The Role of Upper Secondary Education on Students Performance in Mathematics at School of Business and Economics in Spain

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1. Introduction

Students experience problems with Mathematics at all levels of education. The objective of the present paper is to analyze factors affecting results in Mathematics in particular university undergraduate programs offered by the School of Business and Economics, Universidad de León (*ULE*), Spain. Factors affecting results in Mathematics such as individual, family and school attributes have been analyzed extensively in the literature (Hanushek, 1995; Case and Deaton, 1999; Bratti and Staffolani, 2002; Dolado and Morales (2006) and Capellari et al., 2012). In the present paper, we focus on the mathematical background of students when entering university. This approach is interesting from a policy angle since mathematical background could be modified by changes in secondary education or remedial courses at university. Additionally, students and parents could be made aware of the impact of secondary education choices in performance in university.

Spanish secondary education provides an opportunity to analyze the effects of mathematical background on university results since students can choose among two upper secondary school tracks with different mathematical content and depth. Namely, a *Social Science* track (*SS*) and a *Science and Technology* track (*ST*)[1].

Students who choose the *ST* instead of the *SS* track get a deeper and broader mathematical training. So, the comparison of the performance of the students from both tracks could provide evidence on the effects of more secondary education mathematical training on university results in Mathematics.

[1] There are differences both in content and formalization between the *ST* and *SS* tracks. Regarding the content, some topics are covered only in the *ST* track: Integral Calculus, some concepts of Algebra such as determinants, Trigonometry and Geometry. In the other hand, only students in the *SS* track have to take Statistics. Regarding the level of formalization, students in the *SS* track are expected to know and apply mathematical concepts and results. In the other hand, students in the *ST* track are expected to be use a higher level of mathematical formalization and do proofs.

However, this comparison is likely to be affected by self-selection bias. Namely, it is reasonable to expect that students with more mathematical ability are prone to choose the *ST* track. The result is a potential confusion between more training and more mathematical ability. In order to deal with this bias, we have collected data at *ULE* not only on personal and educational features of first year students but also on attitudes and feelings towards mathematics. In the present paper, we propose a method to mitigate the self-selection bias described above using the information on attitudes and feelings towards mathematics.

The present paper relates to a large body of literature that analyzes academic performance such as Dearden et al. (1998), Eide and Showalter, (1998) and Smith and Naylor (2001). A good review of such literature can be found in the paper by Hanusheck (1986). Another strand of literature related to the present paper analyzes performance in Mathematics. Finally, performance of particular subjects related with Business and Economic studies have been analyzed in papers such as Pozo and Stull (2006), Lagerlöf and Seltzer (2009) and Dolado and Morales (2009). In particular, these papers analyze the effects of mathematical background and skills on performance. In the present paper we study the effects of background and skills on performance in Mathematics (Capellari et al., 2012).

Our results confirm that mathematical background plays a role on results in Mathematics at university even after correcting for mathematical ability. However, the weights of background and self-reported mathematical ability are quite different for male and female students.

The structure of the paper is as follows. There is a description of the survey in Section *2*. In Section *3*, there is a discussion of the Index of Mathematical Ability Proposed in the paper and the empirical model estimated. In section 4, there is a discussion of empirical results. Finally, Section 5 provides some conclusions.

2. Description of the survey

The subjects of the survey are students at the school of Business and Economics at Universidad de León in Northwestern Spain. Precisely, freshman enrolled in four year degrees in Business, Finance, International Trade and Marketing[2]. In our analysis, we consider five groups of students since there are two groups of students enrolled in the degree of Business attending respectively morning and afternoon classes.

All students are required to take Mathematics in their first semester at university. The survey was given in the classroom, right before a lecture on Economics, at the beginning of the second semester. The number of students registered for the class in Economics (potential participants in the survey), the number of participants in the survey and the participation rate are shown in Table *1*.

