Perceptions of the Bologna process: what do students' choices reveal?*

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Abstract

A major element in the creation of the European area of higher education is the adoption of a common structure of degrees, implying in several countries the reduction of the duration of the first degree to three years, which is a controversial change. Cardoso et al. (2008) have analyzed student confidence in the curricula change, quantifying its impact on students' first choices of academic programs. This paper goes two steps further. First, it concentrates on a variable that better translates total demand for an academic program, namely the total number of students who place the program among their six revealed preferences, instead of just the first option; and, second, an econometric model that better fits the data is estimated. Results confirm a positive impact of the Bologna process on the demand for programs, which varies with program size and across fields of study. Our results complement those in Cardoso et al. (2008), as they uncover that being a program leader, i.e. the only institution in the country that restructured a given program, was associated with higher demand by prospective students, which nevertheless stemmed from their "second best" options and not from their first choices.

KEYWORDS: education policy; European Higher Education Area; program demand; count data.

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1 Introduction

The Bologna process is a far-reaching reform that aims at creating by 2010 a European higher education area, expected to foster the mobility of citizens, the employability of graduates, and the overall development of the Continent. Among the central features of the Bologna reform is a re-definition of the curricula, a student-centered learning, the definition of learning-outcomes, the development of competencies, and the implementation of a two-tier system, where a three-year shorter first cycle (Bachelor), is followed by a one year and a half or two-year second cycle (Master) (European Ministers of Education, 1999). The two-tier system is expected to enhance flexibility, with students entering the labor market after the end of the first cycle and eventually returning to the higher education system to take the Master that better fits their interests. Jacobs and van der Ploeg (2006) discuss the potential benefits of a two-tier system, based on the experience of Anglo-Saxon countries. Whether Europe will rip the benefits of the reform under course remains to be confirmed by labor market and students' mobility data, which is not available yet.

So far, studies have analyzed the perceptions of society on the Bologna reform through survey evidence. Most noticeable, reports by the European University Association (EUA) have collected information from hundreds of European universities and have provided a broad picture of the implementation of the Bologna process. These reports conclude that the reform has followed different paces, across and within countries, and that the coexistence of the old and new systems in some countries has most likely favored the surge of controversy on its implementation among higher education institutions, students and labor markets (see, for example, Crosier, Purser and Smidt, 2007). Controversies result, on the one hand, from different visions on the nature of the reform and, on the other hand, from insufficient transparency and information conveyed by higher education institutions (Crosier, Purser and Smidt, 2007). For example, according to that report, only 22% of the institutions surveyed reported that most of their students will enter the labor market after finishing the first cycle. Employers'

lack of information on the Bologna principles, on the one side, and the belief, among academics and parents, that the Master's level is the 'real degree' may explain the apparent reluctance of graduates to enter the labor market after concluding their first cycle of studies (Crosier, Purser and Smidt, 2007).

In one of the few studies that analyze the Bologna process from the students' standpoint, Cardoso, Portela, Sá and Alexandre (2008) assess the impact of the Bologna process on students' demand, as measured by applicants' first choice when applying to enter university. Their findings indicate a positive impact of the reform on demand, which, however, hides variation across fields of study and program size. Namely, the Bologna impact is clearly positive for study programs in the field of education, whereas health study programs appear to face lower demand.

This paper goes two steps further. First, we use an alternative proxy for demand, by computing the total demand, rather than first choices. That is, we measure demand as the total number of students that include a given program among their choices, no matter its rank.[1] Second, a different specification of the econometric model, suggested by Allison and Waterman (2002), which better fits the type of data available, is estimated. The analysis refers to the Portuguese higher education setting and uses administrative data on the application processes for the academic years of 2003/2004 to 2006/2007.

The paper unfolds as follows. Section 2 provides a description of the implementation of the Bologna process in Portugal. Section 3 describes the dataset and the empirical strategy. The impact of the Bologna process is quantified in Section 4, while Section 5 concludes.

