REAP Rede de Economia Aplicada

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Outubro, 2011
Working Paper 007

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Permanent Excess Demand as Business Strategy: An Analysis of the Brazilian Higher-Education Market[1]

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June 2011

Abstract

Many Higher Education Institutions (HEIs) establish tuition below the equilibrium price to generate permanent excess demand. This paper first adapts Becker's (1991) theory to understand why the HEIs price in this way. The fact that students are both consumers and inputs on the education production function gives rise to a market equilibrium, where some firms have excess demand and charge high prices, and others charge low prices and have empty seats. Second, the paper analyzes this equilibrium empirically. We estimate the demand for undergraduate courses in business administration in the state of São Paulo, and show that the quality of the student body is important on the students' decisions of where to study. The results show that tuition, quality of incoming students and percentage of professors with doctorates are the determining factors of students' choice. Since student quality determines the demand for a HEI, we calculate how much the HEIs value having better students; that is the total revenue that each HEI gives up to guarantee excess demand. Regarding the "investment" in selectivity, 39 HEIs in São Paulo give up a combined 5 million Reais (or US$ 3.14 million) in revenue per year per freshman class, which means 7.6% of the revenue coming from a freshman class.

Keywords: Higher Education, Market Segmentation, Excess Demand
Code JEL: I23, D43.

[1] The authors would like to express their gratitude to Sônia Aparecida de Carvalho for her excellent work as a research assistant, as well as to the participants in the seminars at INEP, Insper and EESP-FGV.

1. Introduction

Microeconomics manuals teach that in equilibrium, the amount demanded for a good or service must equal the amount offered. In the higher-education market, this principle does not hold. Instead, many higher-education institutions (HEIs) limit the number of available spaces to guarantee excess demand every year. The same phenomenon can be observed in other markets, especially service markets, but the rationale behind excess demand in higher education does not apply to restaurants or large events; in education, the student, in addition to being a consumer, is also a factor of production—the quality of the output is a function of the quality of the student body. For this reason, given the characteristics of HEI and the quantity of available spaces, the institution demands a tuition below equilibrium price to increase the quality of its students through excess demand and greater selectivity.

A characteristic of the Brazilian higher education is the great diversity within HEIs. There are HEIs with good reputation, which charge high tuitions and have hotly disputed selection processes, and others that are little known outside their area and, although they charge low tuitions, have empty slots. Among private Business Administration schools in São Paulo in 2006, for example, the fees range from 170 to 2,250 Reais (or from US$ 106 to US$ 1,415[2]), and the ratio of candidates to slots ranges from 0.17 to 11.5.

This article analyzes the HEI market and attempts to answer three interrelated questions: (a) How do we theoretically understand the existence of the HEI that opts for the strategy of maintaining permanent excess demand? (b) Is this strategy justifiable? (c) How much revenue does the HEI give up to increase the selectivity of its admissions process and, consequently, the quality of its students?

Through two adaptations of the ideas of Becker (1991), we attempt to explain why some HEIs maintain permanent excess demand while others do not. Next, using a database of business schools in the state of São Paulo, we estimate the demand for higher education. The empirical results show that the quality of the student body, the tuition, and the quality of the professors are relevant in determining the demand of the

[2] The exchange rate used in this paper is R$ 1,59 reais to buy one dollar, of June 14th, 2011.

market. The relevance of the quality of the student body justifies the strategy of an HEI that opts for excess demand and confirms the theory that will be developed in the next section: demand for the school hinges on the quality of the students and, ultimately, responds positively to the selectivity imposed by the HEI. Finally, using the results of econometric models, we present the total "investment" in selectivity made by São Paulo HEIs in their business programs. This total, which surpasses 5 million Reais (or US$ 3.14 million – 7.6% of the revenue) per year, can be understood as an investment in differentiation.

While Becker (1991) theoretically shows why some restaurants having long queues for tables do not raise prices, this paper estimates the "investment on queues". The higher education market is specially appropriated for this study because there are data about all the candidates, including those students that failed in the selecting process. In a restaurant-market context, it would be as if we knew the numbers of clients *and* the number of people who give up eating at a given restaurant because of its long queues.

The selection of better students in higher education is well documented by the literature, but how to measure its impact on the education output is a controversial question (see Winston and Zimmerman, 2003). Instead of measuring this effect, the focus of this work is to better understand how the *existence* of those effects modifies the market equilibrium. Thus, we estimate (a) on one side, how the selectivity of HEIs (considering the quality of incoming students as a proxy) affects the demand curve, and (b) on the other side, how much the HEIs invest in selectivity to maximize their long term profits by maintaining permanent excess demand.

In the literature, there is a series of studies that examine the importance of tuition on the decision to pursue higher education. Ehrenberg (2004) makes a review of the literature, corroborating the notion that a higher tuition and fewer financial incentives, such as scholarships, reduce the motivation to study at an HEI. Other characteristics that may affect student preferences are less studied.

Four papers follow this line of research and are closely related to our study. Gallego and Hernando (2008) also use a discrete choice model in Chilean high schools

to estimate the effects of the voucher system on student well-being and socio-economic segregation. Monks and Ehrenberg (1999) use panel data to evaluate the impact on universities of the U.S. News and World Report rankings, the most traditional ranking in the American market. They conclude that a lower position in the ranking is detrimental to the university: fewer accepted students decide to enroll; the quality of new classes decreases, as measured by the admissions test; and the net tuition paid by the student is lower because the university has to be more generous in granting financial aid to attract students from the smaller group of applicants.

Long (2004) examines how different cohorts of students in the United States choose which HEI to attend based on their own characteristics and those of the HEI, such as tuition, quality of student body, percentage of professors with doctorates and student/teacher ratio. Long's study concludes that the quality of the faculty is the most important factor in the student's decision, a result we also find here.

Kelchtermans and Verboven (2009) study student choice in the Belgium region of Flandres. They use a nested logit model that analyzes the problem of whether and where to pursue higher education. They conclude that courses are close substitutes, and that a tuition increase would not affect the decision of whether to study but affect the decision of where to study.

Despite the fact that all these papers also estimate a demand for educational institutions, the details of the method we employ and our goals are quite distinct from the others. We chose to restrict our analysis to business administration courses only. Implicitly, we assume that business administration is not a substitute with other courses, such as biology or engineering.

The rest of this article is organized as follows. In the next section, we discuss why a HEI could use the strategy to operate with excess demand. Section 3 explains the methodology and data employed. The results are presented in Section 4. The final section concludes the analysis.

