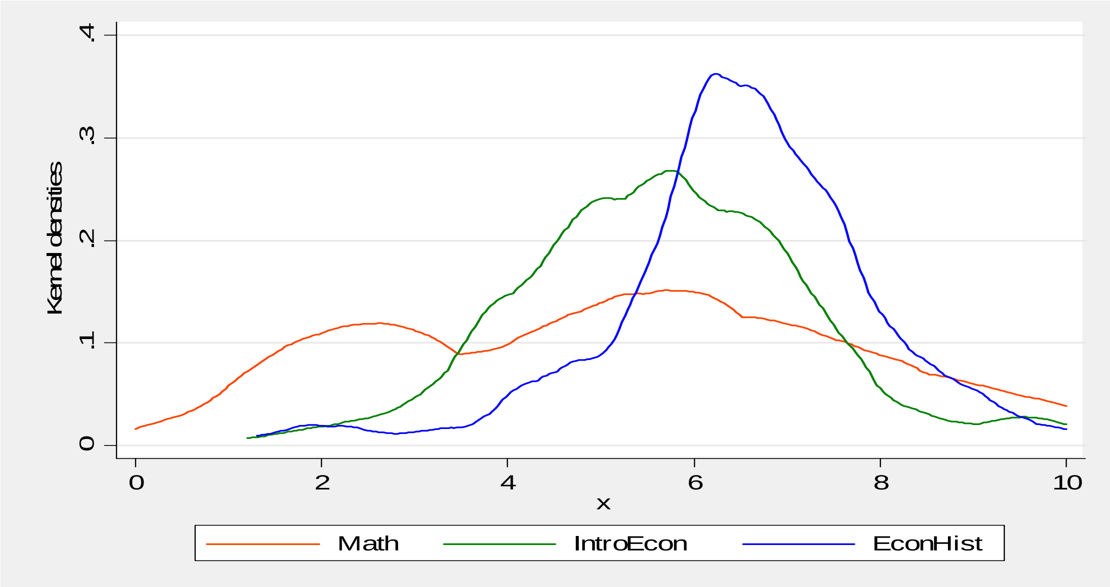

Figure 2: Distributions of Grades in *Selectividad* Exam