476

Carlos Rodrigues VIEIRA,
Isabel Viegas VIEIRA

DETERMINANTS AND PROJECTIONS OF DEMAND FOR HIGHER EDUCATION IN PORTUGAL

Abstract

Place the abstract of you Article This paper formulates a model of demand for higher education in Portugal considering a wide range of demographic, economic, social and institutional explanatory variables. The estimation results suggest that the number of applicants reacts positively to demographic trends, graduation rates at secondary education, female participation, compulsory schooling and the recent Bologna process. Demand reacts negatively to the existence of tuition fees and to unemployment rates. Within an adverse demographic and economic context, forecasts of demand for the next two decades suggest the need to increase participation rates, to avoid funding problems in the higher education system and increase long-term economic development prospects.

Key words:

Demand for higher education; determinants of university participation; applications forecasting.

JEL: I20; I22, I28.

Vieira Carlos Rodrigues, CEFAGE-UE and Universidade de Évora, Portugal.
Vieira Isabel Viegas, CEFAGE-UE and Universidade de Évora, Portugal.

1. Introduction

After half a century of dictatorship, when access to higher education was restricted to a handful of students from the social and economic elite, Portugal experienced a massive educational expansion in the last quarter of the twentieth-century. In this period, the country displayed the highest OECD growth rate of university enrolments, with an annual compound rate close to 6 percent and an almost sevenfold increase in the number of applications. However, by the mid 1990s, the total number of applicants fell around 40 percent, and has since followed a wobbly downward trend. As shown below, demographic factors have been important but cannot fully explain the Portuguese demand for higher education. A deeper analysis is needed to uncover other determinants.

In this study, we investigate the demand for higher education in Portugal, searching for the main factors influencing its past behaviour and attempting to anticipate its development in the next two decades. In order to identify the demand determinants, we estimate an aggregate demand model for the period 1977 to 2010. Subsequently, the estimated model is used to produce tentative demand forecasts up to 2027. The results suggest that demographics, secondary education success rates, female participation, unemployment and some institutional reforms in secondary and tertiary education are statistically significant demand determinants. According to our forecasts, the number of applicants is expected to first decrease for four or five years, mainly following negative demographic and economic developments, and later to recuperate to levels observed in the late 1980s.

The concept of demand adopted in the study relates demand with the desire and the capacity to afford a good or a service. Demand for higher education is a demanded quantity measured by the head count of applicants to public institutions. Demand may also be defined as a relationship between prices (tuition fee levels) and quantities (number of applicants). Such definition, referring to a demand curve, is however of little use in the Portuguese context, given the relatively low level of tuition fees and the fact that poor students are exempt from their payment.

This research may be of interest for both policymakers and individual institutions. Portuguese higher education institutions are highly dependent on public money, mainly allocated according to the number of enrolled students, and have accordingly been experiencing severe funding shortages. Forecasting demand is therefore useful to inform their funding, staff management, tuition and recruitment policies. For policymakers, understanding the trends in demand is crucial for the optimal design of the higher education system, for long-term budget

478 **C a r l o s   R o d r i g u e s   V i e i r a ,   I s a b e l   V i e g a s   V i e i r a**
Determinants and Projections of Demand
for Higher Education in Portugal

planning, for a more correct management of the *numerus clausus* system[1] and, more importantly, to anticipate the overall effects of academic qualifications on social and economic development. Evidence linking higher education to economic growth justifies the implementation of policies aimed at increasing participation rates, in a country displaying low rates of tertiary education attainment and showing no signs of relative improvement in the last decade[2].

Though the study is focused on the specific Portuguese circumstances, its policy implications are also relevant in other contexts. The pool of applicants to higher education is often larger than that of new enrolments, and studies of demand based on information on enrolled students are incomplete and may fail to identify some significant determinants. For lack of available data, our analysis cannot be replicated in locations where applications to higher education are not centralised, but its results, namely information on which variables are statistically significant and on the nature of their impact upon demand, may be of interest to policy makers and to institutions in other locations.

The remainder of the paper is organised as follows. The next section surveys the empirical literature on demand for higher education. Section three describes the recent evolution of higher education in Portugal. Section four provides the estimation of the demand model which allows forecasting for the next few years. Concluding remarks and policy implications are provided in the final section.

2. Literature Survey

The empirical literature on demand for higher education began with Campbell and Siegel's (1967) study of tertiary education enrolments in the United States (US). From this seminal work, a prolific and diverse literature developed. We briefly survey the most relevant studies, sorting them out in terms of scope, motivation, focus and methodological approaches.

Some studies of demand estimated national or regional demand functions, to address funding issues or the optimal number and geographical dispersion of institutions. Most were focused on the US (for instance, Galper and Dunn, 1969; Corazzini, Dugan and Grabowski, 1972; or McPherson and Schapiro, 1991), but other countries have also been examined. Examples are Australia (Nicholls, 1984), Greece (Psacharopoulos and Soumelis, 1979), Belgium (Duchesne and Nonneman, 1998), or Canada (Christofides, Hoy and Yang, 2008). Other studies assessed demand for a particular institution, investigating what motivates or inhibits students to favour one university, and are use-

---

[1] The *numerus clausus system* is a quota imposed on each study programme offered by Portuguese institutions.
[2] In 2000, only 7 percent of the Portuguese, aged between 25 and 64 years, had attended tertiary education, well below the OECD average of 23 percent. In 2008, this share increased, respectively, to 13 percent and 28 percent.

ful tools for institutional strategic planning (e. g., on the US, Hoenack and Weiller 1979; DesJardins, Dundar, and Hendel, 1999; and Buss, Parker and Rivenburg, 2004). A few analyses have also identified demand for a specific scientific area (e. g. Freeman, 1971), either to adjust supply or to induce demand towards key strategic areas.

