

# Expansion of Higher Education and the Equality of Opportunity in Colombia

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In this work, the effects of the expansion of higher education supply in the equality of educational opportunities are analyzed for the Colombian experience during the nineties. The basic question is whether this expansion contributed to reduce the impact of family background on the individual probability of attending and completing the higher education. Using a quasi experimental methodology, this research identifies the students benefited most from this supply expansion and whether these correlations reflect causal effects. This analysis suggests that higher education expansion might have increased the relative advantage of individuals from well-off families in terms of access; an equality of opportunity-enhancing effect just for individuals from medium cultural capital families; and it seems to have no benefit for individuals from the lowest levels of cultural capital.

Keywords: *equality of opportunity; higher education; intergenerational educational mobility*

## 1 Introduction

Much of the explicit purpose of educational policies in many countries has to do with equalizing opportunities for citizens by increasing educational attainment and intergenerational mobility in schooling. Many of the biggest government efforts in order to expand education systems are in this direction. Important reforms in educative systems, a dynamic growth of public spending and a higher openness to private sector have led to an important growth of enrollment rates not only in compulsory education but also at the tertiary level<sup>1</sup>. In the last three decades an accelerated expansion of higher education has taken place both in developed and developing countries, driven mainly by the increasing coverage in secondary education and due to the growing demand for skilled workers. Colombia is not an exception; during the nineties, as the result of a new legislation, both higher education supply and enrollment increased dramatically.

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<sup>1</sup> In this work the terms “higher education” and “tertiary education” are used as synonymous.

But, how can this expansion affect the equality of educational opportunities at the tertiary level? Expanding supply in higher education is likely to produce a cost-reduction effect associated with the increased supply and a potential increase in the expected returns of a higher schooling due to the wider available offer. If the new entrants are the offspring of lower socioeconomic background families, then the expansion increases equality of opportunity almost by definition (Bratti, Checchi, de Blasio, 2008). However, it is not so obvious that an expansion of higher education specifically benefits individuals from worse family backgrounds. There is indeed a trade-off between efficiency and equity since it would be efficient to focus resources on those who are already advantaged.

The purpose of this work is to assess the effects of the extraordinary expansion of higher education supply in Colombia during the 1990s on the equality of tertiary education opportunity. In this work, following Roemer (1998), the notion of increasing equality of opportunity is associated with a reduction in the influence of events that are outside individual control; in particular, the impact of parental education on individual educational choices. Therefore, the basic question is whether or not this expansion, in terms of new institutions and new degree programs, contributed to reduce the impact of family background (parental education) on the individual probability of attending higher education institutions and achieving a higher education degree. Using a quasi experimental methodology following Duflo (2001) and Bratti, Checchi and de Blasio (2008), this research identifies the students benefited most from the higher education supply expansion while investigating whether these correlations reflect causal effects or not.

The main results show that the expansion of higher education supply during the nineties in Colombia increased the relative advantage of individuals belonging to well-off families in terms of access to this level as it had an equality of opportunity-enhancing effect just for individuals belonging to medium cultural capital families; and on the other hand it seems to have no benefit for the individuals related to the lowest levels of cultural capital.

The work is divided into four sections. Primarily, it puts forward a general framework of analysis by summarizing what can be understood by equality of opportunity in higher education while commenting on the results of some empirical studies about the effects of higher education expansion. In the second section, an overview of higher education in Colombia and its expansion in the nineties is presented. The methodological framework and estimated models are offered in the third section. The final section offers an interpretation of the main findings, and lastly some conclusions and some questions for further research are presented.

## 1. Theoretical Approach and Empirical Evidence

Although there are alternative definitions of equality of opportunity (Roemer, 1998), the most common is the notion of increasing equality of opportunity associated with a reduction in the influence of circumstances, i.e. the events that are beyond individual's control. Inequalities which are originated by circumstances are considered as ethically unacceptable while inequalities from individuals' effort are ethically accepted. Thus, inequality due to circumstances must be compensated by public intervention while inequality due to effort factors must not be rectified.

Some authors have emphasized that educational choices are typically correlated with family attributes, including income and inherited wealth, unobservable abilities, education, cultural resources, residential choices, and so on. Empirical evidence suggests that less able but wealthier children have benefited most from education expansion whereas poorer children, even the abler ones, face problems to obtain the similar educational achievement (Haveman *et al*, 1995). Therefore, accordingly with the notion of equality of opportunity, any action capable of reducing the impact of one or some of these variables on individual educational choices can be regarded as reducing inequality of educational opportunity (Bratti, Checchi and de Blasio, 2008).

