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Abstract

This paper analyzes the role of peer effect in the market for higher education. Peer effect is a key variable to understand why higher education institutions set tuition in a way to maintain permanent excess demand. We use data on undergraduate business courses in Brazil to estimate a discrete choice model of demand. The results show a strong impact of peer effect on students' choice of school. We calculate the tuition increase that would eliminate the excess demand. The results show that the upper limit of the total investment in peer effect is equal to US$ 770 thousands per month for the freshmen year, or 5.13% of the current revenues.

Keywords: Higher Education, Peer Effect, Discrete Choice, Multinomial Logit.

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1 Introduction

In the economic literature, several studies have already pinpointed that the higher education sector has peculiar characteristics which differentiate it from

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other sectors in the economy[1]. For example, many higher education institutions (HEIs) do not expand supply (or slots) in order to meet persistent excess demand or adjust the price to clear the market. Quite the opposite, they are likely to reject most of potential customers who are willing and able to pay the full tuition. In fact, the number of potencial customers that the HEI turns away is perceived as an indication of its quality.

While most industries select their customers through price mechanism, the education system takes into account that the quality of demanders matters in the education process. A customer-input technology is employed in the higher education sector[2]. The highest the quality of incoming students (and customers), ceteris paribus, the greatest is the quality of outgoing students or the quality of educational services provided by the HEIs. In great lenght, it occurs because students benefit from the interaction with others, the so called peer-effect[3,4].

In recognizing the importance of students' quality in the production of educational services, HEIs impose a very selective process to choose the students

[1]For example, see Rothschild and White (1995) and Winston and Zimmerman (2003).

[2]Independently of the assumption about the HEIs' objective function, the quality of their students plays an importante role. Epple et al. (2006) assumes that the HEIs maximize the quality of the educational experience provided to their students, which is directly affected by the quality of the student body. Rothschild and White (1995) assumes that HEIs maximize profits and the net tuition takes into consideration the fact that students are inputs and outputs. See also Hoxby (1997) for a similar structure.

[3]There is consensus in the literature that measuring peer-effect is a difficult task mainly because peer groups are endogenous and operate in the same environment. Epple et al. (2003), Zimmerman (2003), Arcidiacono and Nicholson (2004) and Manski (1993) discuss the difficulties and challenges to measure the peer-effects. There are mixed evidence on the recent work on peer effects in higher education. Sacerdote (2001) and Zimmerman (2003) find evidence of peer-effect among roomates. Arcidiano and Nicholson (2005) find no peer effect among medical students, while Dale and Krueger (1998) find mixed results.

[4]About the customer-input technology, Winston (1999) recognizes that peer-effect is not the only effect. He says that "though I believe that interaction among good students plays the central role (...) even in a hub-and-spoke view of education, the professor at the hub can cover more ground or go deeper into subjects the more able are the individual students on the spokes (...)".

and restrict the supply[5]. According to Winston (1999), there are two reasons why a HEI does not satisfy demand fully. On the one hand, it increases selectivity directly. The argument is the following. Given the supply, a greater demand leads to a higher excess demand and the opportunity for selectivity. As students' demand depends on the quality of a HEI's students, this process allows a greater future student quality. On the other hand, it increases selectivity indirectly. Given the fixed amount of donative resources available to a HEI in the short run, a restriction in the number of new students allows a higher subsidy per student. Hence, students' demand increases and, again, assuming fixed supply, a greater selectivity takes place.

Considering this peculiar nature of the higher education sector, it is interesting to investigate empirically some of these characteristics. In this regard, this paper has two main objectives. First, we check if student demand is actually affected by the quality of the student body, as it is currently assumed in the literature. Second, we estimate how much HEIs that operate with excess demand sacrifice in terms of current revenues in order to increase selectivity. In other words, what is the maximum amount of the investments in peer effect.

In order to make the analysis, we use data for the undergraduate courses in business in the State of São Paulo in Brazil[6]. Following the approach used in the discrete choice literature[7], we employ a multinomial logit model to estimate

[5]Winston (1999) notes that there are other possible explanations for a HEI to care about the quality of the student body: network effects discussed in Liebowitz and Margolis (1994) and "the appeal of one's association with people and institutions of status and prestige that are surely reinforced by the exclusivity of strict selection" discussed in Basu (1989) and Becker (1991). About his alternatives, he says that "but these are not mutually exclusive, so arguing that one effect is present doesn't argue that another is not".