2 The implementation of the Bologna process in Portugal

Although the Bologna declaration had been the subject of discussions in academia and in professional bodies —several workshops were organized to discuss the reform

[1] Note that when applying to higher education, students rank up to six pairs program/institution.

in different disciplines—, only after the publication, in 2005, of the legislation that rendered possible the adoption of the two-tier system did the process of reform in the Portuguese higher education institutions gain momentum. According to instructions from the Ministry of Science, Technology and Higher Education (MCTES), higher educations institutions could restructure their study programs according to the Bologna principles beginning in 2006/2007, with 2008/2009 as deadline. The response varied across higher educations institutions, with some institutions restructuring all their study programs, other restructuring some of the study programs and other institutions deciding to delay the implementation of Bologna principles to the next two years. Therefore, in 2006/2007 Bologna-type programs coexisted with old-style programs, both in the same institution and in the same field of study. The co-existence of the two-type of programs may have contributed, as mentioned above, to the controversy over the advantages of the new paradigm.

Additionally, the Bologna reform occurred in the absence of an Agency of Accreditation and, therefore, without quality control mechanisms. This may have favored the implementation in 'form' rather than in 'substance', that is, reducing the number of years to finish the first cycle but keeping old curricula and learning processes.[2] Just like for other European countries, researchers will have to wait for labor market data and for the evaluation process of the recently created Accreditation Agency to evaluate how deep the reform in the Portuguese higher education system was.

As highlighted by Crosier, Purser and Smidt (2007), a 'national understanding of reforms' is crucial for their success. It is therefore relevant to assess the behavior of students and labor market during the period of adjustment to the Bologna changes in higher education curricula. In this paper, we use information on students' choices to evaluate the support that this process has received from the Portuguese society, in particular, from the Portuguese students.

[2]Veiga and Amaral (2008) present survey results from all Portuguese higher education institutions that changed their study programs' curricula according to the Bologna principles in 2006/2007. According to these authors, evidence suggests that the implementation of the Bologna principles was more 'form' than 'substance'.

3 Dataset and empirical strategy

The Portuguese higher education system is a binary system, with universities and polytechnics. In principle, universities should provide academic training, whereas polytechnics are in charge of preparing students for a profession. On the supply side there are constraints imposed by a system of *numerus clausus*. Students rank up to 6 pairs study program/institution, from the most preferred to the 6th preference. A national competition follows, with students allocated to the available places based on their grade point average, which is a weighted average of high school and national exams grades. There are two application phases. The first one takes place in July/August. The second phase takes place in September and includes the places not filled in the first phase.

The application process is centralized, such that the Department of Higher Education (*Direcção Geral do Ensino Superior*) of the MSTHE gathers information on all candidates' choice sets. These administrative data, collected for the whole applicant population and all study programs offered at public higher education institutions, have been made available on-line for the academic years from 2003/2004 to 2006/2007, for both the first and the second phases.[3] The unit of analysis is a study program in a given higher education institution. The data set contains all study programs in both higher education sectors: polytechnics and universities.

Such comprehensive dataset made it possible to build a program demand variable, the variable to be explained in our model. The demand for each program at an institution is, then, quantified as the number of applicants who placed that program in that institution among their choices, no matter its rank. We call this variable *hits*. In Cardoso et al. (2008) demand is proxied by candidates' first choices. We believe that *hits* better proxies program demand, as it contains information on all students that reveal some interest on a program, that is the total potential demand, rather than only on their favorite program. Given the context of *numerus clausus* in which the application process takes place, the total potential demand may be of major interest as not all students are allocated to their best choice.

[3]The data are available at http://www.acessoensinosuperior.pt.

Cardoso et al. (2008) model program demand by means of a fixed effects negative binomial model based on the following arguments. First, given that the dependent variable is a positive integer and its distribution is skewed to the left, a count data type of model (poisson or negative binomial) is appropriate. Second, given that there are repeated observations for the demand for each program, as the data available allows for the computation of demand for four academic years and two phases each year, it is possible to account for unobserved heterogeneity by means of a fixed effect model. Finally, the descriptive statistics and a formal statistical test reveal that the assumption of equal mean and variance is not appropriate, which suggests the use of a fixed effects binomial negative model. The present study also departures from our previous analysis by improving the model estimated. According to Allison and Waterman (2002), the fixed effects in the context of the negative binomial do not have the same meaning that we are used to in other contexts, as they only apply to the overdispersion parameter. In order to avoid this problem, we follow the suggestion by Allison and Waterman (2002) and we estimate, based on the pooled sample, an unconditional negative binomial model with dummy variables to account for the program/institution fixed effects.[4]