2. Theoretical Discussion

The fundamental hypothesis of Becker (1991), who studies the causes of excess demand in the restaurant industry, is that the individual's demand depends on the other individuals' demand. The author suggests that eating out, attending a cultural event or discussing a book are social activities in which people consume the product or service together, and therefore, the number of people sharing the same product influences the utility of the individual consumer.

In the case of higher education, this argument acquires an additional facet: in addition to student interaction, whose positive effect on learning is a function of the qualification and performance of the cohort (the peer effect, which does not occur in the case of restaurants), the quality and success of the graduates serve as signals to the market of the quality of the HEI. Therefore, good students tend to generate good graduates, who contribute to the reputation of the institution. In contrast with restaurants, the quality of enrolled students is fundamental to the choice of the potential student. Because greater selectivity increases the quality of the incoming class, we may conclude that excess demand creates demand. Therefore, excess demand is the result of the maximization of long-term profit.

The coexistence of HEIs with different strategies—with or without excess demand—can be understood using Becker's model (1991). Becker (1991) does not distinguish between the short and long term, but his analysis corresponds to what we consider to be long term here.

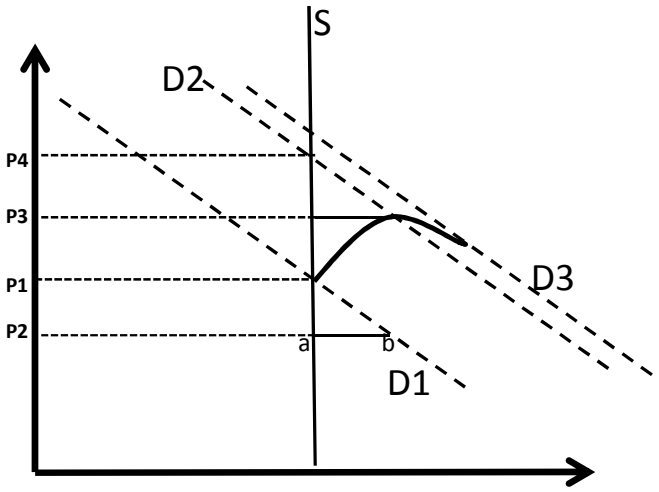
This differentiation seems important with respect to higher education because we assume that permanent excess demand builds the HEI's reputation, which in turn determines its short-term demand curve. If an HEI with a good reputation raises its tuition to eliminate excess demand, the demand during the year in question (the short term) will not be altered. In the short term, tuition set below equilibrium generates excess demand (and greater selectivity), which, in the long term, will shift the short-term demand curve to the right. It happens because, in this analysis, each short-term curve is determined (and sustained) by a given level of excess demand.

For the HEI that maintains excess demand, this movement is sufficiently large for a given interval of prices, and consequently, the long-term demand will be positively

inclined in this interval (Figure I). When the price reaches a sufficiently high level, the large shifts in demand stop, and the long term demand becomes negatively sloped. In this case, the tuition rate that maximizes profit (P3) will be below the short term equilibrium price (P4).

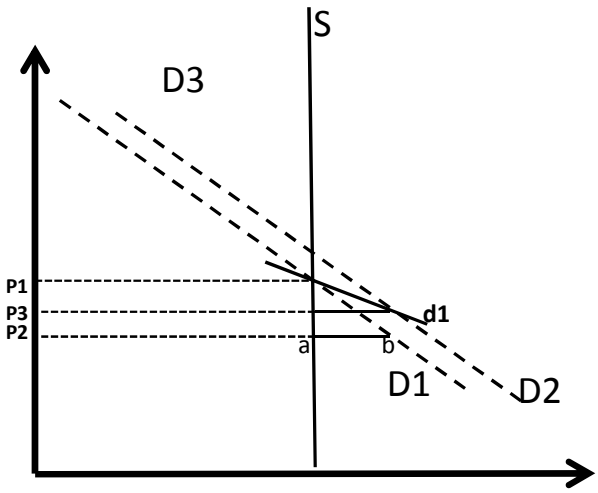
Yet, in the case of the HEIs that do not maintain excess demand, the long-term demand curve will be negatively sloped because excess demand does not create a sufficiently large shift in the short term (Figure II).

Figure I: Long-term equilibrium with excess demand.



In analyzing Figure I, an initial equilibrium in P1 is determined by the D1 demand and supply S. Next, an HEI reduces its price to P2 and creates an excess demand of *ab*. In the long term, for this excess demand, the short-term curve turns out to be D2, which allows the HEI to charge tuition equal to P3, while maintaining the same excess demand. In this step, demand is positively inclined. If the HEI decides to lower the price below P3, the shift of short-term curve due to an increase in excess demand will be smaller and, as consequence, the long-term curve will be negatively inclined (from D2 to D3). In this case, the long-term equilibrium will be in P3, while in the short term (only!) the price P4 maximizes the profits of the HEI.

Figure II: Long-term equilibrium without excess demand.



Following the same sequence in Figure II, suppose there is an initial equilibrium in P1. A new price P2 would create an excess demand for *ab*, which would shift the short-term demand curve to D2. However, in this case, long-term demand (d1) is negatively inclined, and the equilibrium price is the initial price - P1.

3. Empirical Method

The methodological challenge of this project, given the specifics of this market, is to propose estimation strategies through models of discrete choice and the utilization of instrumental variables that can surpass (at least in part) the econometric difficulties arising from the particularities of the market. These strategies are to (1) redefine the question in order to avoid the problem in which, in the higher education market, the student not only chooses the HEI but also is chosen by the HEI, and so be able to use the Aggregate Logit Model; (ii) define the demand for the HEI; and (iii) obtain instrumental variables to correctly estimate the model.

3.1. Econometric Model

The methodology used in this paper to estimate the demand for undergraduate business programs in the state of São Paulo is based in the literature of discrete choice applied to the estimation of demand in markets with differentiated goods. There is a vast range of references, from the seminal work of Lancaster (1971) and McFadden (1974) to more recent contributions well known in the field, such as Berry (1994), Berry, Levinsohn and Pakes (1995) (BLP, as they are referred to from here onward) and Nevo (2001). In this paper, we will use the Aggregate Logit Model.[3]

This methodology has two important characteristics. The first of these is that despite being a model of discrete choice, it is based only on aggregated or market data. The second is that the method projects the goods (HEIs, which hereafter refer specifically to São Paulo business schools) in the space of characteristics, and the dimension of this space is the relevant one. In this sense, the problem of dimensionality is resolved when the system of demand equations for differentiated goods is estimated, wherein the price of all goods must appear in every equation.

Before describing this methodology, it is necessary to evaluate if it is adequate for the HEI market. Models of discrete choice assume that the consumer chooses the good or service. This assumption does not match this market, in which the student not only chooses the HEI but also is chosen by the HEI. The fact that a student goes to study at an HEI indicates that there was a matching between them. This interpretation of the process suggests that models of discrete choice are not appropriate for this sector.