Changing and expanding supply in higher education (HE hereafter) institution is likely to produce at least two effects: a cost-reduction effect, associated with the increased supply and the possibility of enrolling at a university without moving to a different city; and a potential increase in labour market returns, provided if there is an increased possibility of courses selection that is better equipped for the employers' preferences (Bratti, Checchi, and de Blasio, 2008). If the new entrants are the offspring of less privileged families, then the important effect of expansion may be the one of inclusion and increasing equality of opportunity almost by definition. However, the expansion has created a more competitive environment in tertiary education. HE institutions have incentives to attract the better students because this not only improves the quality of teaching but also attract more resources. This implies that there is indeed a trade-off between efficiency and equity in HE, since it would be efficient to focus resources on those who are already advantaged. In this sense, the effect of expanding HE in achieving more equal opportunities is not so obvious.

Substantial research indicates that educational expansion does not necessarily reduce the relative advantages of elite children over children having less-privileged backgrounds, for instance, Araum, Gamoran and Shavit (2007), Blanden and Machin (2004), Büchner, van der Velden and Wolbers (2007), Machin (2004), and Bratti, Checchi and de Blasio (2008). Some of them have investigated the extent to which the expansion of HE was equally or unequally

distributed across the parental income distribution and family backgrounds and if there were differential shifts in participation rates and qualification attainment across different family income groups.

For instance, the Machin's study about educational systems and intergenerational mobility, analyses the idea that education is a 'great leveller' which promotes intergenerational mobility (Machin, 2004). His results paint a depressing picture: intergenerational mobility has fallen over time in Britain, and this has occurred at the same time as the rapid expansion of post-compulsory education, which means that it is children from richer families who have benefited from this change in the education system and, rather than alleviating inequality across generations, the expansion has reinforced already existent intergenerational inequalities. Similar results are found for Italy. On the one hand, Bratti, Checchi and de Blasio's paper establishes that the higher education expansion during the 1990s might have had only limited effects in terms of reducing existing individual inequality in higher education achievement: the expansion of university courses has effectively increased the likelihood of university enrolment for students from middle-class and/or less educated parents, but the expansion in enrolment has not translated into an increased probability of attaining a degree. On the other hand, Peragine and Serlenga (2007), show a strong family effect both in tertiary education and in the transition of graduates to the labour market. Moreover, their analysis also indicates evidence of strong inequality of opportunities among individuals belonging to different types of circumstances, both in the South and in the North-Centre of Italy.

These empirical results show that, while most of the parental background exerts its effect through favoring the educational attainment of the students, expansion of higher education has not contributed necessarily to increase the equality of opportunity, at least in the countries under analysis. Most importantly, it also reveals that it is not so obvious that an expansion of higher education supply especially benefits individuals from worse family backgrounds.

## **2. Higher Education in Colombia: An Overview**

The introduction of a new Constitution in 1991 and the enactment of a new HE law in 1992 (hereon Law 30) established the new legal and political framework for a HE system of growing size and heterogeneity. Both the Constitution and Law 30 advocate the autonomy of the HE institutions and call for government control of the quality of education. Article 69 of the Constitution guarantees university autonomy and grants them the freedom to conduct academic activities and training as they see fit. Articles 28 through 30 of the Law 30 further specify the rights enjoyed by HE institutions, such as the right to create and develop academic programs, select professors and manage their own financial resources.

Although the public universities were the biggest institutions in the 1980s, in the 1990s the increasing demand for HE possibly due to the improvements in basic and secondary education and a growing recognition of the increased returns to a tertiary education<sup>2</sup>, overwhelmed the supply of educational opportunities available in the public sector. In response private institutions emerged as an alternative to the public university education. As a result, and combined with the effects of the Law 30, the expansion of the private sector flourished rapidly and the percentage of institutions and student enrollment in private institutions soon outgrew those in the public universities<sup>3</sup>.

Between 1993 and 2002, 64 new HE institutions were created (38 private), constituting of a 25 percent increase. Undergraduate programs increased from 2,089 in 1993 to 4,201 in 2002, an increase of 101 percent. The major growth was in private offer, which accounted for 66 percent of the programs at this level. The expansion was made through a diversification in the fields of knowledge, a strong level of specialization and an increase in the number of evening or distance learning programs (24 and 9 percent in 2002, respectively). Between 1985 and 2002 student enrollment in HE programs had a yearly average increase of 8.5 percent (See Appendix 1). Despite this enrollment growth, coverage of HE eligible population (traditionally 18 to 24 years old) remained around 20 percent in 2002<sup>4</sup>, compared with a Latin American average of 25 percent and Organization for Economic and Cooperation and Development (OECD) country average of 54 percent.