Table 1: students and participants in the survey by degree

Degree	***Potential participants***	***Actual participants***	***Participation %***
INT. TRADE	*57*	*40*	*70*
MARKETING	*62*	*44*	*70*
FINANCE	*53*	*25*	*47*
BUSINESS 1	*62*	*48*	*77*
BUSINESS 2	*46*	*28*	*60*
TOTAL	*280*	*185*	*66*

The questions in the survey cover personal characteristics, socio-economic status, academic choices and academic results both in Secondary Education and University[3]. Of particular importance are a set of question aimed to

[2] The university offers also a degree in Economics with similar mathematical content in the first year. However, we decided to exclude this degree from the analysis since the grades were much lower than in the other degrees.

[3] See Appendix *1* for the questions of the survey.

uncover attitudes towards Mathematics and provide a self-assessment of mathematical ability (Castrillo and Cabrerizo, 2010).

The survey was given a few days in advance to a control group of *10* third year students. The objective of the control group was to uncover issues in the survey that could be spotted only at the time of answering the questions. We were expecting that students could find mistakes and difficulties with the questions while providing a fair assessment of the time needed to complete the survey.

3. Empirical Analysis

3.1. A proposal for an index of mathematical ability

We start the empirical section with a proposal for an index of mathematical ability. We asked students to declare their degree of agreement with *15* statements describing their feelings about mathematical work and perceptions of their own mathematical ability (see Appendix *1*). There are four degrees of agreement: *Not at All*, *Slightly*, *Quite* and *A lot* coded with integers ranging from *1* to *4*.

We propose to use of the following measure of mathematical ability. First, we run the regression of the value of the item *I am good at Mathematics* against all other *14* items:

$$z_{1i} = a_1 + \sum_{j=2}^{15} a_j z_{ji} + w_i \tag{1}$$

where the index i denotes individuals in the sample, z_{1i} is the value of the item “I am good at Mathematics”, z_{ji} ($j=2,\ldots,15$) are the values of the other items, a_j ($j=1,\ldots,15$) are coefficients to be estimated and w_i is a random disturbance.

Second, after estimating the equation in (1) by *OLS*, we use the fitted values of the regression $\hat{z}_{1i}$ as a measure of mathematical ability.

We choose the degree of agreement with the statement *I am good at Mathematics* as a focal point since it is reasonable to expect a high correlation of the agreement with this statement and mathematical ability. However, we are aware that self-assessment of any item in the survey could be subjected to a whole set of upward and downward bias. So, we try to reduce self-reporting bias by combining in a single index the information provided by students about their mathematical ability in the *15* items of the survey. For that purpose, we propose $\hat{z}_1$ as an index that aggregates the information in *14* items of the survey using as weights the partial correlation of such *14* items with the item *I am good at Mathematics*.

3.2. Empirical model

The empirical model analyzes the linear effect of a set of explanatory variables on grades in Mathematics in the first semester of university.

$$m_i = \alpha_0 + \alpha_1 T_i + \alpha_2 A_i + \sum_{j=1}^{k} \beta_j x_{ji} + u_i \qquad (2)$$

where m_i is the grade in math, T_i is a binary variables that takes the value *0* if a student chooses the *SS* track in upper secondary education and *1* if the student chooses the *ST* track, A_i is the index of mathematical ability defined above, x_{ij} denotes k control variables, u_i is a random disturbance term with the usual properties and the α's and β's are parameters to estimate.

The key parameters for the objective of the present paper are α_1 and α_2. Since T_i is a binary variable, α_1 can be written as:

$$\alpha_1 = \mathrm{E}[m_i \mid T_i = 1] - \mathrm{E}[m_i \mid T_i = 0] \qquad (3)$$

In words, a_1 measures the difference in the expected grade in Mathematics between a student who chooses the *ST* track (T_i=*1*) and a students who chooses the SS track ($T_i=0$) while all other explanatory variables are kept constant. In turn, α_2 measures the effect on the average grade in Mathematics of increasing *1* unit the index of mathematical ability while other variables are kept constant. In order to have a more intuitive interpretation of α_2, we use the standardized value of $\hat{z}_1$ as the index of mathematical ability A_i. As a result, α_2 can be interpreted as the effect on the grade in mathematics of increasing mathematical ability in a standard deviation.