In order to avoid this problem and be able to apply a discrete choice model, we redefine the question of interest. Instead of asking the question "at which HEI will students study", we turn to the question "to which HEI will students apply." Hence, instead of using the number of registered students as the measure of demand, we use the number of student applications (see discussion in Section 3.3). This approach can be understood in terms of the student calculating an *ex ante* utility of studying in a given HEI, before the decision of the HEI of accepting or not him as its student. This approach allows us to use the traditional methods of discrete choice to analyze this market.

[3] A substantial part of this literature is devoted to overcome the Independence of Irrelevant Alternatives (IIA) feature of the logit model (see Train (2003) for a discussion about IIA). It is not a source of concern here, since we are not interested in estimating cross-elasticities or substitution patterns among HEIs.

The primary idea behind this method is that students classify HEIs according to their characteristics. We initially assume that the function of *ex ante* indirect utility that a student has upon applying to an HEI depends on the HEI quality (*qe*), the quality of the students that attend the HEI (*e*), the price of studying at the HEI (*p*) and the difficulty of being accepted to the institution (*sel*). We can then write that the utility that the student *i* has upon registering at the HEI *j* is represented as

$$U_{ij}=U(qe_j, e_j, p_j, sel_j, \varepsilon_{ij}),$$

where ε_{ij} is a non-observable characteristic of individual *i* in relation to HEI *j*, for example, if the HEI is close to the residence of *i.* We assume that the HEI quality depends on both observable characteristics (*x*) and non-observable characteristics (ξ), then $qe=(x,\xi)$. Assuming that the utility function is linear, we find that the utility a student *i* has on choosing school *j* is represented by

$$u_{ij} = \alpha p_j + \gamma e_j + \varphi sel_j + x_j\beta + \xi_j + \varepsilon_{ij} \tag{1}$$

where α, γ and φ are scalars, β is a vector with dimension K, ξ_j is an unobserved characteristic of the HEI (*j*), and ε_{ij} is a characteristic idiosyncratic to consumer *i* in relation to HEI *j*.

The student chooses between (*N*+1) options: the *N* different HEIs available in the market and the option to not study business (which means studying in a different higher-education program or no higher-education program). The utility of each option for the consumer is represented by the following system:

$$\begin{aligned} u_{i0} &= x_0\beta + \xi_0 + \varepsilon_{i0} \\ u_{i1} &= \alpha p_1 + \gamma e_1 + \varphi sel_1 + x_1\beta + \xi_1 + \varepsilon_{i1} \\ &\vdots \\ u_{iN} &= \alpha p_N + \gamma e_N + \varphi sel_N + x_N\beta + \xi_N + \varepsilon_{iN} \end{aligned} \tag{2}$$

From among the available options, the student chooses the option that grants the best utility. We normalize the utility of the option of not studying business as zero, as is usual. Additionally, we assume that the idiosyncratic characteristic ε_{ij} is distributed as a

type I extreme value distribution, which transforms the problem into the well known *logit*.[4] Then a consumer chooses alternative *j* if $u_{ij} > u_{ik},\ k \neq j, k = 0,1,... N.$

If information about the choice of the consumers were available or if we had microdata, then this study would use the hypothesis of logistically distributed errors to calculate the probability of the consumer choosing each alternative. In that case, the model would be the traditional Multinomial Logit Model. Unfortunately, microdata on consumer choices were not available——only the total number of students that chose a determined HEI. Therefore, a model based on aggregated data is used.

With this aim, we define:

$$A_j(x., p., e., sel., \xi.; \alpha, \beta) = \{(\varepsilon_{i0}, \varepsilon_{i1}... \varepsilon_{iN}) \mid u_{ij} > u_{ik}, k \neq j, k = 0, 1,... N\}, \quad (3)$$

where $x. = (x_1,... x_N)$, $p. = (p_1,... p_N)$, $e. = (e_1,... e_N)$, $sel. = (sel_1,... sel_N)$ and $\xi. = (\xi_1,... \xi_N)$ are, respectively, the observable characteristics, the price vector, the student quality vector, the selectivity vector and the vector of the non-observable characteristics of all *N* HEIs existing in the market. Group A_j defines the group of individuals who choose alternative *j*. It is important to note that individual *i* is defined by vector $(\varepsilon_{i0}, \varepsilon_{i1}... \varepsilon_{iN})$. Aggregating all individuals *i* present in group A_j, or integrating the distribution ε over group A_j, one obtain the *market share* of product *j*:

$$s_j = \int_{A_j} f(\varepsilon) d\varepsilon , \quad (4)$$

where $f(.)$ is a density function of the extreme value distribution. This hypothesis on distribution means that the defined integral in (4) has a closed functional form, represented by the following equation (see Train, 2003 pp. 78 and 79 for the algebraic manipulation that transforms the equation from (4) to (5)):

[4] It is worth noting that what is relevant is the utility difference among the schools. The random variable formed by the difference between two random variables with extreme value distribution follows a logistic distribution (see Train, 2003).

$$s_j = \frac{e^{\alpha p_j + \gamma e_j + \varphi sel_j + x_j\beta + \xi_j}}{\sum_k e^{\alpha p_k + \gamma e_j + \varphi sel_j + x_k\beta + \xi_k}} \quad (5)$$

Using the log in equation (5), we reach a linear expression of the fraction of consumers that opt for HEI *j*, which is the model estimated in this paper:

$$\ln(s_j) - \ln(s_o) = \alpha p_j + \gamma e_j + \varphi sel_j + x_j\beta + \xi_j, \quad (6)$$

where s_j is the *market share* of HEI *j*, and s_0 is the *market share* of the option to not pursue a higher education or to undertake a program in an area other than business. Two points should be mentioned. Initially, despite the non-linearity of the initial problem, the hypothesis of logit distribution and the aggregation allowed us to reach a linear equation, which simplifies the estimation process.

Secondly, the non-observable characteristic (by the econometrists) of the HEI, ξ, is the random term of the estimation model. Observing that this term captures the characteristics of the HEI not included in vector *x*, it is intuitive to suppose that this term has a positive correlation with the price, the quality of the students and the selectivity of the HEI. HEIs with better non-observable characteristics in equilibrium charge higher prices, attract better students, and can be more selective. This fact generates a correlation between these variables and the econometric error, resulting in problems of endogeneity for all of them, so instrumental variables are needed to estimate the model. We discuss this issue in the next subsection.

Finally, with respect to the econometric technique, it is necessary then to use those models that permit the use of instrumental variables. We will use the method of two-stage least squares (2SLS).

