

# **Working Paper Series**

## **No. 13**

### **The determinants of success in university entrance**

Anabela Botelho  
Lígia Costa Pinto  
Miguel Portela  
António Silva

September 2001

**Núcleo de Investigação em Microeconomia Aplicada  
Universidade do Minho**



# The determinants of success in university entrance

Anabela Botelho\*  
Universidade do Minho and NIMA

Lúgia Costa Pinto  
Universidade do Minho and NIMA

Miguel Portela  
Universidade do Minho and NIMA

António Silva  
NIMA

August 2001

## Abstract

This paper proposes that high school graduates applying to higher education institutions do not have equal chances of succeeding. Therefore, admission outcomes must be taken into account by researchers and policy makers analysing college-going behaviour and the equity and efficiency of higher education systems.

*Keywords:* Educational economics, higher education, chances of success

*JEL classification:* I2

---

\* Corresponding author: Escola de Economia e Gestão, Universidade do Minho, Campus de Gualtar, 4710-057 Braga, Portugal. Tel.:+351-253-604538; fax:+351-253-676375; e-mail:botelho@eeg.uminho.pt. We gratefully acknowledge the collaboration of the Direcção-Geral do Ensino Superior (DGESUP). The research presented was supported by funding from the Fundação para a Ciência e a Tecnologia (FCT) through grant PRAXIS/C/ECO/13014/98. The DGESUP, FCT, and NIMA are not responsible for our research findings and policy implications.

## 1. Introduction

Much recent research has been devoted to the evaluation of the factors that influence the decision of high-school graduates to pursue further education. One line of research in this field uses time-series data to examine the determinants of the demand of groups of students for higher education. Examples include Campbell and Siegel (1967), Pissarides (1982) and Wetzal et al. (1998). Another line of research uses cross-sectional data to estimate models explaining the college-going decision of individual students. Examples include Christensen et al. (1975), Fuller et al. (1982), Ehrenberg and Sherman (1984), Kodde and Ritzen (1988), López-Valcárcel and Quintana (1998), DesJardins et al. (1999) and Toutkoushian (2001). This research contributes greatly to the understanding of college-going behaviour, and can help in the formulation of educational policy in at least two ways. On the one hand, these studies help to explain and hence to predict the demand for higher education. On the other hand, they can be used to evaluate the extent into which the policy goal of equal access to higher education has been achieved.

However, most of these studies use enrolments as the measure of student demand, assuming, implicitly or explicitly, that there are no institutional constraints to university entrance meaning that anyone possessing a high-school diploma has access to at least one institution of higher education. If this assumption is incorrect, estimated regression coefficients from demand equations specified as single-equation functions are biased and inconsistent. While the assumption of unconstrained access to institutions of higher education may not be too restrictive in systems with relatively open enrolment policies, it might seriously affect the analysis of student demand for higher education in countries with *numerus clausus* admission controls systems. In such cases, enrolment figures reflect both student demand *and* the number of places made available at national levels,

making it difficult to identify whether variations in enrolments are due to variations in student demand or in institutional supply. Moreover, students admitted and enrolled in higher education institutions potentially have characteristics that systematically differ from applicants who are denied admission, specially in countries where educational capacity falls substantially below demand.<sup>1</sup> Failure to take into account the admission process, therefore, limits the inferences that can be drawn from existing studies concerning the equity of the higher education system in those countries. It is the purpose of this study to show that students from applicant pools do not have equal chances of being admitted in higher education institutions holding constant important characteristics such as academic achievement, and an attempt is made to identify the determinants of success in university entrance.

## **2. The education system in Portugal**

Education in Portugal is predominantly funded by the state, but fee-charging private institutions are also available for all educational levels.<sup>2</sup> Currently, compulsory education takes nine years, and students aged 15 or older who successfully complete compulsory education have open access to secondary education. Education at this level runs for three years, and can take the form of general education, technological courses, vocational studies, or art courses.<sup>3</sup> General education is organized into four branches of study: scientific and natural, arts, economic and social, and humanities. National final examinations are taken at the end of the three years and successful students, as

---

<sup>1</sup> See, for example, Mizala and Romaguera (2000) documenting that in Chile only 15 percent of university students come from the 40 percent lowest-income families mainly due to a selective university entrance process in which only 40 percent of the applicants are admitted.