A number of studies, mainly motivated by particular social concerns, examined equity of access and participation in higher education. Focusing on the US, McPherson and Schapiro (1991) and Buss, Parker and Rivenburg (2004) analysed some aspects of potential economic discrimination, such as household income, student aid, tuition and other costs. Social discrimination, either in class, gender or ethnicity was studied by Wetzel, O'Toole and Peterson (1998), Sissoko and Shiau (2005), and Christofides, Hoy and Yang (2010). Sá, Florax and Rietveld (2004) evaluated geographical discrimination in the Netherlands, namely due to travel and accommodation costs.

A separate distinction may also be drawn between student choice and student demand models. While the latter approach employs aggregate data (examples include Hoenack and Weiler, 1979; or Duchesne and Nonneman, 1998), the former, more frequent, focuses on the individual, using large longitudinal survey data and logistic regression techniques (see McPherson and Schapiro, 1991; DesJardins, Dundar, and Hendel, 1999; and Christofides, Hoy and Yang, 2008, among others). The latter approach, adopted in our study, is more adequate to examine effects which can only be picked up over long periods.

Finally, most papers tested hypotheses of demand behaviour but very few attempted to go a step further and presented enrolment projections. Some decades ago, Hoenack and Weiler (1979) and Ahlburg, Crimmins and Easterlin (1981) produced such projections for the US, based on econometric models. More recently, also for the US, Murdoch and Hoque (1999) used a simple extrapolation of trends, exclusively focusing on demographic factors, to project enrolments.

The approach in this paper differs in several aspects. We estimate an aggregate model of demand for higher education with the number of applicants as the dependent variable. Though enrolments are typically used in this type of empirical studies, applications avoid some common conceptual and methodological problems[3]. Data on applicants comprise information on all individuals

---

[3] The use of data on enrolments is possibly not a deliberate choice, but rather imposed by unavailable information on applicants. In most higher education systems, individuals apply directly to as many distinct institutions as they want. In Portugal, applications are centralised and consistent data have been collected for a long period. To apply to a Portuguese public institution, candidates rank their preferences for six pairs of institution/study programmes and compete for a fixed number of places, assigned in accordance to grades. The Portuguese higher education system is highly regulated, with ministerial approval required, inter alia, to create new institutions and study programmes, to define the number of offered places or the interval within which institutions may set tuition fees. The number of available places in the public sector is defined by a system of *numerus clausus*. Private universities and polytechnic schools are, with a few exceptions, still mainly sought out by those unable to enter public institutions.

480 | **Carlos Rodrigues Vieira, Isabel Viegas Vieira**
Determinants and Projections of Demand
for Higher Education in Portugal

wishing to attend higher education, rather than solely on those having their wishes fulfilled, that is, those who actually enrolled in an institution. This is especially relevant in higher education systems that restrict the number of available places, for in such cases enrolments provide a more clear depiction of supply than of demand. Furthermore, unlike total enrolments, applications are not directly dependent on the duration of study programmes. The reduction of programmes' length, for instance following the adoption of the Bologna guidelines, may lead to a decrease of total enrolments, even if demand increases or remains unchanged.

The use of applications to proxy demand as the dependent variable in the model is thus an important contribution of this paper to the literature on demand for higher education. A second contribution is the wide range of explanatory variables included in the model, comprising demographic, economic, social and institutional factors. Thirdly, the model allows the analysis of the initial impact of the Bologna process upon aggregate demand. Finally, we go beyond the usual focus on hypothesis testing and propose a forecast of the number of applicants for the next two decades.

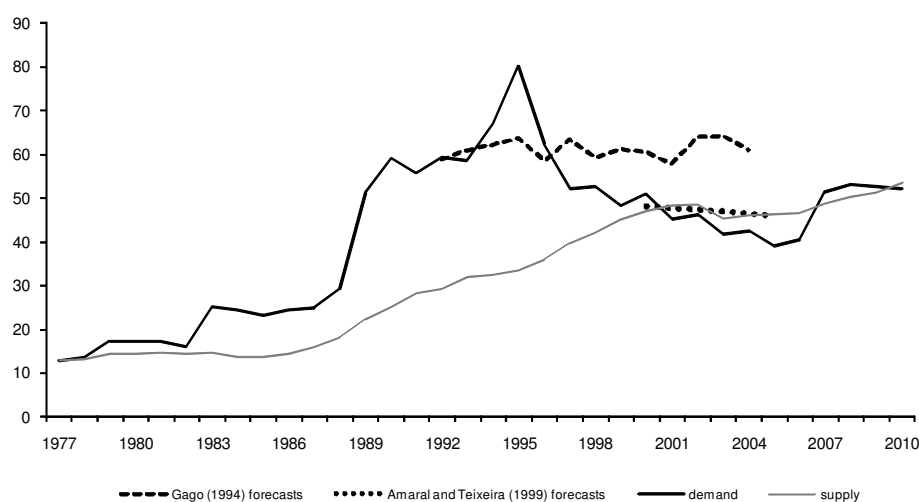# 3. Demand for higher education in Portugal

Until the mid 1970s, only four public and one private university existed in Portugal, in a highly selective and elitist system. The situation began to change in 1973, with the creation of a few more public universities outside the traditional three major urban centres, and gained impetus with the following year's demise of the totalitarian political regime. Applications for higher education soared and had to be restrained by a *numerus clausus* system and other admission restrictions. By 1979, a binary higher education structure was implemented, distinguishing between university and polytechnic education. In the following years, a continuously increasing demand, not fulfilled by the public university sector, opened the way to many new private institutions and polytechnic schools. In 2006, the government imposed the Bologna guidelines, a gradual process whose implementation took three years and compressed the length of most first degree programmes from five or four to three years. Such, mostly demand-driven, quantitative and qualitative changes gradually shaped the Portuguese system of higher education, currently characterised by a multiplicity of public and privately offered degrees, scattered by a large network of around 150 higher education institutions.