Coverage by region shows some remarkable differences. The public sector focuses on provision of education in low-enrollment regions and has put a lot of effort to locate tertiary institutions throughout the country to make HE accessible, even in remote areas, but in general, the large urban areas are the best served. In average, the coverage in Bogotá, the capital city, has been higher than 30 percent, followed by the Atlántico region with nearly 19 percent of coverage, and Antioquia with 18 percent. Valle and Central region have an average coverage rates around 10 and 15 percent, while in the rest of the regions, it is less than 10 percent; even the region called “Rest”, which groups more remote departments has an average very close to zero. In Appendix 2 the different growth in the supply by region between 1993 and 2002 is available.

The diversification and differentiation produced by HE expansion have several positive implications. The impressive growth in HE coverage could not have occurred had it relied

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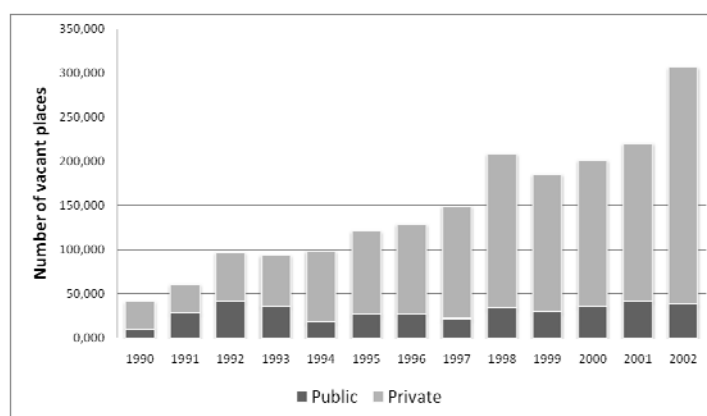
<sup>2</sup> In 2003, the World Bank estimated that HE graduates earned 2.75 times more than average workers and 6.5 times more than those with no education (World Bank, 2003).

<sup>3</sup> While 41 percent of students were enrolled in private schools in the 1960s, about 63.9 percent were enrolled in private HE programs in 2003 according to the ICFES data. In the 1960s, more than 55 percent of HE institutions were official while in 2002 this percentage fell to 32 percent.

<sup>4</sup> Net coverage of the 18–24 year old cohort increased from 9 percent to 15 percent between 1990 and 1999.

solely on the existing, primarily public, HE institutions. However, its extraordinary expansion does not seem the result of a long run, coordinated and planned strategy, but the result of institutions' individual initiatives. This is evident from the fact that historically the places offered by such institutions have overcome the effective demand for HE in a significant proportion. Starting from a supply of 180,000 places in 1990, the system expanded considerably and offered 492,000 places in 2000, a 173 percent increase. Private institutions increased their supply from 119,000 places to 352,000 places (296 percent increase). While at the beginning of the nineties the proportion of non-assigned places was less than 13 percent of the total offered places, during the analyzed period this proportion increased to 53 percent in total. As shown in Figure 1, in 2002 the vacant places were more than 300,000.

Figure 1. Oversupply of Higher Education Places



Source: ICFES, *Estadísticas de la Educación Superior*

The fact that non-assigned places exist could seem incomprehensible and paradoxical given the low coverage rate in HE, which means that there is a non-satisfied demand. Among possible explanations of this situation is the institutions' incapacity to anticipate the effective demand, the saturation of overly-specialized programs, the lack of information available to potential students, the high cost of attending HE institutions, and the limited relationship with the economic system. In any case, this oversupply will be a key factor to be analyzed for the purpose of this work as an effort to disentangle causal effects of the supply expansion on the demand for HE and equality of opportunity at this level.

### 3. Empirical strategy and data

The basic question is whether or not the extraordinary expansion of HE supply in Colombia during the 1990s, in terms of new institutions and new degree programs, helped to reduce inequality of opportunity, that is, if it contributed to reduce the impact of family

background (parental education) on the individual probability of attending HE institutions and achieving a HE degree. This analysis attempts to answer the following questions: i) which students were benefited most from HE supply expansion? and ii) do these correlations reflect causal effects? In order to answer these questions, an estimation of the probability for an individual with a given family background to achieve a HE degree is estimated and it is also assessed whether or not this probability (which depends on family background and other individual and regional level features) has changed due to the expansion of HE supply. The regional expansion of HE supply is the source of variability used to understand the relationship between the availability of new degree programs and infrastructures at the local level and the probability of attending and/or completing a HE degree.

Following Bratti, Checchi and de Blasio (2008), two different indicators of educational attainment are used: (1) the *probability of holding a higher education degree*; and (2) the *probability of holding a higher education degree or being a higher education student*. The former measure takes into account not only the enrolment but also the effectiveness of the educational process, i.e. whether a degree is obtained or not. The latter includes individuals who attended university at or before the time of the survey, but had not completed their studies (due to longer graduation times or high dropout rates). In addition, both indicators are considered again only for the university level.