<sup>2</sup> In 1997, less than 18 percent of the portuguese student population attended private institutions (EURYBASE, <http://www.eurydice.org>).

<sup>3</sup> Special education is also available, and is generally delivered in mainstream schools with local support structures. More detailed information on the education system in Portugal and other European countries can be obtained from the EURYDICE (Education Information Network in Europe) database EURYBASE.

measured by school and exam results, receive a diploma and can apply to higher education institutions. Higher education is provided in universities, polytechnics, and higher education establishments at university or polytechnic level. Institutions set *numerus clausus* for all courses, specify a minimum entrance requirement for their various courses, and applicants may make up to six choices of course and institution in rank order. Selection is based on a weighted average of the mark in the student's secondary school certificate and the exam results in subjects specified by the institution. The institution determines the weight given to each of these components, and also sets minimum marks for admission.

### **3. Data and empirical results**

The data used in the paper were collected through a national survey administered by NIMA<sup>4</sup> in collaboration with the Directorate General for Higher Education, the Portuguese Ministry of Education's central service responsible for organizing the procedure for students' application to higher education. A total of 12473 questionnaires were sent out during August 2000 to be completed by the students at the same place where they were submitting their application form to public higher education.<sup>5</sup> Although there were 4716 replies (a response rate of 38 percent), only 2356 replies are used in our analysis, corresponding to the students who gave complete information on all the variables used in this paper. The variables used in the analysis as well as the descriptive statistics for the sample are shown in Table 1.

---

<sup>4</sup> NIMA is an applied microeconomics research unit at the University of Minho, Portugal.

<sup>5</sup> The number of questionnaires sent out corresponded to 25 percent of the total number of applicants to public higher education in year 2000.

Table 1 – Definition of variables and descriptive statistics for the sample

Variables	Description	Mean
<i>Personal and demographic characteristics</i>		
Female	Dummy variable, 1 if female, 0 otherwise	0.65
Age	Age in years	19.1
Siblings	Dummy variable, 1 if student has siblings, 0 otherwise	0.73
Region of residence	Set of dummy variables for the region of residence	
NorthC	1 if resides in Northern coastal region, 0 otherwise	0.18
CenterC	1 if resides in Central coastal region, 0 otherwise	0.20
Lisbon	1 if resides in Lisbon-and-Tagus-Valley region, 0 otherwise	0.33
Inland (North-and-Center)	1 if resides in Northern and Central inland region, 0 otherwise	0.16
South	1 if resides in Alentejo and Algarve region, 0 otherwise	0.10
Islands	1 if resides in Portuguese islands (Madeira and Azores), 0 otherwise	0.03
Father and Mother	Dummy variable, 1 if both father and mother live in the household, 0 otherwise	0.85
Parents' Education	Set of dummy variables indicating the highest level of education attained by the student's father or mother	
ParEdu1	1 if less than 4 years of education, 0 otherwise	0.01
ParEdu2	1 if completed 6 years of education, 0 otherwise	0.38
ParEdu3	1 if completed 9 years of education, 0 otherwise	0.13
ParEdu4	1 if completed 12 years of education, 0 otherwise	0.18
ParEdu5	1 if college, master or doctoral degree, 0 otherwise	0.29
Work	Dummy variable, 1 if student ever worked for pay, 0 otherwise	0.34
<i>Educational characteristics</i>		
General	Dummy variable, 1 if attended general education in secondary school, 0 otherwise	0.97
Field of Study	Set of dummy variables for field of study attended in general education in secondary school	
Scientific and natural	1 if scientific and natural, 0 otherwise	0.58
Arts	1 if arts, 0 otherwise	0.07
Economic and social	1 if economic and social, 0 otherwise	0.12
Humanities	1 if humanities, 0 otherwise	0.23
Fail	Dummy variable, 1 if student failed to make progress in at least one academic year during basic or secondary school, 0 otherwise	0.49
Mark (range 0 to 20)	Student's combined secondary school and national exam results as are taken into account by higher education institutions for admission	14.4
Success	Dummy variable, 1 if student was admitted by a higher education institution, 0 otherwise	0.73
No. observations		2356