[6]Brazil is a federation divided by 27 states and the Federal Discrict. The State of São Paulo is the most developed on. In contrast with the US market, in Brazil, most students study in the state where they are born (99.95% vs. 80% in the US). For an analysis of the transformation of the US higher education market from a collection of local HEIs to a nationally integrated market, see Hoxby (1997). See next section, for a brief discussion about the characteristics of the Brazilian higher education sector.

[7]For example, see Nevo (2001).

what are the HEIs' characteristics that determine the students' choice or the HEIs' market share. One of these characteristics is the quality of the student body, measured by the HEI's freshman students' average grade in a national exam. This variable affects positively the students' choice, which corroborates the view that students actually base their HEIs' choice on the quality of the student body. Other variables affect, with the expected signs, the HEIs' market share: price, faculty's quality and ranking of the HEIs' academic quality[8].

We then proceed to calculate the investments in peer effect. Using the results from the multinomial logit model, we estimate what is the price that HEIs should charge in order to eliminate the excess demand. A proxy for a HEI's excess demand, given the price, is the difference between the number of applicants and the number of freshman students. This approach may overestimate the excess demand for some HEIs as students in general apply simultaneously to different institutions and, obviously, not all can be their first choice. Nonetheless, one can estimate the upper limit of the investment in peer effect by calculating the difference between the actual price charged and the one that would eliminate the excess demand times the number of enrolled students. The results indicate that this amount corresponds US$ 700 thousand dollars or 5.13% of the current revenues with the new entrants.

It is important to remark that investment in selectivity has been seen here as the upper limit of the investment in peer effect. While peer effect is clearly an increasing function of excess demand, stimulating selectivity may have additional consequences for HEI's besides peer effect. Once significant part of their revenues may come from both donation and private and government funding, selecting the best incoming students could mean more donations from successful professionals in the future and better reputation, which would help HEIs in their funding-raising efforts. However, as will be argued in the next section, the

[8]Monks and Ehrenberg (1999) shows evidence that there is a decrease in net tuition for HEIs in a less favorable rank in the US News and World Report College Ranking. Moreover, an improved ranking can lead to greater donations from alumni and more qualified students in the next year's applicant pool.

specificities of the Brazilian higher education system make this approximation between selectivity and peer effect more precise.

To the best of our knowledge, our paper is the first one to use the discrete choice model in the higher education sector. The closest paper to ours is Gallego and Hernando (2008) that analyze students' choice in the school system in Chile, in order to evaluate the effects of school choice on the students' welfare and socioeconomic segregations.

The remainder of this paper proceeds as follows. In the next section, we explain some characteristics of the Brazilian higher education sector, emphasizing its differences with respect to the US market. In section 3, we present the empirical strategy employed as well as the data used. Then, we present the results. Section 5 presents the estimation of the investment in peer effect. Section 6 offers a brief conclusion.

2 The Brazilian Higher Education Sector

In this section, we will show the differences between the Brazilian and the American higher education system, claiming that HEIs are more similar to traditional firms in Brazil than in the U.S.[9]

The first important difference is that Brazilian students choose the area they want to obtain the bachelor degree before they are accepted as a student in a HEI. For example, if they want to obtain their undergraduate degree in business, they have to apply to programs specialized in business. In contrast, in the US, a student takes core courses common to all students in the first two years and then choose the fields they want to specialize in.

In 2006-2007 academic year there were 4,314 American HEIs. Almost 40%

[9]The Brazilian data come from the National Institute of Educational Studies and Research Anisio Teixeira (INEP) - Sinopse Estatistica da Educacao Superior, 2007 (http://www.inep.gov.br/superior/censosuperior/sinopse/) - a Federal Government institute. The American data are found in The Condition of Education - a report published by the National Center of Education and Statistics (NCES) - The Condition of Education, 2000-2008 (http://nces.ed.gov/programs/coe/).

of them were public and only 22% (986 institutions) were for-profit institutions. Taking into consideration the number of enrolled students, for-profit and private institutions was even less significant: only 5.7% of 17.5 million students took courses in for-profit institutions, whereas the whole private system corresponded to 25.5%.