For a proper identification of the effects of supply expansion, the ideal situation would be to compare individuals exposed to the increase in HE supply during the nineties with fully unexposed ones and those considered as control ones for any other possible determinant of tertiary education. However, the main methodological problem is that the relevant information about the external circumstances when the individuals took the decision about HE enrolment is not available<sup>5</sup>. Following Bratti *et al* (2008), this work attempts to overcome these deficiencies by taking into account different outcome variables and by resorting to a ‘quasi-experimental’ design for data analysis: the educational attainment of individuals with similar characteristics before and after the reform introduced by Law 30 of 1992 are compared using two cross-sectional data.

### ***3.1 Sample and baseline data***

The cross sectional data used in this study comes from two living standards surveys (*Encuesta Nacional de Calidad de Vida*, ECV hereafter) carried out by the National Department of Statistics (DANE) in 1997 and 2003. These surveys gathered information about school level, occupational status, parental schooling, and migration history for all the individuals older than

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<sup>5</sup> One of the major restrictions is that surveys used (ECV) does not provide individuals’ graduation date.

eighteen. The data represents the population as a whole as well as eight main regions included in the study<sup>6</sup>.

The date of birth and the region of residence determine an individual's exposure to the expansion and its intensity respectively. The date of birth also defines the fact that an individual attended university after the promulgation of Law 30, while the intensity of the treatment depends on the size of the HE supply expansion, which varies across the regions<sup>7</sup>. In order to compare the exposed individuals with unexposed ones, the relevant cohorts from both ECV waves must be selected carefully. Since the regular entry age into HE in Colombia is 18 years, the focus is on the population aged 23 to 28 years in both cross sections, of the population considered to already hold a HE degree or who was enrolled at HE by the time the survey was carried out. All individuals from 23 to 28 years of age in 1997 must have been enrolled in HE before the expansion took off after 1992<sup>8</sup>. These individuals are considered to be untreated. Individuals among the same age group from the ECV-2003 are selected. Individuals in this age range may hold a degree or attended HE in 2003 and must have enrolled at HE in 1992 or later, i.e. during the years of supply expansion. The sample size is 9,203 individuals, 3,510 from ECV-1997 and 5,792 from ECV-2003. Sample descriptive statistics are reported in Appendix 3.

One constraint of the ECV data is that it gives information about the current region of residence, and thus it is impossible to identify the region of residence at the age when decisions about enrolling at HE are usually made. Therefore, in the baseline specification it is assumed that the current region of residence was also the region of residence at the age of 18 years or whenever an individual took the decision of whether to enroll in HE or not. Nevertheless, this assumption is not taken for granted and the implications of its failure are examined. The main concern is the possibility of endogenous migration, as it will be discussed in the section 3.5.

### ***3.2 Supply variables***

Information about individual educational attainment is linked with region-level data on the magnitude of the increase in regional HE supply between 1993 and 2002. This period was chosen not only because of the availability of the data, but also because in 2002 there was another important reform (Law 749) which introduced more flexibility in the flow of students

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<sup>6</sup> The ECVs define 8 regions: Bogotá, Antioquia, Valle, Atlántica, Oriental, Central, Orinoquía-Amazonía and San Andrés. For the purpose of this work, seven regions are considered, putting San Andrés into "Atlántica" and merging two regions, Orinoquía-Amazonía and Pacífico, in a group called "Resto", which is the reference category.

<sup>7</sup> Bogotá, Antioquia and Oriental are the regions with major intensity of supply expansion.

<sup>8</sup> Individuals aged 23 to 28 years in 1997 were 18 to 23 years old in 1992, when they should have been HE students or already would have done their HE studies. Those aged 23 to 28 years in 2003 were 18 years or younger in 1993, and in this case they should have attended HE after 1993.



between institutions and type of programs and it likely had an additional effect on the supply and demand for tertiary education.

The territorial distribution of the expansion in the number of *new degree programs* and *new institutions*, normalized by the population aged 18 years and are used as a proxy to measure the expansion of HE supply. Like in Bratti's publication, the main indicator, *new programs*, is the average yearly increase in the number of degree programs (divided by the local population aged 18 years in 1994) at the regional level. This variable reflects both the opening of new programs in sites already served by HE infrastructures and programs in sites not previously endowed with HE infrastructures. The impact of this variable can therefore reflect both "variety" benefits (due to the availability of programs with up-to-date contents and curriculum better tailored to local labour market needs) and "proximity" benefits, which occur if the local availability of infrastructures reduces attendance costs. In an attempt to extricate these two potential sources of benefits, the authors also made use of another indicator, *new institutions*, which is the average yearly increase in the number of university locations (divided by the total population aged 18 years in 1994) at the regional level. This second indicator should reflect more accurately the role of the increased diffusion of HE infrastructures throughout the regions (Bratti *et al*, 2008, 58-61).