As reported in Figure 1, the number of applicants increased until mid 1990s, with three intermediate discernible upward surges in demand in 1979, 1983 and 1989, all of which triggered by institutional reforms. In 1979, as noted above, the government restructured higher education into a binary system, with a clearly defined university and polytechnic sub-systems. In 1981, a reform easing the transition from the final year of secondary education attracted 50 percent

more students to this 12th grade in the following year, resulting in a jump in the number of applicants to higher education in 1983. Finally, the large demand surge in 1989 resulted from a political decision to abolish the eliminatory character of the admission exams, with the aim of facilitating access to the recently created private institutions. For a few years, exams were used only for ranking applicants to higher education, with no minimum marks required provided vacant places existed.

Figure 1

Forecasted and actual demand for higher education in Portugal (10^3)

While demand trended rapidly upwards, supply (measured in Figure 1 by the number of available places) tried to keep the pace, with an increasing number of institutions, degree programmes, staff and infrastructure. The positive demand trend was however abruptly reversed in 1995, predominantly as a result of more restrictive access conditions, reinforced by a continuing demographic decline. The number of places continued to grow, but demand decreased, lagging behind supply after 2001. Whereas by the mid 1990s the number of applications was 2.4 times the available places, this figure decreased in only ten years to 0.84 in 2005. The recent slight recovery in the number of applicants may be explained by the adoption of the Bologna Process, which involved major adaptations of structure, contents and especially length of study programmes.

There are only two publicly available documents, both produced in the 1990s, forecasting higher education applicants in Portugal. The later appointed higher education minister coordinated a large research group in charge of elaborating projections for the following decade (Gago et al., 1994). Their projections for the evolution of applicants were solely supported by the expected attendance rate in the 12th grade, and were largely over-optimistic, as shown in Figure 1, with a 54 percent prevision error in 2003, for example. Explicitly disregarding demographic trends, it was argued that social and economic factors would continue to drive demand upwards.

More recently, Amaral and Teixeira (1999) presented more accurate, although less ambitious, forecasts just for the following five years. Considering the impact of lower birth rates on primary and secondary education attendance, the authors forecasted a slight negative trend in the number of higher education applicants, even so less pronounced than the real figures would later demonstrate.

The ex post assessment of these two forecasting exercises suggests that more factors, other than demographics or secondary school attendance, have an impact upon demand for higher education in Portugal, confirming the need for a more comprehensive analysis.

4. Empirical Analysis

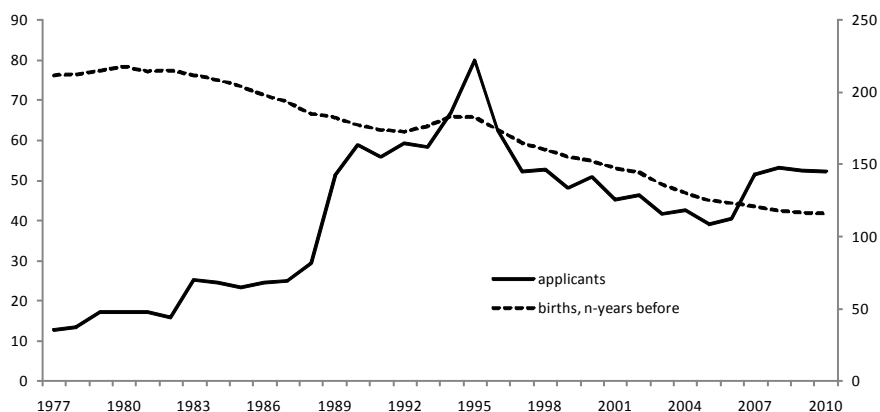## 4.1. Determinants of demand for higher education

A relatively large number of variables have been identified in the theoretical and empirical literature as potential determinants of demand for higher education. These variables can be broadly categorised into four main groups: demographic, social, economic and institutional variables.

Demographics is expectedly the major driver of aggregate demand for higher education, particularly where the focus of student recruitment is almost exclusively domestic. The question is whether demographic data is sufficient to explain past trends in the demand for higher education, and therefore whether it can be used as a single predictor to forecast future trends.

The age structure of the applicants to higher education in Portugal has remained very stable, with about half applying at the age of 18, a quarter at 19, a tenth at 20, and the rest almost evenly distributed by the other age groups. Using this average age structure of the applicants to compute the weighted number of births n years before (applying adjusted weights to n between 18 and 20 and, for simplicity, disregarding the other age groups), we can contrast the progression of this lagged demographic variable with the number of applicants (Figure 2).

Figure 2

Number of applicants (left axis) and births n-years before (10^3)

Note: The number of births considers those born 18 to 20 years before with weights .591, .284 and .125 respectively.

The post-war baby boom years in Portugal ended around 1964, as in most other European countries. This is reflected in the negative demographic trend, at the eligible access ages, observable in Figure 2, which begins 18 years later, in the early 1980s. However, during the first half of the sample period, this negative demographic trend coincides with a fast rising number of applicants to higher education. This is clearly a catching-up effect in a country recently freed from a dictatorship regime with high illiteracy rates, where only a few benefited from higher education. This rapid increase peaked in mid 1990s, coinciding with a noticeable demographic recovery at the eligible ages, curiously 18 years after the democratic transition. After the peak, both demographics and demand trend negatively for the following decade. But the two variables split in opposite directions in the last few years. Since 2005 the number of applicants rose again, despite the continuing demographic collapse. Other variables ought then to be considered in an empirical analysis of demand if more robust forecasts are required.