Data from NCES show that in 2005 more than 70% of for-profit colleges and universities' revenues came from other source rather than student tuitions. Donation and research funding are crucial in their planning and strategies. Therefore, it is easy to understand why no one should consider American HEIs as tuition-maximizing agents.

The scenario in Brazil is quite different. In 2006, of 2,281 institutions, more than 89% were private and about 74.6% of students were enrolled in those private institutions. In this year, the majority of private institutions was for-profit ones, around 52%; which means there were more than one thousand for-profit colleges or universities. Not only is the participation of private sector - and specifically for-profit institutions - much bigger in Brazil than in the U.S, but also it is known that resources from donation are almost zero in Brazil, though there is no official data about it. Moreover, funding for research is considerably lower than the amount received by American universities. Thus, as Brazilian HEIs create excess demand and, consequently, higher selectivity, they are almost exclusively improving the attractiveness of their services through adding positive peer effect; instead of being concerned about the impact of selectivity on different sources of revenue such as donation and research funding.

As mentioned in the introduction, the focus of the analysis is on undergraduate business courses in São Paulo State. This strategy allows us to narrow the investigation without deviating too much from the main features of the Brazilian higher education system. The higher education system in São Paulo is very similar to the national one not at least because almost one fourth (24,1%) of the existing courses in Brazil are located in the State of São Paulo. While 89,1% of institutions are private in the national system, private institutions represent 90,1% of the total in São Paulo. Specifically about business courses, they are the

main major not only in terms of number of courses (7,6%), but also in number of student enrollments (13,9%).

To summarize, private (and for-profit) colleges and universities in Brazil have a significant market share and their revenue coming from tuitions is a key aspect for them. Consequently, a large part of the Brazilian higher education system is formed by institutions whose objectives do not go much further than selling education services for undergraduate students.

3 Empirical Strategy and Data

We follow the approach used in the discrete choice literature to estimate the demand for undergradute courses in business in the State of São Paulo in Brazil. References on this field are vast, but major contributions are Berry (1994), Berry Levinsohn and Pakes (1995) and Nevo (2001).

Two features are key for this method. The first is that, despite being a discrete choice model, it relies only on aggregated (or market) data. The second is related to the problem of having too many parameters to estimate in a system of demand equations for differentiated goods: every price should appear in all equations of the system. In a system with N goods, there would be N^2 parameters to estimate, a number too large for a system with more than four goods. This method projects the goods onto a characteristic space and thus make this space dimension the relevant one, instead of the number of goods.

Students rank the HEIs according to their characteristics. There are $(N+1)$ choices in the market, where N is the number of HEIs offering undergraduate courses in business (or inside goods) and one reference good (or outside good). Student i chooses HEI j, given the vector of observed characteristics (x_j) and price (p_j), an unobserved (to the econometrist) characteristic (ξ_j), and unobserved idiosyncratic preferences ε_{ij}, according to the following indirect utility function:

$$u_{ij} = \alpha p_j + x_j\beta + \xi_j + \varepsilon_{ij},$$

where β is a K-dimensional vector, whose element β_k represents the marginal utility of characteristic k, assumed invariant across students.

Assuming that the utility derived from the consumption of the outside good is normalized to zero ($u_{i0} = 0$), and that the idiosyncratic preference ε is distributed as an extreme value distribution, the probability of student i choosing HEI j (s_{ij}) (or the market share of HEI j) takes the familiar multinomial logit form:

$$s_{ij} = \frac{\exp\left(\alpha p_j + x_j\beta + \xi_j\right)}{1 + \sum_{m=1}^{N} \exp\left(\alpha p_m + x_m\beta + \xi_m\right)}$$

Log-linearizing the above equation, we have:

$$\ln\left(s_j\right) - \ln\left(s_0\right) = \alpha p_j + x_j\beta + \xi_j$$

One could run OLS using the above equation, having the HEIs' market share as the dependent variable and several HEI's characteristics as explanatory variables. However, as one of these explanatory variable is the HEIs' prices and the fact that prices are endogenous, the estimation by OLS is not appropriate as the estimators are biased. The alternative used in the literature (Berry, 1994 and Nevo, 2001), and in this paper, is to use a linear instrumental variable method, such as 2SLS or GMM, to estimate the model.