4. Empirical Results

4.1. Computing an index of mathematical ability

In this section, we show the result of the estimation of the index of mathematical ability in equation (1).

First, we present the estimates of the coefficients of equation (1) that relates the item *I am good at Mathematics* with the rest of the items that evaluate feelings about Mathematics and perceptions of mathematical ability.

Table 2: Supporting regression for the index of mathematical ability

Dependent variable: I am good at Mathematics	*(N=156)*
Consta	*0.468*
Mathematics are a source of anxiety for me	*-0.088*
I enjoy doing Mathematics	*0.120*
My mind is well suited for Mathematics	*0.305* ***
I get nervous when I do not understand a problem	*0.052*
I try to avoid Mathematics	*-0.011*
Mathematics are interesting	*-0.046*
I feel confident when I do Mathematics	*-0.041*
I have aversion to Mathematics	*0.034*
I am afraid of Mathematics	*-0.098*
Mathematics are fun	*0.028*
I like to work with numbers	*-0.083*
I find Mathematics easy	*0.314* ***
I feel I have talent for solving mathematical problems	*0.241* ***
Mathematical problems are useful for my daily life.	*0.057*
R^2	*0.35*

*** Significantly different from zero at *0.01* significance level

The significantly different from zero coefficients have the expected sign. The items, *my mind is well suited to Mathematics*, *I find Mathematics easy* and *I feel I have talent for Mathematics* have a positive coefficient meaning that each one has a positive correlation with *I am good at Mathematics* keeping all other variables constant.

As it was discussed in Section *3.1*, we use as an index of mathematical ability the predicted value of the item I am good at math provided by the linear regression in Table *2*. This predicted value uses the partial correlations measured by the regression coefficients as weights to aggregate the different items measuring mathematical ability. We use the standardized value of the index.

4.2. Descriptive statistics of participants

In Table *3*, we provide sample statistics of the variables used in the empirical analysis including the standardized index of mathematical ability computed above.

Table 3: descriptive statistics

	AVERAGE	***ST. DV***	***MIN***	***MAX***
GRADE MATH	*5.18*	*1.84*	*0*	*10*
SEX	*0.55*	*0.49*	*0*	*1*
TRACK	*0.20*	*0.40*	*0*	*1*
MATH ABILITY	*0*	*1*	*-2.60*	*2.80*

Grades in the Spanish education system are in a *0 to 10* scale. The average grade in Mathematics is above the threshold passing grade of *5*. In turn, the averages of the binary variables show females make *55*% of participants while *20*% of participants chose the *ST* track in their upper secondary education.

The last row of the table shows the descriptive statistics of the index of mathematical ability. The minimum and maximum values suggest that the sample distribution is slightly skewed to the right. In other words, most students have more than average mathematical ability.

Table 4: descriptive statistics by sex, secondary education track and university degree

		GRADE MATH	*MATH ABILITY*	*OBSERVATIONS %*
SEX	***MALE***	*4.78*	*0.05*	*44*
	FEMALE	*5.49*	*-0.04*	*56*
TRACK	***SOCIAL SCI.***	*4.95*	*-0.14*	*79*
	TECHNICAL	*6.05*	*0.56*	*21*
DEGREE	***INT. TRADE***	*4.70*	*-0.07*	*22*
	MARKETING	*5.53*	*-0.44*	*22*
	FINANCE	*4.86*	*0.27*	*14*
	BUSINESS 1	*5.17*	*0.19*	*27*
	BUSINESS 2	*5.74*	*0.18*	*13*

In Table *4*, we show descriptive statistics of grades and mathematical ability stratified by sex, upper secondary education track and university degree. Average grades in Mathematics are higher for female while the average value of the proposed index of mathematical ability is around one tenth of a standard deviation higher for males than for females.