### ***3.3 Identification strategy and potential endogeneity***

It could be objected that the accumulation of human capital has simply grown due to the increase in the general level of education or because of the increase in the number of university-educated parents following an upward trend, regardless of existing supply conditions. Moreover, although exposure to this expansion is completely exogenous (depending only on an individual's birth cohort), the intensity of the treatment is potentially endogenous because the individuals could have migrated looking for better educational alternatives.

It was mentioned before that the increase in HE supply in Colombia does not seem to be the outcome of a long run and well planned strategy, but the product of institutional initiatives taken individually. Following Bratti *et al*, this 'quasi-randomness' of HE expansion with respect to potential demand is assumed as a key to the identifying strategy since the aim is to investigate if larger HE supply created larger HE demand, that is, whether causation run from supply to demand or not.

In order to achieve this, control variables for other factors that can influence on the demand from HE as well as parental education are included in the estimations, and it is assessed the extent to which the results change by considering potential omitted variables that might be simultaneously correlated with both the demand and the supply of HE. This is central to

identifying correctly the causal effect of the expansion in HE supply. Thus regressions include, beside individual features such as gender, year of birth, and region of residence, variables which reflect time-varying and region specific effects correlated with both HE expansion and individual educational achievement.

Both increases of unemployment rates and real income per capita at regional level may increase the demand for tertiary education. Higher unemployment reduces the opportunity costs for acquiring human capital and often more education is perceived by young people as a good way to raise their chances to get a good job. Higher income relaxes credit constraints and is positively correlated with the expansion of HE supply because institutions may set up new programs and open new branches in response to the observed or expected rise in potential demand. Moreover, rates of expansion of secondary education and demographic trends that vary across regions could explain a substantial proportion of the increase in the demand for HE<sup>9</sup>.

For all these reasons, the baseline specification are re-estimated, controlling the absolute variation in unemployment rates, the growth rate in per capita real income at 1994 prices, and the change in the number of upper secondary school diploma-holders in order to check the robustness of the results<sup>10</sup>. All these additional control variables are included as interactions with a post-reform dummy (which takes the value one for the post-reform cohorts and zero otherwise).

### **3.4 Estimated Models**

Duflo (2001) evaluates the effect of the Indonesian government's school construction program between 1973 and 1978 on education and wages by combining differences across regions in the number of schools constructed with differences across cohorts induced by the timing of the program. Duflo (2001, 10-14) uses a simple version of the model of endogenous schooling developed in Card (1994), and extends it in order to consider the general equilibrium implications of the program, since such a large program could have affected the returns to education. The strategy of identification, as it is implemented in Duflo, amounts to estimate a reduced form for both cohorts to obtain a difference in difference estimator that controls for systematic variation of education both across regions and across cohorts. Bratti *et al* (2008), in

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<sup>9</sup> It could be argued that HE institutions tend to open in regions where resident's education is already increasing or is expected to increase, and therefore they are not a cause but an effect of increasing education. If the supply expansion simply imitates the rise in the number of individuals completing upper secondary school then the estimated effect could hardly be considered to be supply driven (Bratti *et al.* 2008, 65).

<sup>10</sup> Given the availability of the data, the per capita real income is measured between 1993 and 2002, unemployment rates between 1996 and 2002 and high school graduates between 1996 and 2003. The source of the first two variables is the DANE (national department of statistics) and the third is from MEN (ministry of education).

turn, used the same strategy but included a fundamental variable for the assessment of the impact of expansion of HE supply on the equality of opportunities: the family background.

Following these works, the strategy of identification can be generalized to an interaction terms analysis to obtain a differences in differences estimator by estimating the following reduced form:

$$S_{i,j,k} = c_i + \alpha_{ij} + \beta_{i,k} + \gamma_1 B_i + \gamma_2 X_i + \delta_0(P_i * B_i) + \delta_1(P_i * B_i * \Delta SUPPLY_j) + \delta_2(P_i * R_j) + \varepsilon_{ijk} \quad (1)$$