3.2 Instrumental Variables

According to the literature on estimating demand for homogeneous goods, the valid instrument to correct for the endogeneity of the price variable is a set of variables that affect business costs and are unrelated to demand shocks. In theory, the same type of instrument can be utilized in markets with differentiated goods. However, there are rare situations in which cost variables of firms are related to only one differentiated

good, without being correlated with all of the market goods. Therefore, another type of instrument should be used.

In the literature, there are two possible solutions to this problem. The first, derived by BLP, uses the exogenous characteristics of the firm's own product as instruments for themselves and the sum or average of the rivals firms' product characteristics as instruments for the price. According to Bertrand's oligopoly model with differentiated goods, in market equilibrium, the better the quality of the rival goods, the lower the equilibrium price of the firm in question.

The second solution, introduced by Hausman (1996), advocates the use of the same product's price in another market as an instrument for the price.[5] In the problem analyzed here, one HEI is different from another, not having a product brand appearing in different markets, nor two HEIs in different cities. This forces us to opt for the first solution, in which we use the average of the characteristics of the other HEIs as an instrument for the price.

The quality of enrolled students and HEI selectivity are also endogenous variables. We will use the same group of instrumental variables that we use for price: competitor characteristics, and the age of the HEI. The age must be related to the reputation of the school, the hypothesis being that the older HEIs are more likely to have better reputations.[6]

3.3. Data

The Brazilian market for HEIs is marked by the predominance of private enterprise. Among 2,281 HEIs in 2006, 89% were private, and 74.6% of all university students were enrolled in these private schools. Additionally, the majority of private HEIs (52%) are for profit.[7] Despite the lack of official data on the amount of donations

[5] For a discussion of the pros and cons of each kind of instrument, see Nevo (2001).
[6] A possible explanation for the reason older schools have better reputations is based in the hypothesis that there is asymmetry of information in the HEI market, which becomes less important over time. Initially, the schools alone know the quality of their students. Over time, this quality is known not only by the alumni of the HEI but also by potential students on the market. Older schools have already revealed their true quality, and only those that reach a certain level can attract students and survive the competition.
[7] The source of these data on Brazilin HEIs is the Sinopse Estatística da Educação Superior do Inep (http://www.inep.gov.br/superior/censosuperior/sinopse/).

received by HEIs, it is known that the resources derived from this source are limited, as are the resources available to fund research. In this context, Brazilian private HEIs primarily raise funds from student tuition payments[8]. The state of Sao Paulo was chosen because 24.1% of the HEIs in the country are located there. The analysis is focused on the area of business because it is the largest in terms of number of programs (7.6% of the total) and number of registered students (13.9% of total students).

As mentioned in the previous section, the model represented by equation (6) will be estimated in this work. We will explain the variables utilized in this estimation, as well as the source of the data.

At the onset, it is important to define the dependent variable or the market share of the HEIs (variable s_j in equation (6)). This is equal to the ratio between the number of students that want to study at an HEI and the number of potential students in the market where the HEI is located.

To reach the market share denominator, it is necessary to explain a priori the markets in which the HEI participates. In the present work, we assume, in a simplifying manner, that each municipality with at least one business program corresponds to a market[9]. At the same time, to reach the number of potential consumers of an HEI, the study takes into consideration the fact that the consumer has completed secondary education, is between 18 and 25 years old, and is being confronted with three possibilities: to attend a business program, to attend a higher-education program in another field or to not attend a higher-education program at all.[10] All of the students who opt for one of these alternatives and who live in the municipality where the HEI is located are part of the HEI's potential market.

[8] In contrast, data from the U.S. National Center of Education and Statistics show that 70% of the income of for-profit HEIs comes from sources other than tuition. Donations and research funds are a crucial part of their strategies and plans.

[9] An alternative would be to define the market in terms of economic regions of different municipalities. However, a certain amount of arbitrariness would be necessary to define these alternative market borders. Another alternative would be to consider the city of São Paulo as more than one market because of its size. Again, it would be difficult to define the boundaries of this market. Next, we will propose models that seek to capture the specificity of the São Paulo market.

[10] The considered age group might omit some recently observed features. For example, the 2006 Higher Education Census, performed by the INEP, shows, for example, an increase in the participation of students in the age group of 25 to 29 years old between the years 2000 and 2006.

The 2006 Higher Education Census from the Ministry of Education (MEC) provides information, by municipality, on the number of students in the first two options, the business program or the program in another field. In addition, the 2007 Population Census carried out by the Brazilian Bureau of Statistics (IBGE) shows that 27% of individuals between 18 and 25 years old who have finished secondary education do attend an HEI. Therefore, knowing the number of students in the first two groups and the participation percentage of the third group, we can estimate the number of potential consumers, which will be the denominator of the market-share formula of the HEI in the municipality. This number is then equal to the ratio between the number of students enrolled in any undergraduate degree (business and others) in the municipality and 0.27.

It is difficult to define the numerator of the market-share formula of the HEI. As we discussed in the econometric model section, we use the number of students who take the entrance exam for the business program at an HEI[11], in order to avoid the fact that in the education sector not only the students chooses the HEI but also is chosen by it. We are aware that there is a problem with this alternative: many students take various exams, for different HEIs, in the same year. Thus, the average might overestimate the demand for the HEI.

A possible alternative is to use the number of registered students in the HEI business program. The problem with this alternative is that the HEIs that are more selective, that is, that have higher candidate/slots ratios, tend to work with excess demand. As discussed in section 2, they do not adjust the tuition to balance the amount demanded with the amount offered. The reason, as was already discussed, is that in the education sector, the consumer (the student) is also an input in the productive process. The better quality the registered students are, *ceteris paribus*, the better the quality of the students educated at the HEI. This occurs in large part because students can benefit from interacting with the other students, through what is known as the peer effect, and because the quality of the HEI supplies a signal about the quality of the graduate in the job market after completing higher education.[12] Moreover, the HEIs with excess

[11] In Brazil, all applicants to a given HEI must take an entrance exam.

[12] See Winston and Zimmerman (2003) for a summary of the literature on the peer effect and MacLeod and Urquiola (2009) on the effect of the reputation of the school on the quality of the students.

demand certainly would have a better market share if they were to have a less rigorous selection process and accept more students. Therefore, the number of registered students as a measure of the numerator for the market-share formula underestimates the demand for the HEIs with higher selectivity. Last but not least, with this alternative, we could not apply the models of discrete choice, as pointed out in the econometric model section. Hence, we do not consider this alternative.

The data of the number of student applicants to each HEI comes from the 2006 Higher Education Census of the MEC.