Average grades in Mathematics are substantially higher for students who chose the *ST* track in upper secondary education. As expected, students who chose the technical track in high school have a substantially higher average value of the index of mathematical ability.

The average grade in Mathematics ranges from *4.70* in International Trade to *5.74* in Business 2. Finally, the average index of mathematical ability ranges from *-0.44* in Marketing to *0.27* in Finance.

4.3. Empirical results

In Table *5*, we show the estimates of the coefficients of three versions of the linear model in equation (2). The model estimates the linear effect of Upper Secondary Education Track and Mathematical Ability on the grades in Mathematics. We estimate the model with two sets of control variables. The first set contains only the binary variables that indicate the degree in which the student is enrolled and sex while the second set includes all control variables[4]. Among all control variables, we chose to show only the coefficient of sex due to its size and significance. Furthermore, in order to analyse impact on grades of our ability measure by gender, we also report the estimated coefficients of equation (2) augmented with the interaction between sex and ability. The estimates of all the coefficients are shown in Appendix *3*.

[4] See appendix *2* for the full list of control variables.

Table 5: Coefficients of linear models explaining grades (full sample)

Dependent variable: grade in mathematics				
N=156	*Control variables: Degree and sex*	*Control variables: all*		
SEX	*0.754****	*0.631***	*0.593***	*0.593***
	(0.284)	*(0.293)*	*(0.262)*	*(0.261)*
TRACK	*1.246****	*1.341****	*0.643**	*0.653**
	(0.351)	*(0.367)*	*(0.348)*	*(0.348)*
ABILITY			*0.831****	*1.019****
			(0.139)	*(0.214)*
SEX×ABILITY				*-0.308*
				(0.268)
R^2	*0.15*	*0.22*	*0.38*	*0.39*

(*), (**) and (***) indicate that the coefficient is significantly different from zero at *0.1*, *0.5* and *0.01* significance level respectively.

The second and third columns of Table *5* contain the estimates of the coefficients of the model in (2) without the index of mathematical ability. In both cases, the coefficient of *TRACK* provides a gross measure of the effect of studying the *ST* track on grades in Mathematics. In other words, a measure of the effect of studying the *ST* track that disregards the fact that students who choose the *ST* track have, on average, a higher level of mathematical ability. The differences between the estimates in the second and third column are due to the number of control variables included in the estimation. The second column shows the estimates of the model in (2) when only the five binary variables of degree and the binary variable SEX are included. In this case, the estimates show that, on average, the grade of a female student is *0.75* points higher than the grade of her male counterpart. In turn, choosing the *ST* track increases *1.24* points the grade in

Mathematics with respect to a student choosing the *SS* track. The estimates of the same model after including all the control variables are shown in the third column. The estimates change moderately when adding family and academic characteristics as control variables. Precisely, the coefficient of *SEX* decreases while the coefficient of *TRACK* increases.

At any rate, after including all control variables, we find a substantial and significantly different from zero gross effect of studying the *ST* track in Upper Secondary Education. Precisely, an increase of *1.34* points associated with the choice of the *ST* track.

In the fourth column, we show the estimates obtained when the index of mathematical ability is included as an explanatory variable. In this case, the effect on grades of choosing the *ST* track decreases considerably. Now, choosing the *ST* track increases the grade in mathematics *0.64* points. In turn, a change of a standard deviation in mathematical ability increases the grade on Mathematics in *0.83*.