It is not trivial to define the market share in the higher education sector and we make use of alternative definitions. Intuitively, the market share of a given HEI is equal to the number of students who demand to study in the HEI divided by the population at the age to attend university and with a high school degree living in the city where the HEI is located[10]. The difficulty is in defining the demand for a HEI, or the numerator. One possibility is to use the number of students who apply to the HEI[11]. The problem with this choice is that it is

[10] In Brazil, students in general study in a HEI located in the city where they obtained their high school degree. The mobility is very strict. Therefore, the relevant market for a HEI is the size of the population at the age to attend it in the city where it is located.

[11] In Brazil, applicants must take the same exam (called "vestibular") prepared by each university and the accepted students are those who achieve the highest scores.

common for students to apply to different universities at the same time. Hence, this measure overestimates the demand.

A second alternative is to use in the numerator the number of students who are selected and registered into the HEI. The problem with this alternative is that the top schools experiment excess of demand, as discussed in the introduction. They would certainly have a higher share if they had a less strict selection process and were willing to accept more students. In this paper, we use the number of applicants as our benchmark to define the market share. However, we also provide a robustness check to see if the results are robust across the alternative definition of market share.

There are several HEIs characteristics that affect its attractiveness and, as a consequence, their market share. We use them as explanatory variables in our empirical model. They are likely to fall into several categories. First, there are characteristics of the HEIs' professors. We use two measures: the fraction of professors who have a doctoral degree (% doctor) and the fraction of full-time professors (% full time) in the institution. As these variables signal the quality of the faculty, one should expect HEIs with higher % doctor and % full time to have a greater market share. Second, there are characteristics of the HEIs' infrastructure. We use three variables: the quality of the physical installations[12] (bldg qual) and the library (lib qual), and the availability of computers (comp qual), obtained from a questionnaire answered by students. The first variable runs on a scale from 1 to 5 and the other two from 1 to 4. Higher values indicate higher quality and, obviously, it should lead to a higher market share.

Third, there are course's characteristics. They are: the monthly tuition (Tuition), course's age (Age) and a dummy variable (Bach) equal to one and zero, respectively, if the HEI provides a baccalaureate or a technical degree. Ceteris paribus, a lower Tuition should attract more students and increase the market share. The number of years that a course exists can be seen as a measure of its reputation. In that sense, we expect the market share to increase with Age.

[12]The quality of the classrooms, labs and study rooms.

Fourth, we use the summary ranking or rating published by a external institution[13]. We define three dummy variables: 5 star, 4 star and 3 star are equal to 1 if the HEI receives, respectively, a five, four or three star classfication and zero otherwise. It is expected that prospective students and their parents pay attention to this type of ranking and the greater the rank is, the higher is the market share. Finally, as a last characteristic, we use the variable Enade score to indicate the quality of the student's body. Enade is a key variable for our purposes. It consists of a test applied by the Ministry of Education to all college students in Brazil to evaluate college quality. A student must take the test twice: when she enters school as a freshman and when she graduates. We use the variable Enade score - entrants' average score - to measure how important is the quality of the other students on prospective students' choice. In other words, this variable capture how much students value peer effect on their school choices. This is a crucial variable in the analysis, as it allows us to check the current view in the literature that students actually base their HEIs' choice on the quality of the student body.

Variables Age and the number of applicants and students that enroll in the course are obtained from the 2006 Brazilian Higher Education Census. % of doctors and % of full time are collected from the 2005 Faculty Census. Variables bldg qual, lib qual, comp qual and Enade score are provided by the 2006 ENADE Census. All these three census are provided by the Brazilian Ministry of Education. The size of the market, or the denominator of the variable market share, are obtained from the 2007 Brazilian Population Census provided by the Brazilian Bureau of Statistics (IBGE). The ranking variables are from the "Student's Guide" 2007 edition. The authors collected data on Tuition for all

[13]The best known and longest running ranking of the Brazilian HEIs is published by the magazine "Student's Guide" (or, in portuguese, "Guia do Estudante") and this is the reason we use it. The top ones receive a grade (five, four or three stars) and the rest receives no grade at all. The ranking is constructed based on the opinions of referees hired by the magazine. These referees are professors and they receive information about faculty and academic publication of all HEIs. Hence, one should expect this variable to be correlated with age (reputation) and faculty's characteristics. We return to this point later in the analysis.

HEIs for the first semester of 2008. The sample comprises 298 observations or HEIs.