This study now proceeds to a discussion of the different observable characteristics related to the variable quality of the HEIs that can affect the choice of the student and are used as explanatory variables (variable x_j in equation (6)) in the empirical model. Two variables are related to the quality of the faculty body: the percentage of professors with doctorates (perc_doutor) and the percentage of full-time professors (perc_int). These variables are collected from the 2005 Faculty Body Census. At first, a high percentage of professors with doctorates and full-time professors might signal the quality of the program; however, the business student certainly is also interested in their professors' business experience, which often competes with the full-time dedication of a university professor. Therefore, whether a superior title means better academic quality in the program (maintaining constant the rest of the variables) is questionable. For example, a professor who is also the director of a large company may attract more candidates to a business course than a full-time professor with a PhD degree.

Other observable characteristics related to the variable quality of the HEIs used as explanatory variables are the ones related the conditions of the infrastructure offered by the HEI. The models in this paper consider three variables: the quality of the overall physical structure (qual_infra), the quality of the library (qual_libr) and the availability of computers (qual_comp). These three variables are obtained from a socioeconomic survey administered to undergraduate students during the National Student Performance Exam (Enade), carried out by the MEC and compiled at the 2006 Enade Census. The students grade each of these variables and an average score for each of those is obtained. In the case of these three physical-infrastructure variables, the signs of their

coefficients are expected to be positive; that is, better infrastructure should correspond to a greater market share.

The authors collected pricing information during the first semester of 2008. A negative sign for the tuition coefficient is expected.

Every new undergraduate student in business (and in other programs as well) must take an exam that encompass specific and general knowledge, the Enade. The average score of the students in a given HEI is used in this paper as a proxy for the quality of the student body that the student will find if he chooses this HEI. This variable comes from the 2006 Enade Census. This variable might signify that the students take into account the effect of their peers (peer effect) in their choice of HEI. Additionally, schools with better students have a better reputation, generating better results for their students in the job market after graduation. In both cases, the higher the Enade score is, the more qualified the group of students and the higher the demand for the HEI.

The selectivity variable is defined as the number of candidates divided by the number of vacancies. On the one hand, a higher selectivity implies less likelihood that the student will be accepted by the HEI. Hence, we expect that this variable will have a negative effect on the choice of the student. On the other hand, this variable may be seen as another proxy for the quality of the student body. In this regard, the higher Enade score is, the higher is the demand for the HEI. Therefore, the sign of the coefficient of the variable selectivity is unclear from a theoretical point of view.

In terms of the market (municipality) in which the HEI is located—as identified by the 2006 Higher Education Census—the model includes the GDP per capita of the municipality (GDP-pc) for the year 2007, as obtained from Ipeadata.[13] In terms of the location, a dummy variable (SP) assumes the value one when the HEI is in the market of the capital, the city of Sao Paulo, and zero otherwise. As the density of business programs in relation to the total population is smaller in the capital than in other cities, an inferior market share is expected in the capital.

[13] See www.ipeadata.gov.br.

Our sample contains 298 observations of HEIs located in 130 municipalities (or markets) in Sao Paulo state. As previously mentioned, each market is defined as a municipality.

Table 1 shows the distribution of programs in the different markets. In 83 markets (municipalities), or in 63% of markets, there is only one undergraduate business program. Two HEIs share students in 25 markets, and 97 programs are distributed through 21 markets, each containing between 3 and 11 competitors. Additionally, the principal market is certainly the municipality of Sao Paulo, where there is a concentration of 22.8% (n=68) of all programs in the state.

Table 1: HEI and Markets

Number of HEI	Number of Markets	Total
1	83	83
2	25	50
3 to 11	21	97
68	1	68
Total	130	298

Source: The authors.

Table 2 presents a statistical summary of the variables used in the analysis, with the average and standard deviation of each one. The average of the dependent variable, i.e., the market share, is equal to 6.9% once the total market includes all of the individuals of university age who have completed secondary school, whether enrolled in a business program or not. The HEIs are, on average, 9.2 years old, and practically all offer a bachelor's program rather than a technical program.

The average Enade score of the registered students is equal to 39.5 (on a scale of 0 to 100). Considering only the 20 programs with the highest candidate/vacancy ratios, the Enade average rises to 44.6.

The average tuition is equal to R$ 506.85 (or US$ 318), and the municipalities' average GDP per capita is equal to R$ 28.750,95 (or US$ 18.082). Additionally, among the HEIs analyzed, the average percentage of professors with doctorates and full-time professors are, respectively, 8.5% and 12.5%.

Table 2: Statistical Summary

Variable	Average	Standard Deviation
Mkt Share (%)	6.9	11.2
Enade Score (0-100)	39.5	4.3
Price (R$)	506.85	249.2
Professors with Doctorates (%)	8.5	9.3
Full-time Professors (%)	12.5	15.1
GDP per capita (R$)	28750.95	18200.1
Age	9.2	12.2
Bachelor's Degree Offered (%)	94.8	

Source: The authors.

Finally, Table 3 shows the distribution of the average scores of the variables related to the conditions of the infrastructure: the quality of the overall physical infrastructure, the library, and computer availability. The second, third and fourth columns present the number of programs with evaluation, respectively, 'worse than average by one standard deviation (sd)', 'average ± one sd', and 'better than average by one sd'.

Table 3: Distribution of Quality of Physical Infrastructure

Variable	Worse than average by one standard deviation	Average ± one standard deviation	Better than average by one standard deviation	Total
Qual_Infra	48	201	49	298
Qual_Comp	42	204	52	298
Qual_libr	46	206	46	298

Source: The authors.

4. Empirical Analysis

In this section, we show and discuss the empirical results. In the first part, various estimates will be presented, which vary according to the explanatory variables used. Here, we aim to explain which factors are considered by students when choosing an HEI. In the second part, using the coefficients estimated, the HEI's investment in excess demand is calculated.

4.1 Results of the Regressions

Table 4 shows the results of the different estimation models. Model (1) is estimated via OLS. Models (2) through (5) are estimates with instrumental variables (IVs) for the price, Enade score and selectivity via 2SLS.

As mentioned in the previous section, OLS is not the indicated method in this case, but we present the result of this estimate to highlight the effect of the instrumental variables. The comparison between model (1) and the others allows us to identify a substantial difference when we use IVs for the estimate of the models. In particular, the coefficients of the variables price, Enade and selectivity change substantially when the 2SLS method is employed.