These results provide valuable evidence on the role played by mathematical background on university results and its relationship with mathematical ability. As expected, the results show that more mathematical background (namely, to choose the *ST* track) increases the grades in Mathematics at university. However, the coefficients in the fourth column show how a sizeable portion of that increase is due to the superior mathematical ability of the students who choose the track with more mathematical training. In the last column, we show coefficient estimates after the inclusion of the interaction between sex and ability. The negative sign of the interaction indicates that ability is rather less important for girls in determining math grades, although it is not statistically significant.

The coefficient of the control variable *SEX* is shown among all other control variables because it is quite large and significantly different from zero. In fact, such a large effect of the control variable *SEX* led us to estimate the model separately for male and female students. We show the estimates of the model with the sample split by genre in Table *6*.

Table 6: Coefficients of linear models explaining grades by genre

	Dependent variable: grade in mathematics			
	Male (N=69)		*Female (N=87)*	
TRACK	*1.188**	*0.577*	*1.476****	*0.700*
	(0.602)	*(0.511)*	*(0.496)*	*(0.507)*
ABILITY		*1.161****		*0.664****
		(0.228)		*(0.184)*
R^2	*0.31*	*0.54*	*0.31*	*0.41*

(*), (**) and (***) indicate that the coefficient is significantly different from zero at *0.1*, *0.5* and *0.01* significance level respectively.

The coefficients were estimated with all control variables. We choose to show only the coefficients *TRACK* and *ABILITY*. The coefficients of all control variables are shown in Appendix *3*.

The estimates in Table *6* show that the gross effect on grades of choosing the *ST* track is larger for female students. However, the inclusion of the ability index as an explanatory variable produces noticeable changes in the estimates of the coefficients. On the one hand, the coefficient of *TRACK* is not significantly different from zero for both male and female students. On the other hand, the coefficient of ability is almost twice as large for males. These results indicate that ability is the mechanism through which tracking affects math grades. Those students with more ability who tend to choose the ST, which includes more mathematical content, obtain higher grades. In particular, this effect is much stronger for male students.

Finally, we test the hypothesis that students self-select into the *ST* on the basis of ability. In Table 7, we show the estimates of two coefficients (SEX and ABILITY) of a Probit model of the choice of secondary education track. The coefficients of all control variables are shown in Appendix *3*. Clearly, ability increases the probability of choosing the *ST* track. Besides, female students are more likely to choose the *SS* track.

Table 7: Coefficients of a Probit model explaining the choice of Secondary Education Track

N=156	*Dependent variable: ST=1, SS=0*	
	Coefficient	*Standard Error*
SEX	*-0.075*	*0.286*
ABILITY	*0.666****	*0.168*

(*), (**) and (***) indicate that the coefficient is significantly different from zero at *0.1*, *0.5* and *0.01* significance level respectively.

5. Conclusion

In this paper we analyse the main determinants affecting math grades at the university level. In particular, we focus on the effect of tracking during high school and propose an index of mathematical ability that aims to mitigate students' self-selection.

Results indicate that more able students tend to choose the ST track that provides more basic mathematical skills. Notwithstanding, once ability is taken into account the effect of tracking on math grades is reduced by almost *50%*. Furthermore, ability is rather strong for males. In particular, our estimates suggest that ability is the main channel through which tracking raises math grades at university.

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Appendix 1

Survey

Personal characteristics and socioeconomic status of students

1	Age						
2	Sex			Female		Male	
3	Did you live at home while completing upper secondary education?						
	Yes		Only with mother/father			No	
4	Do you have any siblings?			Yes		No	
5	What of the following statements best describes your household						
	a) There were a lot of books at home. More than 100		There were not a lot of books at home. Between 25 and 50			b) There were few books at home. Less than 25.	