Information obtained from the Directorate General for Higher Education indicates that the composition of the sample by gender and entry success rates is similar to the composition of the universe.<sup>6</sup> Table 2 reports binomial probit estimates of the determinants of success for the whole sample. To aid in interpretation, the coefficient estimates reported are the marginal effects evaluated at the sample means of all the variables, showing the impact of each variable on the probability of an applicant being admitted to a course/institution in his/her choice set.

Table 2 – Binomial probit estimates of probability of success

Variables	Coefficient	Std. Error	Significance Level
Female	-0.057	0.019	0.003
Age	0.001	0.005	0.871
Siblings	0.022	0.022	0.302
<i>Region of residence:</i>			
NorthC	-0.017	0.028	0.530
CenterC	0.028	0.025	0.275
Inland	0.072	0.026	0.009
South	0.037	0.030	0.235
Islands	-0.130	0.064	0.029
Father and Mother	0.039	0.028	0.155
<i>Parents' Education:</i>			
ParEdu2	0.005	0.004	0.237
ParEdu3	0.004	0.003	0.178
ParEdu4	0.002	0.002	0.296
ParEdu5	0.002	0.002	0.248
Work	-0.019	0.021	0.351
General	-0.112	0.061	0.048
<i>Field of Study:</i>			
Arts	-0.025	0.039	0.510
Economic and social	0.163	0.021	0.000
Humanities	0.031	0.022	0.171
Fail	-0.025	0.021	0.220
Mark	0.059	0.006	0.000
Chi-square ( <i>df</i> )	231.26 (20)		0.000

<sup>6</sup> In 1999, females accounted for about 60 percent of the applicant pool, and about 75 percent of the applicants were admitted in higher education institutions (Directorate General for Higher Education-*Direcção-Geral do Ensino Superior* (<http://www.desup.min-edu.pt>)).

As expected, given that it is taken as a method of rationing higher education places, students' application marks play an important role in determining success in higher education institutions' entrance. The results show that a one-unit increase in students' application marks increases the probability of success by about 6 percentage points, and the effect is highly statistically significant. The effect of Fail, which is taken as a further measure of students' academic ability, has the expected negative sign but is insignificant. Students taking general education in secondary school (which account for 97 percent of the sample) are, *ceteris paribus*, 11.2 percent less likely to succeed in entering higher education institutions than similar students taking technological, vocational or art courses. A possible explanation for this result might be that students taking more career-oriented courses are more likely to apply to higher education institutions with less stringent admission requirements.

Having studied the economic and social field significantly improves the probability of success. The results show that these students are 16.3 percent more likely to enter a higher education institution than their peers who studied the scientific and natural field (the reference category). Likewise, students taking the humanities' field are more likely to succeed in higher education entrance, but the effect is not statistically significant at conventional levels. These results may be reflecting constraints in the supply of spaces made available by higher education institutions for courses likely to be chosen by students studying scientific and natural subjects while in general secondary education, or quite stringent requirements for admission in those courses. These findings clearly have potential educational policy implications. First, if admission controls are supposed to restrain the oversupply of graduates in certain fields, our findings suggest that the Portuguese education system is not performing well in this respect given that there appears to be an excess number of college graduates in the economic and social, and



humanities specializations, while there is a shortage of graduates in the scientific and natural specializations (European Commission, 1999). Secondly, if secondary school students wishing to pursue higher education base in part their choice of study field in the success in entrance to higher education institutions of earlier cohorts, they might be discouraged from choosing scientific and natural subjects because they expect lower chances of success in admission to those specializations.