The second class of potential demand determinants includes several social variables. In the particular case of Portugal, the rapid growth of demand until the mid 1990s can be partly attributed to the increasing women's participation rate. The proportion of females in higher education increased rapidly since the beginning of the sample period, overshooting OECD and EU averages by the turn of the century, and has since slightly decreased to average international levels.

Most studies in this research area, particularly those using large longitudinal survey data to estimate student choice models, agree that the parents' edu-

484 **C a r l o s   R o d r i g u e s   V i e i r a ,   I s a b e l   V i e g a s   V i e i r a**
Determinants and Projections of Demand
for Higher Education in Portugal

cational attainment greatly influences their children's choice to attend higher education. Nature, nurture and income can all help explain this effect: either the offspring inherit a genetic disposition to be better students, or their parents provide a more propitious learning environment at home or can afford more expensive schools. In aggregate terms this evidence is less clear cut, since the expected positive family effect can be weakened by the negative effect of an inferior wage premium (an higher proportion of graduates in the population decreases the returns from a degree) and lower fertility rates (usually associated with higher levels of education).

A third important factor in this group is academic success in pre-tertiary schooling, that is, how effective the educational system was in bringing students to the universities' doors. Many educational reforms aiming at reducing dropout and improving success rates in secondary education have occurred in Portugal within the analysed time frame, particularly the increase in the compulsory minimum schooling age.

The third group of demand determinants includes the economic variables, either at a microeconomic (cost) level or at a macroeconomic level. First, the price of higher education, the average cost of tuition fees, introduced in Portugal in 1992 and briefly abandoned in 1995 and 1996. Other costs, such as accommodation, study materials, travel and living expenses, are probably not very significant to aggregate demand, since lower income families can either apply for student social support or choose a higher education institution close to home. The policy of regional dispersion of universities and polytechnics, and the shortening length of the first degree, reduce these direct costs of higher education. Student loans were introduced in 2009, but are not available for first year students and only a negligible number of students have yet applied[4].

Possibly more important, especially for lower income families, is the opportunity cost of attending higher education, measured by the expected foregone wage income. But this cost must be balanced against the returns from higher education, particularly the expected wage premium of a degree.

The country's macroeconomic conditions may also affect the aggregate demand for higher education. The average household disposable income or, more indirectly, real GDP, its growth rate or GDP per capita, or even the unemployment rate, all indicate how the economy is globally performing and therefore how families can cope with the costs of higher education. The unemployment rate must however be considered with some caution, since it may have an ambiguous effect on demand. On the one hand, it usually reflects depressed incomes, and may therefore have a negative impact on demand for higher education. On the other hand, it reduces the opportunity cost of attending, with the opposite effect on demand.

---

[4] On the role of student loans and of other financing opportunities on the decision to go to university or opting for the job market see, for instance, Christou and Haliassos (2006).

Finally, there is a fourth group, of institutional or public policy variables, that should also be considered. Throughout the period under analysis, beginning in the late 1970s, several legislative changes have occurred, to restrain or encourage admissions in higher education, according to the evolution of the system's capacity: changes in *numerus clausus* limits, more or less restrictive admission requirements, imposition or withdrawal of minimum grades, tuition fees, approval of new public and private institutions, reforms in secondary education, adoption of the Bologna guidelines. In order to acknowledge their impact on demand, a number of (mostly dummy) variables can be included in the estimating models.

4.2. The empirical demand function
for higher education

The sample covers the period from 1977 to 2010[5]. The beginning of the sample was chosen to coincide with a major structural break in the time series, caused by the generalisation of the system of *numerus clausus*, the introduction of a transition year from secondary to higher education (later corresponding to the 12th year of schooling) and the creation of the 'short length' higher education model (afterwards renamed as polytechnic).

According to the potential determinants identified above, the limitations of available data and the statistical characteristics of the different collected series, the econometric specification for the multiple regression model is the following (all variables, apart from *bologna* and the qualitative variables, are in logs, allowing their estimated coefficients to be interpreted as elasticities):

$$applic_t = \beta_0 + \beta_1 births_{t-n} + \beta_2 success_{t-1} + \beta_3 unemp_t + \beta_4 fem_t + \beta_5 bologna_t +$$
$$+ \beta_6 schooling_{t-k} + \beta_7 Dreform + \beta_7 Dtuition + \varepsilon_t \quad ,$$

where *applic* is the number of students applying for a place in a public higher education institution in year *t*, *births* are the weighted number of live births *n* (18 to 20) years before[6], *success* refers to the previous year academic success rate in the 12th grade, the percentage of enrolled students effectively completing this grade, *unemp* stands for the economy's unemployment rate, *fem* is the proportion of female students in higher education, *bologna* represents the percentage of first degree programmes adopting the so-called Bologna guidelines, *schooling* indicates the number of years a student must stay in school, lagged a *k* number of periods corresponding to the difference between the compulsory years of

---

[5] The data series were collected from several national sources: the macroeconomic variables came from the Bank of Portugal; demographic data was collected from the National Statistical Institute; success rates in secondary education from the Ministry of Education; the number of applicants and all other higher education-related variables are available from the Ministry of Science and Higher Education's statistical office.

[6] Using the simpler, unweighted, number of live births 18 years before yields similar conclusions but a slightly lower overall significance of the model.

schooling and the necessary to reach higher education, *Dreform* is a dummy variable accounting for a transitory reform in secondary education facilitating access to higher education in 1994 and 1995 (see MCTES, 2006), which helps explain the sudden peak in applicants, *Dtuition* is a dummy variable indicating the existence of tuition fees since 1992, with a brief gap in 1995 and 1996, and finally   is the usual error term. *Augmented Dickey-Fuller* (ADF) tests for the presence of unit roots have been performed on all variables and the evidence points to stationarity, although in a few cases only after allowing for a structural break in the trend.