Table 4: Econometric Results

	(1)	(2)	(3)	(4)	(5)
	OLS	**2SLS**	**2SLS**	**2SLS**	**2SLS**
Price	-0.000642	-0.0319	-0.0192**	-0.0322	-0.0214**
	(-1.07)	(-1.60)	(-3.00)	(-1.55)	(-2.96)
Enade	0.0199	0.0888	0.736*		0.770*
	(0.65)	(0.09)	(2.15)		(2.13)
Selectivity	0.369***	6.314		6.742	
	(4.35)	(0.89)		(1.26)	
Doctorates	-0.366	4.776	12.06*	4.247	13.20*
	(-0.27)	(0.33)	(2.14)	(0.30)	(2.14)
Full-time	0.602	-7.175	-1.111	-7.466	
	(0.84)	(-0.91)	(-0.61)	(-0.99)	
qual_instal	-0.346	-0.795	-0.665	-0.789	
	(-1.18)	(-0.56)	(-1.01)	(-0.52)	
qual_comp	-0.502	7.937	-0.808	8.580	
	(-0.80)	(0.77)	(-0.55)	(1.14)	
qual_libr	0.491	0.745	1.929	0.667	1.242
	(1.12)	(0.27)	(1.70)	(0.24)	(1.08)
saopaulo	-4.599***	0.251	-2.568**	0.413	-2.209*
	(-17.11)	(0.07)	(-2.64)	(0.12)	(-2.06)
GDP-pc	-0.00575	0.0654	0.0294	0.0670	0.0329
	(-0.43)	(0.81)	(0.92)	(0.82)	(0.94)
_cons	-4.551**	11.35	-23.25	15.28	-22.55
	(-3.03)	(0.24)	(-1.86)	(1.18)	(-1.79)
N	298	298	298	298	298

t statistics in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

For models (2) through (5), the IVs used is the average values of the other HEIs (the rivals) for the following characteristics: the percentage of professors with doctorates (ivdoc), the quality of the infrastructure (ivinstal), the quality of the computers (ivcomp), the quality of the library (ivbibl) and the percentage of full-time professors (ivintegr). Moreover, we use the age of the HEI itself as a measure of its reputation, which should have a direct impact on students' choices and Enade scores. We observe in the correlation of variables in Table 5 that the Enade scores as well as the price of the HEI show a correlation of around 0.3 with the age of the institution.

The results of the first stage of the models (2) through (4), which contains all of the variables, are presented in Appendix 1. Importantly, some of the IVs are significant and exhibit the expected sign, configuring instruments that present a significant (conditional) correlation with the endogenous variable.

Tuition, Enade scores, and selectivity are all endogenous variables, and they represent the market equilibrium of the HEI. Some difficulties arise with this fact. First, at equilibrium, these variables are positively correlated: better HEIs charge a higher tuition, are more selective, and attract better students, implying a positive correlation between these three variables (see Table 5). Secondly, as discussed, the instruments used in the identification of the model are made up of the exogenous characteristics of the HEIs that determine the market equilibrium and, therefore, are the same for these three variables. In contrast, BLP uses the group of instruments to identify only one endogenous variable, instead of three in this case.

Table 5: correlation

	Ms	rice	Enade	selectiv.	doctor	integral	qual_inst	qual_comp	qual_libr	age
MS	1.00									
Price	-0.21	1.00								
Enade	-0.14	0.60	1.00							
Selectivity	0.04	0.39	0.32	1.00						
Doctor	-0.11	0.51	0.42	0.36	1.00					
Full-time	-0.12	0.16	0.22	0.23	0.27	1.00				
qual_instal	-0.03	0.17	0.22	0.06	0.12	0.14	1.00			
qual_comp	0.01	0.27	0.30	0.04	0.24	0.15	0.58	1.00		
qual_libr	0.06	0.24	0.27	0.13	0.13	0.18	0.58	0.60	1.00	

Age	-0.14	0.25	0.28	0.18	0.23	0.24	0.00	0.14	0.07	1.00

All of these factors complicate the identification of the effect of these three variables, as can be observed in model (2) of Table 4. This specification includes all of the explanatory variables, including tuition, Enade scores, and selectivity. None of these is significant in this specification. The positive correlation between them complicates the correct identification of the parameters. To avoid this problem, we estimate the model with only Enade (models (3) and (5)) or selectivity (model 4) as the explanatory variable, apart from tuition.

The only difference between models (3) and (5) is the fact that some control variables (full-time, qual_instal and qual_comp) are excluded in the last model. The results of models (3) and (5), which exclude selectivity, are similar to each other. The coefficients of the price variable are approximately -0.02, and those of the Enade score variable are approximately 0.74. The percentage of professors with doctorate degrees is also statistically significant, with a coefficient close to 13. The coefficients of the other variables are also robust compared to the different specifications. The results in these models suggest the importance of the price variable for student choice.

In the case of the Enade score variable, the positive, robust, and significant effect shows that the students take into account the quality of the student body when they choose where to study. The primary justification for this fact is that employers on the job market do not perfectly observe the quality of the student or the recent graduate. The reputation of the student's school provides a sign about his or her quality. In equilibrium, HEIs with more qualified students would have a better reputation and would signal a higher quality to the market. Thus, the candidates would ultimately prefer an HEI with a better student body.[14] Another explanation for the importance of the quality of the student body on the choice of the applicant has to do with what the literature calls the peer effect. This effect consists of the positive externality that qualified colleagues have on the learning process. In other words, studying and living with intelligent and studious individuals contributes to the student's ability to learn. For this reason, the quality of the students in the HEI affects the decision of the

[14] MacLeod and Urquiola (2009) formalize this argument.

applicants.[15]With the available data, it is not possible to define which of the alternatives better explains the decision to take the entrance exam; we limit ourselves to the conclusion that students have a preference for better peers.

In model (4), in comparison with model (2), we exclude the variable Enade. The variable 'selectivity' is not statistically different from zero. As we mentioned before, this variable captures two effects. On the one hand, a higher selectivity implies less likelihood that the student will be accepted by the HEI and a negative sign is expected. On the other hand, this variable is a proxy for the quality of the student body, and a positive sign is expected. The empirical result suggests that the net effect is zero.

In Table 4, we still observe that the percentage of full-time professors shows is not significant in all models, similar to the coefficients for computer access and infrastructure quality. Business students might prefer to take classes with professors who are professionals in the market, and therefore part-time at the HEI, rather than with professors with a full time academic profession. This may explain the non-significance of the percentage of full-time professors in the students' choice.

The percentage of professors with doctorates, in contrast, seems to be a relevant variable to the student decision-making process. This variable has a positive value and is statistically significant in all of the estimate specifications via IVs that do not include selectivity. Taken together, the results obtained by the characteristics of the faculty—the percentage of professors with doctorates and the percentage of full-time professors—indicates that students take into account faculty quality, but that professors do not need to be academics in the traditional sense, i.e., dedicated solely to research and teaching.