With respect to the set of personal and demographic variables included in the analysis, only gender and two of the region of residence' indicators, taken as proxies for geographic barriers to access, are significant predictors of the probability of success. Students living in the northern and central coastal region are more likely, and students coming from the Portuguese islands less likely, to succeed in higher education entrance than their counterparts living in the Lisbon-and-Tagus-Valley region (the omitted category). *Ceteris paribus*, females are 5.7 percent less likely to being admitted to a higher education institution than their male counterparts. A tentative explanation for this result might be that female students select courses/institutions for which more supply constraints or more selective requirements are in place.<sup>7</sup> This effect might therefore be reflecting supply side as well as demand side effects.

#### **4. Conclusions**

It has been shown in this paper that the assumption of unconstrained access to institutions of higher education might seriously limit the usefulness of existing studies for explaining and predicting the demand for higher education. The results suggest that students' ability, secondary-school choices, and personal characteristics affect the

---

<sup>7</sup> The raw data show higher levels of academic ability for female students (mean marks are 14.6 and 14.2 for female and male students, respectively), and evidence found for the United States suggests that more able students are more likely to apply to more selective institutions. See, for example, Manski and Wise (1993), and Toutkoushian (2001).

probability of success in higher education entrance. These findings should be of interest both to educational choice researchers and policy makers concerned about assessing and improving the efficiency and the equity of higher education systems.

## References

- Campbell, R. and B. Siegel, 1967, The demand for higher education in the United States, 1919-1964, *The American Economic Review* 57, 482-494.
- Christensen, S., J. Melder and B.A. Weisbrod, 1975, Factors affecting college attendance, *The Journal of Human Resources* 10, 174-188.
- Clements, B., 1999, The efficiency of education expenditures in Portugal, WP/99/179, Working Paper of the International Monetary Fund.
- DesJardins, S.L., H. Dunbar and D.D. Hendel, 1999, Modeling the college application decision process in a land-grant university, *Economics of Education Review* 18, 117-132.
- Ehrenberg, R. and D. Sherman, 1984, Optimal financial aid policies for a selective university, *The Journal of Human Resources* 19, 201-230.
- European Commission, 1999, Key data on education in Europe (Office for Official Publications of the European Communities, Luxemburg).
- Fuller, W.C., C.F. Manski and D.A. Wise, 1982, New evidence on the economic determinants of postsecondary schooling choices, *The Journal of Human Resources* 17, 477-495.
- Kodde, D.A. and J.M.M. Ritzen, 1988, Direct and indirect effects of parental education level on the demand for higher education, *The Journal of Human Resources* 23, 356-371.
- López-Valcárcel, B.G. and D.D. Quintana, 1998, Economic and cultural impediments to university education in Spain, *Economics of Education Review* 17, 93-103.
- Manski, C. and D.A. Wise, 1993, *College choice in America* (Harvard University Press, Cambridge, Massachusetts).
- Mizala, A. and P. Romaguera, 2000, School performance and choice: the Chilean experience, *The Journal of Human Resources* 35, 392-417.
- Pissarides, C.A., 1982, From school to university: the demand for post-compulsory education in Britain, *The Economic Journal* 92, 654-667.
- Toutkoushian, R.K., 2001, Do parental income and educational attainment affect the initial choices of New Hampshire's college-bound students?, *Economics of Education Review* 20, 245-262.
- Wetzel, J., D. O'Toole and S. Peterson, 1998, An analysis of student enrolment demand, *Economics of Education Review* 17, 47-54.

Working Papers - NIMA series

No.