As mentioned before, the data used in the econometric model is composed by all business courses in Sao Paulo State. There are 298 courses; which have been separated into 130 markets according to their location. A market is defined as a municipality.

As can be seen in Table 1, there was just one HEI in 63% of markets, which means that 83 courses (27.8% of total) were the only business courses in their cities. Two HEIs disputed students in 25 markets and 97 courses were distributed in 21 markets with more than 2 and less than 12 competitors. Besides, about 22.8% of courses (68) were in Sao Paulo city, the biggest market by far.

Table 1: Markets and HEI's

# of HEIs	# of markets	total
1	83	83
2	25	50
3 to 11	21	97
68	1	68
total	130	298

In Table 2, we present the summary statistics of the variables employed in the analysis. The average market share of our sample is 6.9%, since the total market includes individuals that are not enrolled in business courses. HEIs are on average 9.2 years old and almost all of them provide baccalaureate degree (94.8%).

Enade average score corresponds to 39.5 (in a scale from 0 to 100). Average monthly tuition is 218 dollars and the municipalities average GDP per capita is US$ 12,366 dollars. 45 courses (15.1%) have 3 or more stars in "Guia do Estudante" classification. Moreover, across the HEI's analyzed, on average, the percentage of professors with doctoral degree and full time professors are,

respectively, 8.5% and 12.5%.

Table 2: Summary Statistics

Variable	Average	Std Deviation
Market share (%)	6.9	11.2
Enade Score (0-100)	39.5	4.3
Tuition (US$)	218	107.2
Doctors (%)	8.5	9.3
Full time (%)	12.5	15.1
GDP per capita (US dollars)	12,366	7,828
Age	9.2	12.2
3,4, or 5 Stars (%)	15.1	
Bach (%)	94.8	

Finally, the average of all courses for building quality, computer quality, and library quality are, respectively, 1.75, 1.56, and 1.7. Table 3 shows the distribution of grades relating to the physical infrastructure quality. The central column presents the number of courses that have obtained grades around the average; whereas the second and fourth column shows the number of courses with good and bad grades, respectively.

Table 3: Infrastructure

Variable	Better than Average + StdDev	Average + StdDev and Average - StdDev	Worse than Average - StdDev	Total
Bldg. Qual.	49	201	48	298
Comp. Qual.	52	204	42	298
Lib.Qual.	46	206	46	298

4 Econometric Results

Table 4 presents the estimation results of different especifications of the model. Model 1 is estimated using OLS while the other specifications make use of instrumental variables to correct for the price endogeneity. The OLS gives results that are quite different from the other estimations, while the IV especifications give results that are consistent across the different estimations. The following analysis focuses on the IV estimations.

Model 2 estimates using 2SLS, while models 3 and 4 use GMM to correct for possible heteroscedasticity problems. The main observation at this point is that the results of models 2 (2SLS) and 3 (GMM) are very similar. Some heteroscedasticity may exist but it is not severe. Since the ranking uses information about the percentage of doctors and age of the HEI, we exclude ranking in model 4.

The price coefficient shows a drastic change when using IVs. It goes from near zero in the OLS estimation to about -0.03 and highly significant when using instrumental variables. This result is robust across all estimations of the model.

The results show that the ranking variables have a strong effect on market share determination. A 5 star institution has a much stronger chance of being chosen than a school with no stars.

The percentage of the faculty with doctoral degree has a strong positive and statistical significant effect. On the other hand the percentage of full time professors is not siginificant in any of the specifications. It indicates that prospective students pay attention to the quality of the body of professors but not to their employment situation in the institution.[14]

We use three variables that measure HEIs' infrastructure quality: building, computers and library quality. Building and computers are not significant, while library has the opposite sign.

[14]It was pointed out to us that it makes sense for business courses, where good professors may also work in the business world, and this kind of background may be desirable.