Parent's schooling

6	No graduation	Primary	Secondary	University
Father				
Mother				

Employment status of parents

Tick the alternative which better defines the employment status of your parents during when you were in Primary and Secondary school

7	Stay at home	Unemployed	Employed
Mother			
Father			

Characteristics of the student related to Secondary and Upper Secondary Education

8	Type of upper secondary school						
	Public		Charter			Private	
9	Type of math in lower secondary school ****			A		B	
10	Did you have to repeat a year in Secondary Education			Yes		No	
11	Upper Secondary Education Track						

	Arts		Science and Technology		Humanities and Social Science		

12	Did you study math in bacheleurate	Yes		No	
13	In the event you have studied math in Upper Secondary Education , what was your grade?	,			

Characteristics of the student related to University

14	Did you applied for financial aid to attend university?				Yes		No	
15	If yes, did you get financial aid to attend university?				Yes		No	
16	Work status at University							
	Full time schooling		Full time schooling with sporadic work		Half time schooling and half time job		Full time job and full time schooling	

17	Would you have liked to go to a different university?	Yes		No	
18	Would you have liked to enroll in a different Degree?	Yes		No	
19	Is this your first year studying for this Degree?	Yes		No	
20	Have you had to retake first year math?	Yes		No	
21	Have you pass first year math in your first attempt?	Yes		No	
22	What was your numerical grade in first year math? (up to one decimal place)	,			
23	What was your numerical grade in first year Economics? (up to one decimal place)	,			
24	What was your numerical grade in Economic History? (up to one decimal place)	,			
25	What is your current Grade Point Average?	,			

Attitudes toward Mathematics

What is your level of agreement with the following statements?

		Not at all	Slightly	Quite	A lot
26	Mathematics are a source of anxiety for me				
27	I feel happy when I do math				
28	My mind is well suited for Mathematics				

29	I get nervous when I do not understand a problem				
30	I try to avoid Mathematics				
31	Mathematics are interesting				
32	I feel confident when I do Mathematics				
33	I have aversion to Mathematics				
34	I am afraid of Mathematics				
35	Mathematics are fun				
36	I like to work with numbers				
37	I believe I am good at Mathematics				
38	I find Mathematics easy				
39	I feel I have talent for solving mathematical problems				
40	Mathematical problems are useful in my daily life.				

Appendix 2

List of control variables used in the analysis

Binary variable denoting the degree in which de student is enrolled: *International Trade*, *Marketing*, *Finance*, *Business 1* and *Business 2*. There are five binary variables that take the value of *1* when the student enrolls in the degree and *0* otherwise.

INTACT is a binary variable that takes the value of *1* when the student lived with both parents in Secondary School and *0* otherwise.

SIBLINGS is a binary variable that takes the value of *1* when the student has siblings and *0* otherwise.

BOOKS is a binary variable that takes the value of *1* when there was more than *100* books at home and *0* otherwise.

MOTHER ED is a binary variable that takes the value of *1* when the mother graduated from university and *0* otherwise.

FATHER ED is a binary variable that takes the value of *1* when the father graduated from university and *0* otherwise.

CHARTER is a binary variable that takes the value of *1* when the student attended a charter school and *0* otherwise.

REPEAT is a binary variable that takes the value of *1* when the student was had to repeat a year through Secondary Education and *0* otherwise.

SCHOLARSHIP is a binary variable that takes the value of *1* when the student has applied for financial aid and *0* otherwise.

OTHERUNIVERSITY is a binary variable that takes the value of *1* when the student wanted to enroll in a different university and *0* otherwise.

OTHERDEGREE is a binary variable that takes the value of *1* when the student wanted to enroll in a different degree and *0* otherwise.

SEX is a binary variable that takes the value of *1* for female students and *0* for males.