The quality variables of the HEI are not significant. A possible cause for this is the high correlation that exists between them, close to 0.6 (Table 5). For this reason, we remove infrastructure quality and computer access from the specification (5) of the model, but the results do not change substantially. The quality of the library coefficient continues to be non-significant in this specification.

[15] Epple and Romano (1998) develop a model of competition between schools, where the peer effect is the key factor in the division of schools by quality.

Aside from the variables mentioned, we include controls for characteristics of the counties: GDP per capita and a dummy for the city of Sao Paulo. We believe that the Sao Paulo dummy makes the value of the price coefficient more accurate. Without this differentiation, the regression might overestimate the impact of price because the correlation between lower tuition and greater participation in the market might be partially explained not by a causal relationship but by the fact that these characteristics are typical in the markets of smaller cities. Yet, the programs in the city of San Paulo, a city with a higher cost of living, tend to have smaller market shares , since the market-share denominator is the number of potential applicants, which is enormous for the Sao Paulo's market. Therefore, the higher prices of the Sao Paulo programs and their smaller market share might intensify the impact of prices on the market-share, if the regression were not to include a dummy for the city of Sao Paulo. The interpretation seems clear: the programs in the city of Sao Paulo tend to present a market share smaller than the others and are, on average, more expensive (R$ 663.9 Reais or US$ 417 in the capital versus R$ 460.3 Reais or US$ 289 in the other cities). Therefore, if we had not controlled for location (capital versus countryside), we would have created an overestimation of the importance of the price in the determination of the market share.

4.2 Estimation of the "Investment" in Excess Demand

According to the results presented in the prior section, one can estimate the total volume of revenue that a specific HEI gives up by maintaining a lower tuition in order to generate excess demand and, therefore, selectivity of the applicants for the business program. The procedure is simple. Using the price coefficient estimated in the previous section, one can calculate the necessary price increase that would reduce the HEI market share in order to eliminate the excess demand. In other words, the price increase that would make the number of applicants equal to the number of offered slots. The amount of revenues that the HEI gives up is equal to the difference between the price that would eliminate the excess demand and the actual price charged multiplied by the number of slots available.

Before presenting the results, a methodological procedure deserves mention. This estimation should be made only for the HEI that has a number of offered spaces lower than the number of applicants, which is a condition necessary but not sufficient

for the characterization of excess demand. Furthermore, the applicants should fill all of the spaces because some institutions present a number of applicants greater than the number of slots but without all the slots being filled, which does not allow us to identify excess demand. Therefore, it is important that there are no unfilled slots. However, in some cases, the HEIs present an applicant/vacancy ratio much greater than one, but only one or two spaces are not filled. Clearly, in this case, the unfilled space is not a consequence of demand scarcity for the program but simply an operational question or a registration cancellation. For this reason, we considered programs with a number of applicants greater than the total number of vacancies and with at least 98% of the slots occupied.

Figures 1 present the amount of revenues that the HEIs give up in order to operate with excess demand. The calculation is done using the price coefficient estimated in model 3. This is the model chosen because the variables *Enade* and *Price* have significant coefficients and all control variables are present. The values correspond to the annual revenue that the HEI gives up in the year 2006 with regard to the first-year class.

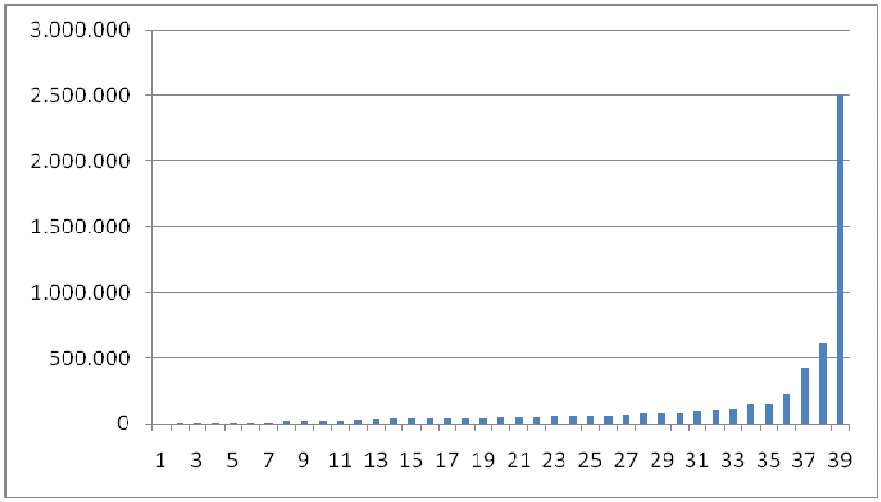


Figure 1: HEI Total Investment in Excess Demand by year and applying class (Model 2).

There are 39 HEIs with excess demand, and the value of the "lost" revenue is presented for each HEI in a growth curve. In model 3, 39 HEIs in the state of Sao Paulo

gives up, in the short term, a total of 5,499 million Reais (or US$ 3,458 million) per year by "investing" in the selectivity of their students. Considering the 39 HEIs with excess demand, this amount corresponds to 7.6% of the total revenue coming from a freshman class.

5. Conclusion

This article analyzes the private higher education sector and attempts to explain and quantify some particularities of this sector, such as the strategy of some institutions to maintain permanent excess demand and the strong segmentation that exists in this market. To achieve this objective, various peculiarities in this sector had to be taken into account in the analysis, requiring specific theoretical and empirical treatment, which we explain throughout the paper.

First, we attempt to elaborate a theoretical outline, based on Becker (1991), that would explain consumer demand and the problem of the firm as well as why in equilibrium some institutions present permanent excess demand, while others do not. In summary, for some institutions, it is advantageous to generate excess demand to increase the selectivity and quality of the students. This greater selectivity today would increase the demand in the future, as the HEI is going to be perceived by the market as having better inputs (higher quality students who are the consumers) that would allow it to produce a higher quality output. This higher demand allows the HEI to charge a higher tuition in the future, even maintaining the same excess of demand, that more than compensate the relatively lower tuition in the short run. For the rest of the institutions, excess demand in the short run would create a modest shift to the right of the future demand. This modest shift would not allow them to charge significantly higher tuition in the future to compensate the lower revenues today in order to operate with excess demand. In equilibrium, this last group prefers to operate without excess demand.

On the empirical part, there are two peculiarities that complicate the analysis. First, the HEI's market is a *matching* market, which consists of students choosing the HEI as well as the HEI selecting the students. To avoid this problem, we changed the student's question from "at which HEI to study" to "at which HEI to apply." Instead of

using the number of registered students as a measure of demand, we use the number of applicants in the selection process. This avoids the problem of the *matching* market because the application precedes the HEI's selection process.