1. Lígia Pinto , Glenn Harrison, *Multilateral negotiations over climate change policy*, May 2000
2. Paulo Guimarães, Douglas Woodward, Octávio Figueiredo, *A tractable approach to the firm location decision problem*, May 2000
3. Miguel Portela , *Measuring skill: a multi-dimensional index*, September 2000
4. Rosa Branca Esteves , Paulo Guimarães, *Price discrimination and targeted advertising: a welfare analysis*, November 2000
5. Anabela Botelho , Lígia Pinto , *Has Portugal gone wireless? Looking back, looking ahead*, December 2000
6. Pedro Barros, Clara Dismuke , *Hospital production in a national health service: the physician's dilemma*, December 2000
7. Anabela Botelho , Mark A. Hirsch, Elisabet E. Rutström, *Culture, nationality and demographics in ultimatum games*, December 2000
8. Miguel Portela , *The impact of segregation on wage inequality: a look at recruitment and pay policies at the firm level*, January 2001
9. Pedro Portugal, Ana Rute Cardoso, *Disentangling the minimum wage puzzle: an analysis of job accessions and separations from a longitudinal matched employer-employee data set*, April 2001
10. Ana Rute Cardoso, Priscila Ferreira , *The dynamics of job creation and destruction for University graduates: why a rising unemployment rate can be misleading*, May 2001
11. Octávio Figueiredo, Paulo Guimarães, Douglas Woodward, *Asymmetric information and location*, July 2001
12. Anabela Botelho , Lígia Pinto , *Hypothetical, real, and predicted real willingness to pay in open-ended surveys: experimental results*, September 2001
13. Anabela Botelho , Lígia Pinto , Miguel Portela , António Silva, *The determinants of success in university entrance*, September 2001

14. Anabela Botelho , *Strategic behavior at trial. The production, reporting, and evaluation of complex evidence*, September 2001
15. Paulo Guimarães, *The state of Portuguese research in economics: an analysis based on publications in international journals*, September 2001
16. Anabela Botelho , Glenn Harrison, Marc Hirsch, Elisabet E. Rutström, *Bargaining behavior, demographics and nationality: a reconsideration of the experimental evidence*, December 2001
17. João Cerejeira da Silva , *Identification of the Portuguese industrial districts*, February 2002
18. Octávio Figueiredo, Paulo Guimarães, Douglas Woodward, *Modeling industrial location decisions in U.S. Counties*, April 2002
19. Aslan Zorlu , Joop Hartog, *The effect of immigration on wages in three European countries*, October 2002
20. Elvira Lima , David K. Whynes, *Finance and performance of Portuguese hospitals*, February 2003
21. Aslan Zorlu , *Do ethnicity and sex matter in pay? Analyses of 8 ethnic groups in the Dutch labour market*, June 2003
22. Cécile Wetzels , Aslan Zorlu , *Wage effects of motherhood: a double selection approach*, June 2003
23. Natália Barbosa , *What drives new firms into an industry? An integrative model of entry*, October 2003
24. Elvira Lima , Teresa Josefina Lopes Esquerdo , *The economic costs of alcohol misuse in Portugal*, October 2003
25. Anabela Botelho , Lígia Pinto , Isabel Rodrigues , *How to comply with environmental regulations? The role of information*, October 2003
26. Natália Barbosa , Helen Louri, *Corporate performance: does ownership matter? A comparison of foreign - and domestic - owned firms in Greece and Portugal*, October 2003
27. Anabela Botelho , Lígia Pinto , *Students' expectations of the economic returns to college education. Results of controlled experiment*, December 2003

28. Paula Veiga , *Income-related health inequality in Portugal*, July 2005
29. Anabela Botelho , Glenn Harrison, Lúcia Pinto , Elisabet E. Rutström, *Testing static game theory with dynamic experiments: a case study of public goods*, November 2005
30. Anabela Botelho , Glenn Harrison, Lúcia Pinto , Elisabet E. Rutström, *Social norms and social choice*, November 2005
31. Anabela Botelho , Glenn Harrison, Lúcia Pinto , Elisabet E. Rutström, Paula Veiga , *Discounting in developing countries: a pilot experiment in Timor-Leste*, November 2005
32. Paula Veiga , Ronald P. Wilder , *Maternal smoking during pregnancy and birthweight - A propensity score matching approach*, January 2006

---

The Working Papers of the Applied Microeconomics Research Unit (NIMA) can be downloaded in PDF format from <http://nima.eeg.uminho.pt>

---