Appendix 3. Tables with all coefficients in the model

N=156	***Dependent variable: grade in mathematics***			
	Control variables: Degree and Sex	*Control variables: all*		
INT. TRADE	*4.039*	*3.235*	*4.216*	*4.155*
	(0.344)	*(0.821)*	*(0.753)*	*(0.754)*
MARKETING	*4.800*	*4.212*	*5.307*	*5.219*
	(0.357)	*(0.823)*	*(0.758)*	*(0.761)*
FINANCE	*3.946*	*3.426*	*4.119*	*4.018*
	(0.419)	*(0.868)*	*(0.785)*	*(0.789)*
BUSINESS 1	*5.305*	*4.665*	*5.290*	*5.155*
	(0.399)	*(0.771)*	*(0.697)*	*(0.706)*
BUSINESS 2	*4.552*	*4.0046*	*4.600*	*4.499*
	(0.309)	*(0.740)*	*(0.670)*	*(0.675)*
INTACT		*0.341*	*0.042*	*0.113*
		(0.483)	*(0.435)*	*(0.439)*
SIBLINGS		*0.029*	*-0.176*	*-0.143*
		(0.343)	*(0.309)*	*(0.310)*
BOOKS		*0.011*	*-0.320*	*-0.359*
		(0.315)	*(0.287)*	*(0.289)*
MOTHER ED		*0.036*	*-0.015*	*-0.007*
		(0.317)	*(0.284)*	*(0.283)*
FATHER ED		*0.264*	*0.137*	*0.105*
		(0.321)	*(0.288)*	*(0.289)*
CHARTER		*-0.161*	*-0.012*	*0.001*
		(0.311)	*(0.279)*	*(0.279)*
REPEAT		*-1.401*	*-1.224*	*-1.109*
		(0.454)	*(0.407)*	*(0.421)*
SCHOLARSHIP		*0.518*	*0.425*	*0.412*
		(0.368)	*(0.329)*	*(0.329)*
OTHER		*0.331*	*0.286*	*0.293*
UNIVERSITY		*(0.316)*	*(0.282)*	*(0.282)*
OTHER DEGREE		*-0.310*	*-0.2093*	*-0.183*
		(0.325)	*(0.291)*	*(0.292)*
SEX	*0.754*	*0.631*	*0.593*	*0.593*
	(0.284)	*(0.293)*	*(0.262)*	*(0.261)*
TRACK	*1.246*	*1.341*	*0.643*	*0.653*
	(0.351)	*(0.367)*	*(0.348)*	*(0.348)*
ABILITY			*0.831*	*1.019*
			(0.139)	*(0.214)*
SEX×ABILITY				*-0.308*
				(0.268)
R^2	*0.15*	*0.22*	*0.39*	*0.39*

	Dependent variable: grade in mathematics			
	Male (N=69)		*Female (N=87)*	
INT. TRADE	*4.619*	*4.910*	*2.666*	*3.992*
	(1.243)	*(1.028)*	*(1.094)*	*(1.076)*
MARKETING	*5.438*	*5.952*	*3.540*	*4.968*
	(1.206)	*(1.001)*	*(1.132)*	*(1.119)*
FINANCE	*4.439*	*4.216*	*3.206*	*4.365*
	(1.288)	*(1.065)*	*(1.175)*	*(1.133)*
BUSINESS 1	*6.291*	*5.664*	*3.944*	*5.197*
	(1.114)	*(0.928)*	*(1.088)*	*(1.065)*
BUSINESS 2	*5.270*	*5.043*	*3.614*	*4.649*
	(1.075)	*(0.889)*	*(1.044)*	*(1.007)*
INTACT	*-0.579*	*-0.240*	*1.084*	*0.470*
	(0.723)	*(0.601)*	*(0.672)*	*(0.644)*
SIBLINGS	*-0.061*	*0.033*	*0.089*	*-0.231*
	(0.606)	*(0.500)*	*(0.425)*	*(0.403)*
BOOKS	*0.312*	*-0.216*	*0.169*	*-0.135*
	(0.549)	*(0.465)*	*(0.418)*	*(0.396)*
MOTHER ED	*-0.027*	*0.034*	*-0.060*	*-0.174*
	(0.520)	*(0.429)*	*(0.410)*	*(0.380)*
FATHER ED	*-0.557*	*-0.697*	*0.945*	*0.881*
	(0.522)	*(0.432)*	*(0.423)*	*(0.391)*
CHARTER	*-0.448*	*-0.345*	*0.121*	*0.299*
	(0.494)	*(0.408)*	*(0.420)*	*(0.392)*
REPEAT	*-1.49*	*-0.638*	*-1.802*	*-2.016*
	(0.686)	*(0.591)*	*(0.671)*	*(0.623)*
SCHOLARSHIP	*1.021*	*0.757*	*0.256*	*0.144*
	(0.569)	*(0.473)*	*(0.498)*	*(0.461)*
OTHER	*0.071*	*0.207*	*0.748*	*0.619*
UNIVERSITY	*(0.480)*	*(0.397)*	*(0.429)*	*(0.398)*
OTHER DEGREE	*-0.783*	*-0.627*	*-0.236*	*-0.112*
	(0.513)	*(0.425)*	*(0.449)*	*(0.416)*
TRACK	*1.188*	*0.577*	*1.476*	*0.700*
	(0.602)	*(0.511)*	*(0.496)*	*(0.507)*
ABILITY		*1.161*		*0.664*
		(0.228)		*(0.184)*
R^2	*0.31*	*0.54*	*0.31*	*0.41*