In the context of this model, the total demand for higher education programs is explained based on a set of program's characteristics, similar to those used by Cardoso et al. (2008). First of all, we consider three explanatory variables that capture the group of Bologna adopters: (i) Bologna implementer - a program at an institution, which has been restructured according to the Bologna process; (ii) Bologna leader - a Bologna implementer, who was the only institution in the country that restructured that academic program; (iii) Integrated master - a Bologna implementer that nevertheless did not shorten its duration, i.e. programs that offer a joint first and second cycle degree, thus keeping a longer duration while having restructured to comply with Bologna.

The model controls for other factors that may have had an impact on study programs' demand such as the major national admission exams (dummy variables for

[4]For technical details on the choice of the model, see the Appendix.

Mathematics, Physics, Chemistry, Biology and Portuguese, which are the exams with the highest failure rate), given that a generally poor performance in the admission exam in a certain subject reduces the pool of potential applicants. Moreover, we control for the scientific field of the program (9 dummy variables), since different fields reacted differently to the implementation of the Bologna process. We also account for the phase of the application process, with a dummy variable equal to one in the second phase. Given sharp differences in the dimension of the different programs and across institutions, we also control for the size of the program (number of vacancies posted). Interactions between the Bologna variables presented above and some control variables are included as well.

Table 1: Summary statistics by year and phase

	2003		2004		2005		2006	
Variable	Ph1	Ph2	Ph1	Ph2	Ph1	Ph2	Ph1	Ph2
Number of institutions/programs	946	903	989	942	1012	976	985	965
Number of candidates	41662	15514	42595	10348	38976	13688	40521	15432
University	0.52		0.52		0.50		0.49	
New study programs	0.04		0.08		0.05		0.06	
Demand: number of *hits*	196.94	64.95	195.25	38.35	178.61	56.20	194.22	69.36
	(207.70)	(55.73)	(204.13)	(36.56)	(227.91)	(52.30)	(230.33)	(59.93)
Bologna implementer							0.43	0.43
Bologna leader							0.17	0.17
Integrated master							0.04	0.04
Program size (vacancies)	45.66	14.21	44.69	12.92	44.23	16.96	46.96	17.20
	(33.19)	(13.40)	(39.27)	(12.24)	(38.99)	(17.46)	(38.76)	(16.69)
Exams:								
maths	0.33	0.33	0.28	0.28	0.26	0.27	0.21	0.21
physics	0.05	0.06	0.03	0.03	0.03	0.03	0.02	0.02
chemistry	0.07	0.07	0.07	0.06	0.07	0.06	0.05	0.05
biology	0.16	0.15	0.13	0.13	0.14	0.13	0.11	0.11
portuguese	0.12	0.13	0.10	0.11	0.08	0.08	0.07	0.07
Field of study:								
agriculture	0.06	0.07	0.07	0.06	0.05	0.06	0.06	0.06
architecture	0.05	0.04	0.05	0.05	0.06	0.06	0.07	0.07
natural sciences	0.07	0.07	0.07	0.08	0.07	0.07	0.08	0.08
law, social sciecnes	0.11	0.11	0.13	0.13	0.14	0.14	0.16	0.17
economics, business	0.10	0.10	0.10	0.11	0.10	0.11	0.11	0.11
sports, arts	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.03
education	0.13	0.14	0.11	0.11	0.09	0.09	0.07	0.08
humanities	0.11	0.11	0.11	0.11	0.10	0.10	0.08	0.08
health	0.10	0.10	0.11	0.10	0.11	0.10	0.11	0.11
technologies	0.24	0.24	0.24	0.24	0.23	0.24	0.22	0.22

Notes: Ph1 and Ph2 stand for phases 1 and 2 in the application process, respectively. Standard deviations are shown in parenthesis, while the remaining numbers are averages, with the exception of the last two rows which show the number of observations and the number of candidates.