The second difficulty results from the fact that some variables that determine the decision of the student are endogenous, such as tuition, quality of the student body and the HEI's selectivity. These variables are determined by the market equilibrium, so that there is no causal relationship between them and the firm's market share. We use the solution proposed by BLP, using the characteristics of the competitors, in addition to the age of the HEI itself, as instruments for the endogenous variables of the model.

Using data from all business-administration programs in the state of Sao Paulo, the study shows that the most relevant factors for student choice are the tuition charged by the institution and the quality of the professors and students. The other characteristics, such as the quality of the infrastructure or computer access, are shown to be insignificant. In a general way, we found evidence that the tuition and quality of both professors and the student body define an institution and its position in the market.

The data shows that the market can be segmented into two groups. A large group, containing the majority of the HEIs, in which the institution presents a low tuition, a low student quality and does not have excess demand. And a smaller group - the elite institutions - which presents a higher tuition and quality, with substantial excess demand.

If the segmentation of the market is based on these variables, we expect the elite HEIs to invest in their differentiation. Using the results of the model, we present a new estimate of "lost" revenue or, stated from another perspective, of the investment in student quality made by Brazilian HEIs, which have strategies of long-term profit maximization that recommend permanent excess demand. The results show that the HEIs collectively invest more than 5 million Reais (or US$ 3.14 million) per year in selectivity. This corresponds to a drop in total short-term revenue of Sao Paulo elite HEIs, with their students enrolling in business programs because of the investment made in the quality of the freshman students.

Surely, the present study does not attempt to exhaust the subject; on the contrary, the intention is to open topics for further research that may answer important questions that were not central to the objective of this article. The demand estimated in the first section, using cross-sectional data, with an observation on each institution, corresponds to what we consider throughout the article to be short-term demand. A study that can estimate the size of external diffusion (network externality) in the higher-education sector would be extremely valuable. Additionally, alternative solutions from the point of view of econometric methodology might also be tested.

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Appendix I

First-stage regressions

ivregress 2sls and (price Enade score selectivity = ivdoc ivintegr ivinstal ivcomp ivbibl idade) professors with doctorates full-time professors qual _instal qual_comp qual_libr Sao Paulo GDP, first

Number of obs =	298
F(13, 284) =	17.13
Prob > F =	0
R-squared =	0.4394
Adj R-squared =	0.4138
Root MSE =	190.7078

price	Coef.	Std. Err.	T	P>t	[95% Conf.	Interval]

doctorate	1008.407	134.3834	7.5	0.000	743.8932	1272.921
full-time	-54.1632	80.72751	-0.67	0.503	-213.0634	104.737
qual_instal	-27.56862	32.68935	-0.84	0.400	-91.91277	36.77554
qual_comp	76.03494	67.64821	1.12	0.262	-57.12057	209.1904
qual_libr	135.4646	47.90007	2.83	0.005	41.18042	229.7488
saopaulo	-707.8994	362.8459	-1.95	0.052	-1422.108	6.30914
GDP	2.02062	1.47984	1.37	0.173	-.8922256	4.933466
ivdoc	-274.127	94.74874	-2.89	0.004	-460.6259	-87.6281
ivintegr	68.2894	58.28421	1.17	0.242	-46.43444	183.0132
ivinstal	-46.37654	25.04962	-1.85	0.065	-95.68302	2.929934
ivcomp	56.59547	41.48354	1.36	0.174	-25.05873	138.2497
ivbibl	-22.91079	35.69463	-0.64	0.521	-93.17039	47.34881
idade	1.587884	0.996742	1.59	0.112	-.3740543	3.549823
_cons	621.7086	91.41559	6.8	0.000	441.7705	801.6467

Number of obs =	298
F(13, 284) =	10.3
Prob > F =	0
R-squared =	0.3204
Adj R-squared =	0.2893
Root MSE =	3.643

enade	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
doctorate	12.09247	2.567086	4.71	0.000	7.039544	17.1454
full-time	1.740024	1.542114	1.13	0.260	-1.295399	4.775447
qual_instal	0.0823146	0.624455	0.13	0.895	-1.146833	1.311462
qual_comp	1.894934	1.292264	1.47	0.144	-.6486966	4.438564
qual_libr	1.982027	0.915021	2.17	0.031	.1809435	3.78311
Saopaulo	2.256302	6.931338	0.33	0.745	-11.38701	15.89962
GDP	0.0204556	0.028269	0.72	0.470	-.0351876	0.076099
ivdoc	-5.75277	1.809957	-3.18	0.002	-9.315403	-2.19014
ivintegr	0.7415933	1.113386	0.67	0.506	-1.449942	2.933129
ivinstal	-0.5083176	0.478516	-1.06	0.289	-1.450205	0.433569
ivcomp	-0.3936111	0.792448	-0.5	0.620	-1.953427	1.166205
ivbibl	0.5855984	0.681864	0.86	0.391	-.7565499	1.927747
idade	0.040099	0.019041	2.11	0.036	.0026207	0.077577
_cons	43.66687	1.746285	25.01	0.000	40.22956	47.10417

Number of obs =	298
F(13, 284) =	5.1

Prob > F =	0
R-squared =	0.1892
Adj R-squared =	0.1521
Root MSE =	1.2611

selectivity	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
doctorate	4.300412	0.888617	4.84	0.000	2.5513	6.049524
full-time	0.9045524	0.533815	1.69	0.091	-.1461836	1.955288
qual_instal	-0.03066	0.21616	-0.14	0.887	-.4561392	0.394819
qual_comp	-0.9940431	0.447328	-2.22	0.027	-1.874541	-0.11355
qual_libr	0.6006139	0.316742	1.9	0.059	-.0228455	1.224073
Saopaulo	-1.602265	2.399338	-0.67	0.505	-6.325007	3.120478
GDP	0.0016438	0.009786	0.17	0.867	-.0176175	0.020905
ivdoc	-1.240264	0.626531	-1.98	0.049	-2.473497	-0.00703
ivintegr	-0.0840831	0.385408	-0.22	0.827	-.8427007	0.674535
ivinstal	-0.171523	0.165642	-1.04	0.301	-.4975647	0.154519
ivcomp	0.2393273	0.274312	0.87	0.384	-.3006156	0.77927
ivbibl	-0.1370188	0.236033	-0.58	0.562	-.6016142	0.327577
idade	0.008284	0.006591	1.26	0.210	-.0046894	0.021257
_cons	0.2189698	0.604491	0.36	0.717	-.9708805	1.40882