	Dependent variable: grade in mathematics	
	SS Track (N=124)	*ST Track (N=32)*
INT. TRADE	*3.310*	*5.474*
	(0.955)	*(1.514)*
MARKETING	*4.669*	*6.009*
	(0.966)	*(1.332)*
FINANCE	*3.555*	*4.474*
	(1.005)	*(1.404)*
BUSINESS 1	*4.632*	*6.392*
	(0.880)	*(1.660)*
BUSINESS 2	*4.194*	*4.477*
	(0.832)	*(1.242)*
INTACT	*0.298*	*-0.495*
	(0.545)	*(0.951)*
SIBLINGS	*0.225*	*-1.244*
	(0.394)	*(0.621)*
BOOKS	*-0.291*	*-0.093*
	(0.331)	*(0.658)*
MOTHER ED	*-0.080*	*0.234*
	(0.343)	*(0.566)*
FATHER ED	*0.414*	*-0.812*
	(0.355)	*(0.562)*
CHARTER	*-0.051*	*1.067*
	(0.325)	*(0.758)*
REPEAT	*-1.548*	*-0.106*
	(0.478)	*(0.998)*
SCHOLARSHIP	*0.414*	*0.669*
	(0.389)	*(0.645)*
OTHER	*0.234*	*0.822*
UNIVERSITY	*(0.345)*	*(0.562)*
OTHER	*-0.0732*	*-0.266*
DEGREE	*(0.361)*	*(0.576)*
SEX	*0.575*	*0.619*
	(0.306)	*(0.636)*
ABILITY	*0.681*	*1.031*
	(0.166)	*(0.293)*
R^2	*0.33*	*0.78*

Probit model

N=156	*Dependent variable:; ST=1, SS=0*	
	Coefficient	*Standard Error*
INT. TRADE	*-0.188*	*0.769*
MARKETING	*-0.517*	*0.754*
FINANCE	*0.017*	*0.760*
BUSINESS 1	*-1.060*	*0.761*
BUSINESS 2	*-0.367*	*0.674*
INTACT	*-0.368*	*0.425*
SIBLINGS	*-0.738*	*0.325*
BOOKS	*-0.983*	*0.354*
MOTHER ED	*0.038*	*0.313*
FATHER ED	*-0.117*	*0.308*
CHARTER	*1.228*	*0.350*
REPEAT	*0.533*	*0.436*
SCHOLARSHIP	*-0.163*	*0.370*
OTHER UNIVERSITY	*0.108*	*0.305*
OTHER DEGREE	*0.281*	*0.311*
SEX	*-0.075*	*0.286*
ABILITY	*0.666*	*0.168*