Where  $S_{i,j,k}$  is the education attainment of an individual  $i$ , born in region  $j$ , in the year  $k$ . The constant is represented by  $c_i$ , while  $\alpha_{ij}$  is a region of birth fixed effect and  $\beta_{i,k}$  is a cohort of birth fixed effect. The coefficients  $\gamma$  are associated with individuals' features (gender, age) and their background in terms of parental education, which in turns interacts with the treatment dummy  $P_i$ , indicating whether the individual belongs to the exposed cohort. The variable  $\Delta SUPPLY_j$  denotes the intensity of the growth of supply in the region  $j$ , i.e., the number of per capita increase in HE supply in each region, and interacts with the treatment dummy. In this way, each coefficient  $\delta_1$  can be interpreted as an estimate of the impact of the increased supply on the exposed cohort and allows heterogeneity effects due to different family backgrounds. The identification assumption that there are no omitted time-varying and region specific effects correlated with the program is satisfied by controlling for these factors. Then, the treatment dummy variable interacts as well with  $R_j$ , a vector of region specific variables that could be related with the educational attainment. Finally,  $\varepsilon_{ijk}$  is a stochastic error term that reflects changes in all other factors affecting the educational attainment, in this case the returns and cost of education.

For the purpose of this paper,  $S_{i,j,k}$  is defined as a dichotomous variable representing the educational outcome of interest –either “*holding a higher education degree*” or “*holding a higher education degree or being a higher education student*”–and takes the value one if the educational outcome has been achieved<sup>11</sup>. Following the reference studies, this outcome is assumed to be a linear function of some observable and unobservable characteristics, and therefore a Linear Probability Model is used as a technique of estimation<sup>12</sup>. The equation (1) is estimated using a synthetic measure of parental educational background, which defines four

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<sup>11</sup> The corresponding zero outcomes are the probability of never having enrolled in HE, or of having enrolled and then dropped out from HE, or of being a student when considering the first indicator, and the probability of never having enrolled in HE, or of having enrolled and dropped out from HE at the time of the survey when considering the second indicator.

<sup>12</sup> The LPM delivers unbiased and consistent estimates when variables uncorrelated with the included covariates are omitted from the regression, whereas nonlinear models do not have this property (see Cramer, 2005).

levels of cultural capital: *no education*, when neither a father nor a mother has any education; *low* when both parents have completed primary education or have some years of this level; *medium* when at least one parent has an upper secondary school diploma; and *high* when at least one parent has a HE degree or has some years of tertiary education.

It is important to note that in specification (1) region fixed effects capture regional time invariant unobservable variables, cohort fixed effects capture country-level time trends in the demand for education, whereas the interaction between family background and the post-treatment dummy allows these trends to differ by family background. This interaction also helps to capture the fact that students with the same cultural capital in the pre and post-expansion periods are likely to have different levels of real income or pressures to acquire HE. The expansion of HE supply enters equation (1) interacted with the post-reform dummy because only the post-1992 cohorts were exposed to it, and interacted with family background in order to capture heterogeneity effects of HE regional supply expansion by levels of cultural capital.

Table 1 reports the estimated coefficients of the interaction of HE supply with the post-reform dummy and parental background ( $\widehat{\delta}_1$ ) in the estimation of the probability of holding a HE degree or being a HE student. Section *a*) of the table shows the estimated coefficients of the interactions with increase in the number of new HE institutions; these show only a significant positive effect of the creation of new institutions on the probability of students from medium cultural capital whether regional controls are omitted or included. Multiplying these coefficients in the most complete specification (column 5) by the actual average increase in the number of institutions in the period considered, which was 0.01 institutions per year per 1000 individuals aged 18 years in 1994, an effect of 8.3 percentage points is obtained.

Section *b*) of the table shows the estimated coefficients of the interactions with increase in the number of degree programs. Again, a significant positive effect on the probability of students from medium cultural capital is observed, and a positive effect on the probability of students from high level of cultural capital, although the latter is not robust to the inclusion of all regional controls. Multiplying the coefficient in column 5 by the actual average increase in the number of degree programs, which was 0.40 programs per year per 1000 individuals aged 18 years in 1994, an effect of 12 percentage points is obtained on the probabilities of students from medium cultural capital background.

In table 2 the estimated coefficients of the interaction of HE supply with the post-reform dummy and parental background in the estimation of the probability of holding a HE degree are reported. Only one effect of the increase in the number of both institutions and degree programs is significant, and again it is positive and concerns medium background individuals, an effect of 4.2 percentage points and 6.6 percentage points respectively.