Table 1 shows the descriptive statistics on those variables for every academic year from 2003/2004 to 2006/2007, for the two application phases. It is evident that about 43% of the academic programs have adjusted to Bologna in 2006/2007. About 17% of the programs are leaders in Bologna implementation, while only 4% opted to be an integrated master. In 2006/2007 the most required exam is Math, followed by Biology and Portuguese, which are required by 21%, 11% and 7% of the programs, respectively. The least required are Chemistry and Physics, demanded by 5% and 2% of the programs, respectively. Interesting enough is that these exams, which face the lowest passing rates, are less and less required. The highest decrease goes for Math, which was a requirement for 33% of the programs in 2003/2004, but only to 21% in 2006/2007. When we look to the fields of study in the school year of 2006/2007, the biggest share of programs is in the field of Technologies (about 22% of the total number of programs). It is followed by Law and Social Sciences, with 16% of the study programs, and Economics and Business and Health, both fields representing 11% each. The least represented field is Sports and Arts, with 3% of the programs. We should highlight the increase, in the first phase, in the programs in the field of Law and Social Sciences; its quota has increased from 11% in 2003/2004 to 16% in 2006/2007. It is also visible the decrease in the relative importance of the field of Education, which studies represented 13% of the all offer in 2003/2004, but only 7% in 2006/2007. In the field of Humanities the decreased has been from 11% to 8% over the same period. Health increased 1 percentage point, while Technologies decreased 2 percentage points. The average program size in the first phase is bounded between 44 and 47, a stable figure during the period under analysis. The second phase is characterized by an average number of vacancies bounded between 13 and 17.

The proportion of University programs evolved from 52% in 2003/2004 to 49% in 2006/2007, which means that polytechnic studies are gaining relative importance in terms of the total number of programs. In 2003/2004, about 4% of the available study programs were newly created. That number doubled in the folowing year, but decreased to 6% in 2006/2007. The average number of *hits* per program in the first phase has

remained relatively stable: around 195 *hits*, with the exception being the school year of 2005/2006 when it decreased to about 177 average *hits*. The dispersion of the average number of *hits*, considering the first phase, has increased from around 208 in 2003/2004 to about 230 in 2006/2007. If we look at the second phase the dispersion varies between 37 in 2004/2005 and 60 in 2006/2007.

Finally, it is interesting to look at the pool of applicants. The number of candidates in the first phase has slightly decreased between 2003/2004 and 2006/2007, going from 41662 candidates in the beginning of the period to 40521 in the most recent year. In 2005/2006 the system registered the lowest number of candidates, 38976, during the period of analysis. For the second phase the number of candidates was stable above 15 thousand candidates in 2003/2004 and 2006/2007. It registered, however, a significant decrease in 2004/2005, 10348 candidates, but recovered in 2005/2006 (13688 candidates).

4 The Bologna process and demand for programs

Estimation results from the negative binomial model on the total program demand, using the explanatory variables described above, are reported in Table 2. We present the first three specifications for benchmark purposes. The first specification is our base specification. Specification 2 further allows the impact of Bologna to diverge between leader and non-leader programs. Specification 3 alternatively checks whether the impact of the Bologna process has been different for integrated masters and other programs. Finally, Specification 4 combines the previous specifications. The sign and significance of the coefficients do not vary much across specifications and therefore for interpretation purposes we will refer below to the most complete specification, Specification 4.[5]

In general, programs that restructured to comply with the Bologna principles were

[5]The log-likelihood for each estimation reported at the bottom of Table 2 provides evidence in favor of our option for Specification 4, since this is the estimation reporting the lowest log-likelihood in absolute value. The α parameter reveals that there is overdispersion (it relates to the presence of a higher than expected variance), which justifies the use of the negative binomial model. In our analysis we use 1323 programs of study, corresponding to 7718 observations.

subject to an increase in demand, when compared to programs that did not restructure. This effect (slowly) decreases with the size of the academic program. For example, a program posting 50 vacancies saw its demand increase by 26%.[6] The impact becomes negative for programs with more than 108 vacancies (note however that over 94% of the programs post less vacancies than this benchmark). Since the Bologna dummy variable also enters the regression interacted with the field of study, these results on the impact of Bologna on program demand refer to the baseline field, Humanities. The results are not significantly different for programs in Law and Social Sciences, Economics and Business, Sports and Arts, Education, and Technologies; i.e., Bologna also has a positive impact on these fields of study. Agriculture, Architecture, Natural Sciences, and Health show a significantly lower impact of the Bologna process when compared to Humanities. For Architecture, the results indicate that the impact of Bologna on demand is negative. The impact of the Bologna process is different by field of study. This might result from the fact that we are dealing with different market segments, where the incentives to choose can be quite diverse.