Table 4: Econometric Results

	OLS	2SLS	GMM	
	1	2	3	4
Tuition	-0.003	-0.03	-0.027	-0.017
	(-3.59)	(-5.52)	(-4.81)	(-4.94)
Bach	0.52	2.40	3.25	1.24
	(0.50)	(1.15)	(1.99)	(1.10)
5 star	0.85	24.16	21.44	
	(0.47)	(4.22)	(2.70)	
4 star	0.33	10.65	8.28	
	(0.27)	(3.39)	(1.67)	
3 star	-0.11	1.47	2.25	
	(-0.21)	(1.43)	(2.20)	
% docs	1.54	10.83	10.28	14.51
	(0.75)	(2.45)	(2.36)	(4.12)
% full time	1.19	0.01	-1.62	-2.70
	(1.10)	(0.01)	(-0.93)	(-2.13)
Bldg quality	0.40	0.36	0.25	0.59
	(0.92)	(0.42)	(0.41)	(1.18)
Comp quality	0.03	-0.90	-0.95	-0.59
	(0.04)	(-0.50)	(-0.72)	(-0.54)
Lib quality	-1.54	-1.63	-1.36	-2.89
	(-2.38)	(-1.28)	(-1.56)	(-3.70)
Age	-0.01	-0.005	-0.01	0.01
	(-0.62)	(-0.18)	(-0.59)	(0.44)
Enade	0.02	0.46	0.43	0.40
	(0.33)	(3.71)	(3.96)	(4.38)
GDPpc	-0.04	0.05	0.05	0.01
	(-2.00)	(1.24)	(1.38)	(0.53)
c	-1.34	-7.82	-8.99	-8.69
	(-0.54)	(-1.56)	(-2.03)	(-2.34)

*t-ratios are in parentheses.

Table 5: Marginal Effects

	mean	std dev	min	max
Tuition	-0.0007	0.0009	-0.0034	0
% docs	0.232	0.2868	0	1.1195
% full time	0.0226	0.028	0	0.1092
Bldg quality	-0.0149	0.0185	-0.0722	0
Comp quality	-0.0084	0.0103	-0.0404	0
Lib quality	0.0474	0.0586	0	0.2286
Age	-0.0001	0.0002	-0.0007	0
5 stars	0.6386	0.7896	0	3.0819
4 stars	0.2983	0.3689	0	1.4398
3 stars	0.022	0.0272	0	0.106
Enade	0.0116	0.0143	0	0.056

As mentioned, Enade score is a key variable for our purposes, as it measures how important is the quality of the other students on prospective students' choice. The results show a strong positive significant effect, showing that peer effect plays a important role on school choice.

Other controls are used in the estimation. Age has no statistical effect on market share determination, implying that school reputation is linked to other features of the institution but age. Municipality per capita GDP is not statistically significant. The fact that the course has a baccalaureate degree (as opposed to technical degree) has no effect on students choice.

Since marginal effects on a logit model depend on the market share of the firms, each firm has a marginal effect. Table 5 shows some statistics of the marginal effects for the relevant variables. Comparing the mean and the standard deviation it is possible to conclude that marginal effects have a large variation across firms.

4.1 Robustness Check: alternative data set and market share definition

Now we go back to the problem of defining market share in this market. Table 6 shows the estimation results for both the alternative market share definition, the number of students that enroll in the course, and the one we have been using, the number of applicants. The main point we make here is that the results are almost identical under both definitions and estimation method. Therefore, the results are not compromised by the fact that we are using an approximation to the true (but unknown) market share definition.

5 Peer Effect

Now we turn to the question of why do some schools show persistent excess demand. As discussed before, the existing literature on the topic says that this is due to selection of better students, or investment in 'peer effect'. The econometric results (table 4) goes in favor of this assumption: the peer effect, represented by the variable Enade score, plays an important role in school choice.

We calculate investment in peer effect in the following way.[15] It is the variation in prices (Δp_j^*) such that

$$\frac{candidates_j}{pop} - \frac{slots_j}{pop} = \frac{\partial s_j}{\partial p_j}\Delta p_j^*$$

In words, it is the rise in price that would reduce the number of candidates to be equal to the number of slots. Investment in peer effect by school j is $\Delta p_j^* * slots$. Figure 1 show the distribution of investment in peer effect for the freshmen year among the schools in our sample. Slightly less than half of the sample does not have excess demand, and therefore no peer effect investment (PEI). A good number of schools have a light selection, which means that they are not spending much on peer effect, and a few schools concentrate most of