The obtained estimation results are (with standard errors in parentheses):

$$\hat{applic}_t = -13.9632^{***} + 0.4869^{**}\ births_{t-n} + 0.4685^{***}\ success_{-1} - 0.0344^{**}\ unemp_t + 3.8430^{***}\ fem_t +$$
$$(3.3506) \quad\quad (0.2202) \quad\quad\quad (0.1201) \quad\quad\quad\quad (0.0159) \quad\quad\quad\quad (0.3665)$$

$$+0.4631^{***}\ bologna_t + 0.8651^{***}\ schooling_{-k} + 0.2403^{***}\ Dreform - 0.1202^{*}\ Dtuition$$
$$(0.1059) \quad\quad\quad (0.2071) \quad\quad\quad\quad (0.0832) \quad\quad\quad (0.0654)$$

All the estimated coefficients display the expected signs and are statistically significant. The asterisks indicate 1 percent (***), 5 percent (**) or 10 percent (*) significance levels. The *Ramsey RESET* test for the functional form did not reject the null hypothesis of functional form misspecification and the *Breusch-Pagan* test and the *Durbin-Watson* test also did not uncover problems of, respectively, heteroscedasticity or autocorrelation in the estimated model. The model appears to fit the data well, explaining 97 percent of the variation in the number of applicants.

In a country with negligible international student flows, the first two variables indicate the potential number of students able to access higher education in a given year, because they have reached the eligible age and were awarded a secondary school diploma.

The country's unemployment rate is the only significant variable related to the general macroeconomic conditions. It has a negative impact on demand, suggesting that the effect of loss of family income is greater than that of a lower opportunity cost of attending higher education. Splitting the unemployment rate by age group could eventually help differentiate the various possible effects of unemployment on demand for higher education, but unfortunately no such series are available for the whole sample period. Alternative indicators of the economic conditions, such as real GDP, either global or per capita, or real disposable income, were found not to be statistically significant (results not shown) and, when considered together with unemployment, render the latter non-significant, probably due to multicollinearity problems. This suggests that small variations in income do not significantly affect the number of students seeking to enter higher education, but large variations due to unemployment do. This negative impact of unemployment may have various causes: families may not be able to afford the costs of a degree; there may be a fall in the level of motivation of young people

to continue studying; or they may be forced to look for work in order to supplement the family income[7].

Another relevant variable is the percentage of female students in higher education. This reflects the fast increase in the women's participation rate, socially restrained in Portugal until the mid 1970s. In 16 years, the women's share in higher education increased 16 percentage points, from 41 percent in 1977 to 57 percent in 1993, falling slightly in the last few years.

The variable denoting the gradual adoption of the Bologna guidelines since 2006 is also significantly positive, suggesting a rise in the number of applicants that may partly compensate for the marked drop in the total number of enrolments due to the shorter length of study programmes. It is probably soon to assess the full impact of the Bologna process on demand, but it is possible to gauge the initial reaction of demand in the five years since the adoption of the Bologna guidelines. The results above confirm evidence for other countries suggesting a positive impact (accounting for a 10 percent increase in Italy, for example, according to Cappellari and Lucifora, 2009). With regard to Portugal, Cardoso et al. (2008) found an increase in demand for programme degrees that were first reorganized according to Bologna, relatively to other programmes that postponed restructuring; they did not, however, investigate the effects of the Bologna process on global demand for higher education.

A further institutionally induced change positively affecting demand is the compulsory years of schooling. The increase in the length of the period of compulsory education from six to nine years, introduced in the early 1990s, encouraged a larger number of students to go on to higher education. The recent reform extending compulsory education by a further three years is expected to be reflected in an increased number of applications to higher education institutions over the next few years.

The two dummy variables are also relevant for the number of applications, although with opposite signs and different significance levels. The first dummy explains the transitory peak in applications by the mid 1990s, fostered by more relaxed transition rules from secondary to higher education, which ceased in 1996 with the reintroduction of compulsory exams to complete secondary school and the establishment of a minimum grade to access higher education.

The second dummy reveals the (less significant and smaller) negative impact of tuition fees. Substituting this dummy by the actual value of annual tuition fees as a share of the monthly minimum wage yields slightly worse results, sug-

---

[7]The media in Portugal tend to overemphasize the percentage of graduates in the unemployed population, when these are mostly recent graduates looking for a first job. Available studies show that a higher education degree increases the chances of finding a job and of having a more satisfying and better remunerated professional life (see, for instance, studies by Portugal, 2004 or Boarini et al., 2008).

gesting that it is the existence of fees, not the relatively small changes in their value, that affects demand for higher education.[8]

Other dummy variables have been tentatively added to the model, standing for other major institutional reforms in secondary or tertiary education, mentioned above, but were dropped for lack of statistical significance.

The human capital theory suggests that demand for higher education is responsive to the opportunity cost of enrolling in higher education and to the wage premium of a degree (see Blaug, 1976). The former variable was proxied by the real wages of a non-graduate individual in the first level of the 'technical' career in the public sector, while the latter was constructed as the difference in wages between graduate and non-graduate workers recently admitted in the public services. Both variables turned out to be statistically non significant. Although certainly influential in the decision to apply to higher education, the real value of these variables has been very stable in Portugal throughout the sample period and, probably for this reason, is not significant in explaining changes in the number of applicants. Soumelis (1981), for Greece, and Duchesne and Nonneman (1998), for Belgium, also concluded that rates of return to education do not matter much for educational decisions. The latter authors found foregone earnings to be negatively statistically significant, but their variable was corrected by the unemployment rate.