Table 2: Demand for academic programs, negative binomial model with academic program fixed effects

Variable	Spec. 1	Spec. 2	Spec. 3	Spec. 4
Bologna implementer	0.456**	0.396*	0.489**	0.431**
	(0.215)	(0.207)	(0.214)	(0.206)
Bologna implementer * program size	-0.003***	-0.002***	-0.004***	-0.004***
	(0.0006)	(0.0006)	(0.0006)	(0.0007)
Bologna leader		0.178*		0.165*
		(0.092)		(0.091)
Bologna leader * program size		-0.001		-0.0006
		(0.002)		(0.001)
Integrated master			0.036	0.052
			(0.112)	(0.112)
Integrated master * program size			0.004***	0.004***
			(0.001)	(0.001)
Bologna implementer * field of study:				
agriculture	-0.413*	-0.418*	-0.439*	-0.443*
	(0.251)	(0.241)	(0.251)	(0.240)
law, social sciences	-0.292	-0.298	-0.277	-0.285
	(0.229)	(0.222)	(0.228)	(0.220)
architecture	-0.474**	-0.510**	-0.510**	-0.549**
	(0.228)	(0.226)	(0.229)	(0.227)
natural sciences	-0.426*	-0.447*	-0.415*	-0.439*

Continued on next page...

[6] The overall impact being equal to $[exp(0.431 - 0.004 * size) - 1] * 100$.

... table 2 continued

Variable	Spec. 1	Spec. 2	Spec. 3	Spec. 4
	(0.245)	(0.237)	(0.244)	(0.236)
economics, business	-0.222	-0.215	-0.203	-0.196
	(0.239)	(0.232)	(0.238)	(0.231)
sports, arts	0.015	-0.088	0.009	-0.092
	(0.673)	(0.669)	(0.664)	(0.664)
education	0.015	-0.079	0.033	-0.068
	(0.313)	(0.316)	(0.311)	(0.315)
health	-0.382	-0.338	-0.436*	-0.390*
	(0.242)	(0.234)	(0.237)	(0.229)
technologies	-0.202	-0.198	-0.265	-0.265
	(0.226)	(0.219)	(0.227)	(0.220)
Program size (vacancies)	0.005***	0.005***	0.005***	0.005***
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
Phase 2	-0.902***	-0.903***	-0.904***	-0.904***
	(0.024)	(0.024)	(0.024)	(0.024)
Exam:				
maths	-0.443***	-0.445***	-0.448***	-0.451***
	(0.062)	(0.062)	(0.062)	(0.062)
physics	-0.576***	-0.576***	-0.579***	-0.580***
	(0.127)	(0.127)	(0.128)	(0.128)
chemistry	-0.126	-0.127	-0.122	-0.122
	(0.088)	(0.086)	(0.088)	(0.087)
biology	-0.545***	-0.544***	-0.548***	-0.547***
	(0.068)	(0.068)	(0.068)	(0.068)
portuguese	-0.123	-0.111	-0.122	-0.110
	(0.088)	(0.087)	(0.088)	(0.087)
α	0.115***	0.115***	0.115***	0.114***
	(0.003)	(0.003)	(0.003)	(0.003)
N	7718	7718	7718	7718
N-g	1323	1323	1323	1323
LL	-35712.13	-35706.39	-35698.47	-35692.73

Significance levels: $*$: 10% $**$: 5% $***$: 1%. Standard errors in parentheses: Huber-White adjusted standard errors, considering clustering of observations within each academic program for different moments in time. N is the number of observations, N-g is the number of groups institution/program, and LL stands for log-likelihood. All regressions include year controls, their interaction with field of study, and institution/program-specific dummy variables.