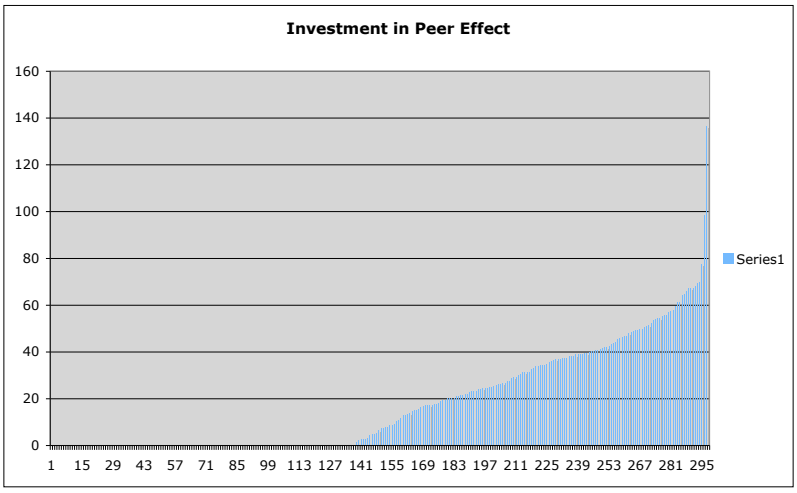
[15] It is in fact the upper limit of the investment in peer effect, since we are using the total number of applicants to define market share.

Table 6: Alternative Market Share Definition

	2SLS		GMM	
	# enrolled	# applicants	# enrolled	# applicants
Tuition	-0.03	-0.03	-0.03	-0.027
	(-5.77)	(-5.52)	(-5.06)	(-4.81)
Bach	2.29	2.40	3.07	3.25
	(1.06)	(1.15)	(1.64)	(1.99)
5 star	26.31	24.16	25.78	21.44
	(4.42)	(4.22)	(2.81)	(2.70)
4 star	11.72	10.65	10.49	8.28
	(3.60)	(3.39)	(1.82)	(1.67)
3 star	1.29	1.47	1.88	2.25
	(1.21)	(1.43)	(1.82)	(2.20)
% docs	10.11	10.83	10.65	10.28
	(2.21)	(2.45)	(2.16)	(2.36)
% full time	0.25	0.01	-1.43	-1.62
	(0.11)	(0.01)	(-0.73)	(-0.93)
Bldg quality	0.61	0.36	0.49	0.25
	(0.69)	(0.42)	(0.70)	(0.41)
Comp quality	-1.48	-0.90	-1.41	-0.95
	(-0.79)	(-0.50)	(-0.94)	(-0.72)
Lib quality	-1.40	-1.63	-1.26	-1.36
	(-1.06)	(-1.28)	(-1.33)	(-1.56)
Age	0.00	-0.005	-0.01	-0.01
	(0.01)	(-0.18)	(-0.21)	(-0.59)
Enade	0.50	0.46	0.48	0.43
	(3.86)	(3.71)	(3.89)	(3.96)
GDPpc	0.06	0.05	0.06	0.05
	(1.32)	(1.24)	(1.63)	(1.38)
c	-8.86	-7.82	-9.41	-8.99
	(-1.70)	(-1.56)	(-1.91)	(-2.03)

the investment in peer effect. Table 7 shows the statistics of investment in peer effect. The monthly investment of the undergraduate business courses in the state of Sao Paulo in peer effect is 770 thousands of dollars.

Figure 1: US$ per month - for the freshmen year only



6 Conclusion

This paper identified empirically the determinants of student demand for higher education. Employing the approach used in the discrete choice literature, we estimated the demand and market share of the undergraduate courses in business in the state of São Paulo in Brazil. We obtained that price, the faculty quality and the ranking position affect significantly, with the expected signs, a HEI market share. Mostly important, we found strong evidence that the demand is influenced by the quality of the student body. This result confirms the view in the literature that students care about the peer effect when selecting the HEI.

Table 7: Investment in Peer Effect - statistics

# firms w/ Inv PE =0	138
# firms w/ Inv PE greater than 0	160
max	US$70
mean	US$16
peer effect invest. (monthly)	US$770,000.00

The main novelty in this paper was the estimation of the upper limit of the investiment in peer effect. We estimated how much the HEIs with excess demand sacrifice in terms of current revenues in order to select the brighest students through their selection processes. The estimated monthly investment of the undergraduate courses in business in the state of São Paulo is approximately US$ 770 thousands of dollars per month, which corresponds to 5.13% of the current revenues with the new entrants.

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