4.3. Demand for higher education in the next eighteen years

The obtained estimates, together with projections of the independent variables, can be used to forecast the number of applicants for higher education. Forecasting demand is indispensable for an efficient management of the individual institutions and of the whole higher education system. However, as with any other social phenomena, forecasting requires strong assumptions, particularly that the patterns and relationships observed in the past will continue to hold into the future and that the forecasts of the independent variables are reliable.

For the first variable, the lagged number of live births, predictions are not necessary, as current available data allow observations for the next 18 years. Forecasting the academic success rates for the 12th year is much more difficult a task, depending on a number of hard to predict factors. However, disregarding the first few years in the sample, when this transition year to higher education was introduced and its success rates were very low, this variable has been quite stable in Portugal. An effort to improve success rates in the near future may even be hindered by a negative effect of the increase in the minimum compul-

---

[8] The annual amount of tuition fees has varied, in time and across higher education institutions, roughly between one and two monthly minimum wages.

sory schooling, forcibly maintaining in the educational system less capable and less motivated students. Therefore, the average value observed in the last decade is imposed on this variable in order to forecast applicants.
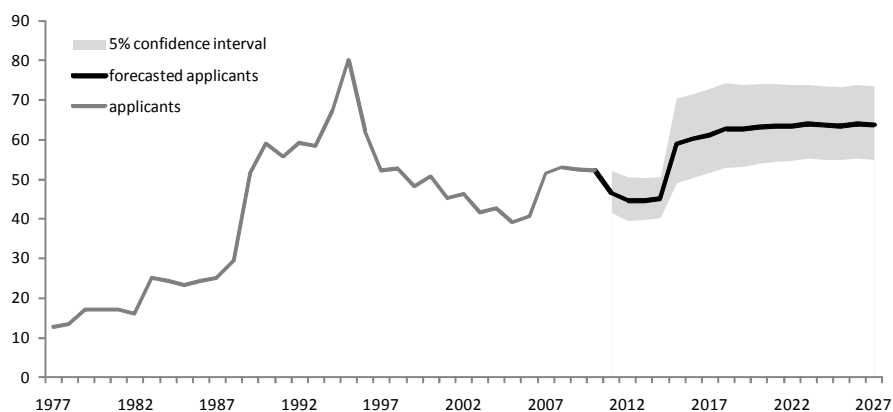
For the unemployment rate, the current IMF estimates for the next five years have been adopted. Considering the current recession affecting Portugal, the IMF expects a continuous deterioration of this rate, with a recovery only after 2015. Given the well documented phenomenon of hysteresis in the unemployment rate (a short-term rise in unemployment rates tends to persist), we assume a slow return to the country's long-term average values by the end of the forecasted period.

For the female share of students in higher education, it is assumed that after the recent convergence period, Portugal has reached a steady-state value, very similar to average EU values. The mandatory minimum schooling years have been recently increased from nine to 12 years. The law applies to all students enrolled in the seventh grade in 2009, and therefore its expected impact on demand for higher education will only occur after 2015.

Since the dependent variable is in logs, simply exponentiating the predicted value for the log of applicants would systematically underestimate the expected number of applicants. The estimates have therefore been scaled up using the usual technique of multiplying by an adjustment factor obtained from an auxiliary regression (see for example Wooldridge, 2009: 211).

Figure 3

Demand for higher education, actual and forecasted (10^3)

490 C a r l o s   R o d r i g u e s   V i e i r a ,   I s a b e l   V i e g a s   V i e i r a
Determinants and Projections of Demand
for Higher Education in Portugal

The results of the forecasting exercise for the progression in the number of applicants are exhibited in Figure 3, together with prediction intervals (shaded area) that expose the uncertainty of the forecast. Using the currently observable number of births, and assumptions on the other explanatory variables, allows forecasts until 2027.

There is an expected small reduction in the number of applicants in the next few years, primarily due to a continuing demographic decline and to the indirect effects of the economic crisis. The recovery in demand, expected around 2015, can be explained by three major factors: a temporary demographic increase in the number of youngsters reaching higher education age; an economic upturn, with a decreasing unemployment rate; an increase in the number of students finishing secondary education (the 2009 law raising the compulsory minimum schooling age has full effect). Afterwards, the model predicts a stabilisation of the number of applicants around 62000, a value comparable to those registered by the early 1990s.
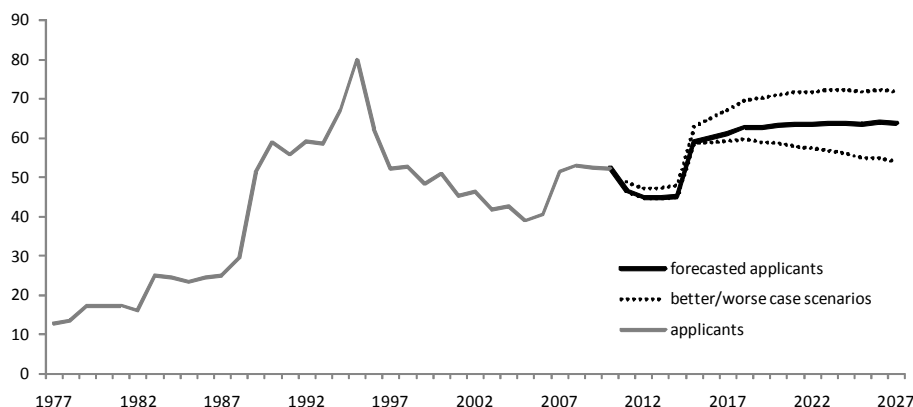
The continuing fall in the number of births is thus expected to be compensated by higher participation rates. However, in terms of the sustainability of the current higher education system, this scenario entails major financial difficulties for some, mostly polytechnic and private, institutions. The expected recovery in demand is not sufficient to compensate for the recent drop in total enrolments, caused by the shortening length of study programmes following the adoption of the Bologna guidelines.