Table 1. Effect of HE supply expansion on the probability of holding a higher education degree or being a higher education student

*Coefficients of the interactions of HE supply with posttreatment dummy and family background*

| Effect of expansion by cultural capital                        | (1)                | (2)                | (3)                | (4)                | (5)               |
|--|--------------------|--------------------|--------------------|--------------------|-------------------|
| <b>a. Increase in the number of institutions</b>               |                    |                    |                    |                    |                   |
| High   | 3.902<br>(4.43)    | 3.891<br>(4.44)    | 3.649<br>(4.42)    | 3.834<br>(4.43)    | 3.324<br>(4.42)   |
| Medium   | 8.846***<br>(3.21) | 8.840***<br>(3.21) | 8.578***<br>(3.21) | 8.730***<br>(3.21) | 8.315**<br>(3.23) |
| Low  | 3.242<br>(2.43)    | 3.237<br>(2.43)    | 3.198<br>(2.43)    | 3.258<br>(2.43)    | 3.102<br>(2.44)   |
| No education   | -1.417<br>(2.44)   | -1.415<br>(2.44)   | -3.398<br>(2.58)   | -1.965<br>(2.45)   | -4.129<br>(2.59)  |
| R-squared  | 0.311              | 0.311              | 0.311              | 0.311              | 0.311             |
| <b>b. Increase in the number of degree programs</b>            |                    |                    |                    |                    |                   |
| High   | 0.299*<br>(0.18)   | 0.295*<br>(0.18)   | 0.298*<br>(0.18)   | 0.299*<br>(0.18)   | 0.289<br>(0.18)   |
| Medium   | 0.315**<br>(0.13)  | 0.312**<br>(0.13)  | 0.314**<br>(0.13)  | 0.315**<br>(0.13)  | 0.307**<br>(0.13) |
| Low  | 0.115<br>(0.10)    | 0.114<br>(0.10)    | 0.116<br>(0.10)    | 0.116<br>(0.10)    | 0.116<br>(0.10)   |
| No education   | -0.004<br>(0.10)   | 0.003<br>(0.10)    | -0.117<br>(0.14)   | -0.004<br>(0.11)   | -0.205<br>(0.16)  |
| R-squared  | 0.311              | 0.311              | 0.311              | 0.311              | 0.311             |
| <b>Regional control variables</b>                              |                    |                    |                    |                    |                   |
| Change in the number of upper secondary school diploma-holders | No                 | Yes                | No                 | No                 | Yes               |
| Growth rate in per capita real income                          | No                 | No                 | Yes                | No                 | Yes               |
| Absolute variation in unemployment rates                       | No                 | No                 | No                 | Yes                | Yes               |
| Number of observations   | 9,302              | 9,302              | 9,302              | 9,302              | 9,302             |

Notes: All regressions include year of birth dummies, region of residence dummies, gender dummy, parental education variable and the interaction between parental education and posttreatment dummy. Heteroskedasticity robust standard errors in parenthesis. \* significant at 10 per cent, \*\* significant at 5 per cent; \*\*\* significant at 1 per cent.

Table 2. Effect of HE supply expansion on the probability of holding a higher education degree

*Coefficients of the interactions of HE supply with posttreatment dummy and family background*

| Effect of expansion by cultural capital                        | (1)              | (2)              | (3)              | (4)              | (5)              |
|--|------------------|------------------|------------------|------------------|------------------|
| <b>a. Increase in the number of institutions</b>               |                  |                  |                  |                  |                  |
| High   | 3.815<br>(4.59)  | 3.877<br>(4.59)  | 3.654<br>(4.59)  | 3.758<br>(4.59)  | 3.541<br>(4.60)  |
| Medium   | 4.526*<br>(2.56) | 4.559*<br>(2.56) | 4.354*<br>(2.56) | 4.427*<br>(2.57) | 4.242*<br>(2.57) |
| Low  | 0.949<br>(1.91)  | 0.976<br>(1.91)  | 0.920<br>(1.91)  | 0.962<br>(1.91)  | 0.900<br>(1.91)  |
| No education   | -0.192<br>(1.94) | -0.204<br>(1.94) | -1.458<br>(2.05) | -0.655<br>(1.93) | -1.814<br>(2.04) |
| R-squared  | 0.165            | 0.165            | 0.165            | 0.165            | 0.166            |
| <b>b. Increase in the number of degree</b>                     |                  |                  |                  |                  |                  |
| High   | 0.182<br>(0.17)  | 0.183<br>(0.17)  | 0.182<br>(0.17)  | 0.183<br>(0.17)  | 0.180<br>(0.17)  |
| Medium   | 0.166*<br>(0.10) | 0.167*<br>(0.10) | 0.166*<br>(0.10) | 0.166*<br>(0.10) | 0.164*<br>(0.10) |
| Low  | 0.041<br>(0.07)  | 0.041<br>(0.07)  | 0.041<br>(0.07)  | 0.041<br>(0.07)  | 0.042<br>(0.07)  |
| No education   | 0.028<br>(0.08)  | 0.027<br>(0.08)  | -0.033<br>(0.11) | 0.020<br>(0.09)  | -0.080<br>(0.12) |
| R-squared  | 0.165            | 0.165            | 0.166            | 0.165            | 0.166            |
| <b>Regional control variables</b>                              |                  |                  |                  |                  |                  |
| Change in the number of upper secondary school diploma-holders | No               | Yes              | No               | No               | Yes              |
| Growth rate in per capita real income                          | No               | No               | Yes              | No               | Yes              |
| Absolute variation in unemployment rates                       | No               | No               | No               | Yes              | Yes              |
| Number of observations   | 9,302            | 9,302            | 9,302            | 9,302            | 9,302            |