The positive coefficient on the Bologna leader variable indicates that, if a program was restructured at one single institution in the country, it benefited from an increase in demand over Bologna implementers in general. This additional impact with respect to Bologna implementers in general took place irrespective of the size of the Bologna leader (see the insignificant coefficient on the interaction of Bologna leader with program size). This result complements those in Cardoso et al. (2008), when analyzing the first options, which had shown that the Bologna process had no impact on the number of first choices that bologna leaders received. The increase in demand faced by Bologna leader programs that is now uncovered therefore stems from students' 'second best'

choices and not their first option.

Programs that restructured to become integrated masters were subject as well to a positive impact above the impact for Bologna implementers in general. The overall impact on integrated masters increases with the size of the program.

Finally, looking at the control variables, larger programs (posting more vacancies), as expected, are subject to larger demand. Also quite naturally, the second phase gathers a remarkably lower number of applications, since it is a residual phase. The demand for a higher education program is strongly affected by the performance of the candidates in the national admission exams, with exams on Biology, Mathematics or Physics lowering the demand for the program.

5 Concluding remarks

We have checked the impact on the demand for academic programs resulting from changes in the curricula currently taking place under the Bologna process. The relevance of the issue follows from the mix of enthusiasm and criticism that these changes have raised, in countries where the first degree of higher education used to last for four or five years and is now reduced to three years. Results indicate that most programs that changed their curricula to comply with the Bologna principles were subject to an increase in demand by prospective students, indicative of support for the shorter first degree. Nevertheless, their receptiveness to the curricula changes varied across fields of study and with program size. Interesting enough is the fact that the increase in demand faced by institutions that were the only ones in the country that restructured a given academic program came from 'second best' choices and not from students' first choices.

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Appendix

Given that the dependent variable is a positive integer and its distribution is skewed to the left, Poisson models are an adequate tool (Cameron and Trivedi, 1998). Furthermore, we have data for four school years and two phases, that is, the data shows a panel structure with repeated observations on the same program and institution, which

allows controlling for study program characteristics that are not observable, but are assumed constant over time. So, a possible solution would be to use the fixed effects Poisson model, to take into account for this unobserved heterogeneity across academic programs. This type of models assumes that there is no overdispersion, which is to say that the mean and the variance of the variable being modeled are identical. The descriptive statistics, however, reveal that the dependent variable presents raw overdispersion. This indicates that the negative binomial regression model might be more appropriate for our data, since it relaxes the hypothesis of equal mean and variance. The results of formal overdispersion tests indeed show clearly that a negative binomial specification is more appropriate. The test is based on the idea that a fixed effects Poisson model can be seen as a multinomial model (see Guimarães and Lindrooth, 2007), implying that testing for overdispersion in the multinomial model can be achieved by testing for overdispersion in the Poisson model. We then use a Pearson test for the null hypothesis of no overdispersion in the multinomial model, which is rejected at any ordinary level of significance in all the specifications reported.

Allison and Waterman (2002), however, point out that the fixed-effects negative binomial model, as defined by Hausman et al. (1984), is not a fixed-effects model in the usual sense, because the fixed effect applies to the overdispersion parameter, rather than to the covariates. That is, that model specification solves the overdispersion problem, but does not guarantee that the program-specific effects are conditioned out of the likelihood. As such, a test for the null hypothesis of successful removal of the fixed effects is required. To our knowledge, the only test available is that proposed by Guimarães (2008). When applied to our data, that test rejects the null hypothesis of overdispersion. Nevertheless, according to the simulations performed by Guimarães (2008), the test is not recommended for samples with small time dimensions, as is our case. According to Guimarães (2008: 65) "with panels as large as 1000 individuals the test requires at least 20 observations per individual to adequately control for type I error."

Combining the arguments and the results we obtained, we have decided to imple-

ment the strategy proposed by Allison and Waterman (2002). This consists on the estimation on the pooled sample of an unconditional negative binomial model with dummy variables to account for the program/institution fixed effects. This is the most adequate solution to deal with unobserved heterogeneity in a count data model and at the same time take into account the difference between the variance and the mean of the distribution.