In order to evaluate the forecasting ability of the model, we can check how well it has performed historically in predicting demand for higher education. Two problems however arise: first, the relatively small number of observations in the sample; second, the identified structural breaks in the series, particularly the recent impact of the Bologna process. For example, arbitrarily considering the sub period 1977–2000 as the estimation subsample for model fitting, corresponding to 70 percent of the observations, we can evaluate the forecasting performance of the model in a forecasting subsample from 2001 to 2010. The out-of-sample forecasted values follow the observed figures relatively close, with a 6.9 and 10.3 percent prediction error four and five years later, respectively, but the error increases twofold in the following year, when Bologna began to be implemented.

Since the analysis includes forecasted values of the explanatory variables, alternative scenarios may be constructed (see Figure 4). A «worse-case» scenario assume that, within the euro straightjacket, unemployment remains for a long time at current high levels, success rates at the end of secondary education return to lower long-term averages, a consequence of higher participation rates following the increase in the compulsory schooling age, and the share of women in higher education continues decreasing. The 'better-case' scenario assumes that unemployment converges more rapidly to lower long-term Portuguese averages, academic success rates at the 12th grade continue increasing, and the percentage of women in tertiary education evolves to the 2008 euro-area average value of 53.7 percent.

Figure 4

Demand for higher education, actual and forecasted scenarios (10^3)

The more optimistic scenario guarantees that the places currently offered by the higher education institutions will be met by demand, both at the university and polytechnic sub-systems, and at public and private institutions. This secures long-term funding, if the current financing model is maintained, and a faster convergence to OECD levels of the share of population with a higher education degree. The pessimistic alternative suggests that the continuing demographic decline will prevail over the tendency for higher participation rates, with a consequent need to downsize the higher education system and, most critically, deterring convergence of higher educational attainment levels and jeopardizing the social and economic development of the country.

Beyond the picture drawn on Figure 4, it is difficult to construct 'worst-case' and 'best-case' scenarios, given the wide range of possible events affecting both the number of prospective students and their willingness to access higher education. The curve may shift downward if economic conditions remain gloom for longer than expected, or it can move upwards if economic growth is rapidly resumed. The economic circumstances affect demand not only via the unemployment rate, but also because recession reverses the international migration flows that could partly compensate for the domestic demographic natural decline.

Demand will also increase if upper secondary education success rates improve significantly, above those registered during the past ten years, if tuition fees are discarded, currently not a reasonable assumption, or if the length of the first degree is further reduced.

492 C a r l o s R o d r i g u e s V i e i r a , I s a b e l V i e g a s V i e i r a
Determinants and Projections of Demand
for Higher Education in Portugal

On the other hand, there may be some other exogenous factors affecting demand in the future, such as a more extensive *de jure* and *de facto* compulsory education, the opening or closure of higher education institutions, developments in student social support policies or student loan programmes, an increase in the number of mature students applying, changes in admission rules, or any other unexpected event. Projections of future demand, and discussions about their expected impact on the system's organisation and on long-term social and economic conditions, may even precipitate a change in higher education policies.

5. Conclusions

This study estimates a model of aggregate demand for higher education in Portugal, with the objective of identifying demand's main determinants and producing forecasts for the next two decades. The results of the econometric estimation suggest that, from 1977 to 2010, demand was positively influenced by the number of live births 18 to 20 years before, the academic success rates at the end of secondary education, the rate of female participation in higher education, the adoption of the Bologna process and the length of compulsory schooling. Unemployment and the existence of tuition fees have both exerted a negative impact upon demand.

Information on the relevant determinants and on the nature of their effects on aggregate demand for higher education is useful also for countries where applications are not centralized and comprehensive studies of aggregate demand cannot be developed. As argued above, proxying demand by enrolments involves identification problems. Our analysis suggests that policies that improve the birth rate, increase the number of compulsory schooling years, induce higher rates of academic success in secondary education, avoid gender discrimination in access to higher education and promote the restructuring and length reduction of tertiary education programmes have a positive impact on demand. Economic conditions, however, may exert some unexpected effects. Unemployment, which decreases the opportunity cost of education and therefore could be expected to be positively related to demand, came out as a negative determinant. This result, and the fact that the unemployment rate was the only statistically significant macroeconomic variable in our model, suggests that small changes in income may not affect decisions to apply to a higher education institution but large negative variations do. Therefore, in periods of economic recession, and especially in countries with negative demographic trends, additional social support and specific credit lines should be available for students, in order to maintain or expand the demand for higher education.

The forecasts produced with actual data on the number of live births and assuming more or less favourable scenarios for the other explanatory variables, anticipate a decline in the number of applications until 2015, and then a gradual recovery to values close to those observed in the late 1980s. Such recovery is

mainly expected to run from a brief demographic upturn, the increase in compulsory schooling from nine to 12 years, implemented in 2009 but producing full effects only after 2015, and from a gradual return of unemployment rates to their long term average levels, as economic conditions expectedly improve.

The demand scenarios presented in this study are useful to guide higher education institutions in their budget planning, enrolments and staff management, tuition setting and other resource allocation decisions. With prospects of timid increases in demand and a strong reliance on public funding, either current financing rules change or some institutions will have to close or merge to survive. Competition for new students will probably intensify, with increased awareness of the importance of quality, marketing and ranking lists. The forecasts may also substantiate the adoption of public policies aimed at improving the participation rate, to prevent major financial disruption in institutions left with too many vacant seats and, above all, to boost domestic economic competitiveness perspectives.

In order to reap the benefits of a better educated population, policies should be implemented to widen the admission base and to attract more students, especially from lower income and less educated backgrounds. Active financial measures may include expanding students' social support and more attractive loan systems. However, the students' willingness to borrow depends on the perceived financial gains from higher education, which also require more active information policies on the benefits of education. This is an especially sensitive subject in societies with a relatively low educational level, where many families fail to fully acknowledge the advantages of a tertiary education diploma in increasingly global and highly competitive labour markets.

Place the body of Section 2 HERE. [Times New Roman, size 10, single space, no blank lines between paragraphs, 0,5 cm indent at the beginning of paragraph,]

Bibliography

1. Ahlburg, D., Crimmins, E. and Easterlin, R. (1981) The outlook for higher education: a cohort size model of enrolment of the college age population, 1948–2000, *Review of Public Data Use* 9, 211–227.

2. Amaral, A. and Teixeira, P. (1999) Previsão da evolução do número de alunos e do financiamento, Fundação das Universidades Portuguesas.

3. Blaug, M. (1976) The empirical status of human capital theory: a slightly jaundiced survey, *Journal of Economic Literature* 14(3), 827–855.

4. Boarini, R., Martins, J., Strauss, H., Maisonneuve, C. and Nicoletti, G. (2008) Investment in tertiary education: main determinants and implications for policy, *CESifo Economic Studies* 54 (2), 277–312.

494 **C a r l o s   R o d r i g u e s   V i e i r a ,   I s a b e l   V i e g a s   V i e i r a**
Determinants and Projections of Demand
for Higher Education in Portugal

5. Buss, C., Parker, J. and Rivenburg, J. (2004) Cost, quality and enrolment demand at liberal arts colleges, *Economics of Education Review* 23, 57–65.

6. Campbell, R. and Siegel, B. (1967) The demand for higher education in the United States, 1919–1964, *American Economic Review* 57(3), 482–494.

7. Cappellari, L. and Lucifora, C. (2009) The «Bologna Process» and college enrolment decisions, *Labour Economics* 16(6), 638–647.

8. Cardoso, A., Portela, M., Sá, C. and Alexandre, F. (2008) Demand for higher education programs: the impact of the Bologna process, *CESifo Economic Studies* 54(2), 229–247.

9. Christofides, L., Hoy, M. and Yang, L. (2008) The determinants of university participation in Canada (1997–2003), Department of Economics DP 2008–05, University of Cyprus.

10. Christofides, L., Hoy, M. and Yang, L. (2010) Participation in Canadian universities: the gender imbalance (1977–2005), *Economics of Education Review* 29(3), 400–410.

11. Corazzini, A., Dugan, D. and Grabowski, H. (1972) Determinants and distributional aspects of enrolment in U.S. higher education, Journal of Human Resources 7(1), 39–59.

12. Christou, C. and Haliassos, M. (2006) How do students finance human capital accumulation?: The choice between borrowing and work, Journal of Policy Modeling, 8 (1), 39–51

13. DesJardins, S., Dundar, H. and Hendel, D. (1999) Modelling the College Application Decision Process in a Land-Grant University, *Economics of Education Review* 18, 117–132.

14. Duchesne, I. and Nonneman, W. (1998) The demand for higher education in Belgium, *Economics of Education Review* 17, 211–218.

15. Freeman, R. (1971) *The Market for College-Trained Manpower: A study in the economics of career choice*, Harvard University Press.

16. Gago, J., Amaral, J., Grácio, S., Rodrigues, M., Fernandes, L., Ruivo, B., and Ambrósio, T. (1994) Prospectiva do Ensino Superior em Portugal, Ministério da Educação: Departamento de Programação e Gestão Financeira.

17. Galper, H. and Dunn, R. (1969) A short run demand function for higher education in the United States, *Journal of Political Economy* 77(5), 765–777.

18. Hoenack, S. and Weiler, W. (1979) The demand for higher education and institutional enrolment forecasting, *Economic Inquiry* 17(1), 89–113.

19. McPherson, M. and Schapiro, M. (1991) Does student aid affect college enrollment? New evidence on a persistent controversy, *The American Economic Review* 81(1), 309–318.

20. MCTES (2006) OECD Thematic Review of Tertiary Education, Country Background Report: Portugal, Ministry of Science, Technology and Higher Education.

21. Murdoch, S. and Hoque, M. (1999) Demographic factors affecting higher education in the United States in the twenty-first century, *New Directions for Higher Education* 108, 5–13.

22. Nicholls, M. (1984) The demand for tertiary education–an Australian study, *Higher Education* 13(4), 369–377.

23. Portugal, P. (2004) Mitos e factos sobre o mercado de trabalho português: a trágica fortuna dos licenciados, Boletim Económico do Banco de Portugal, Março.

24. Psacharopoulos, G. and Soumelis, C. (1979) A quantitative analysis of the demand for higher education, *Higher Education* 8(2), 159–177.

25. Sá, C, Florax, R. and Rietveld, P. (2004) Determinants of the regional demand for higher education in the Netherlands: a gravity model approach, *Regional Studies* 38(4), 375–392.

26. Sissoko, M. and Shiau, L. (2005) Minority enrolment demand for higher education at historically black colleges and universities from 1976 to 1998: an empirical analysis, *Journal of Higher Education* 76(2), 181–208.

27. Soumelis, C. (1981) Do rate of return matter for public and private educational decisions?, *Higher Education* 10(3), 353–361.

28. Wetzel, J., O'Toole, D. and Peterson, S. (1998) An analysis of student enrolment demand, *Economics of Education Review*, 17(1), 47–54.

29. Wooldridge, J. (2009) *Introductory Econometrics: A Modern Approach*, South Western Cengage Learning, 4th ed.