Notes: All regressions include year of birth dummies, region of residence dummies, gender dummy, parental education variable and the interaction between parental education and posttreatment dummy. Heteroskedasticity robust standard errors in parenthesis. \* significant at 10 per cent, \*\* significant at 5 per cent, \*\*\* significant at 1 per cent.

In table 3 only graduates and students at university level are considered. Panel a) shows the effect of the increase in university degree programs on the probability of holding a bachelor degree or being a university student. Here there is only a significant and positive effect on high background individuals. Multiplying this coefficient by the actual annual increase in the number of university degree programs (0,259) per 1000 individuals aged 18 years in 1994, the effect is nearly 40 percentage points on the probability of holding a bachelor degree or being a university student. If the probability of holding a university bachelor degree is considered, the effect is 43 percentage points<sup>13</sup>.

Table 3. Effect of the increase of university degree programs  
Coefficients of the interactions of HE supply with posttreatment dummy and family background

| Effect of expansion by cultural capital   | (1)                | (2)                | (3)                | (4)                | (5)                |
|---|--------------------|--------------------|--------------------|--------------------|--------------------|
| <b>a. Probability of holding a university bachelor degree or being a university student</b> |                    |                    |                    |                    |                    |
| High  | 1.586***<br>(0.59) | 1.594***<br>(0.59) | 1.584***<br>(0.59) | 1.583***<br>(0.59) | 1.589***<br>(0.59) |
| Medium  | 0.379<br>(0.32)    | 0.383<br>(0.32)    | 0.377<br>(0.32)    | 0.370<br>(0.32)    | 0.374<br>(0.32)    |
| Low   | -0.052<br>(0.21)   | -0.049<br>(0.21)   | -0.052<br>(0.21)   | -0.046<br>(0.21)   | -0.044<br>(0.21)   |
| No education  | 0.003<br>(0.22)    | -0.013<br>(0.22)   | -0.009<br>(0.23)   | -0.092<br>(0.23)   | -0.096<br>(0.24)   |
| R-squared   | 0.287              | 0.287              | 0.287              | 0.287              | 0.287              |
| <b>b. Probability of holding a university bachelor degree</b>                               |                    |                    |                    |                    |                    |
| High  | 1.684***<br>(0.45) | 1.695***<br>(0.45) | 1.694***<br>(0.45) | 1.683***<br>(0.45) | 1.711***<br>(0.45) |
| Medium  | 0.289<br>(0.20)    | 0.294<br>(0.20)    | 0.299<br>(0.20)    | 0.286<br>(0.20)    | 0.305<br>(0.20)    |
| Low   | -0.041<br>(0.13)   | -0.038<br>(0.13)   | -0.039<br>(0.13)   | -0.039<br>(0.13)   | -0.032<br>(0.13)   |
| No education  | 0.065<br>(0.14)    | 0.043<br>(0.15)    | 0.140<br>(0.15)    | 0.028<br>(0.15)    | 0.100<br>(0.15)    |
| R-squared   | 0.177              | 0.177              | 0.177              | 0.177              | 0.177              |
| <b>Regional control variables</b>   |                    |                    |                    |                    |                    |
| Change in the number of upper secondary school diploma-holders                              | No                 | Yes                | No                 | No                 | Yes                |
| Growth rate in per capita real income   | No                 | No                 | Yes                | No                 | Yes                |
| Absolute variation in unemployment rates  | No                 | No                 | No                 | Yes                | Yes                |
| Number of observations  | 9,302              | 9,302              | 9,302              | 9,302              | 9,302              |

Notes: All regressions include year of birth dummies, region of residence dummies, gender dummy, parental education variable and the interaction between parental education and posttreatment dummy.

Heteroskedasticity robust standard errors in parenthesis. \* significant at 10 per cent, \*\* significant at 5 per cent; \*\*\* significant at 1 per cent.

By interpreting the results of Tables 1, 2 and 3 it can be concluded that: at first, the expansion of HE supply, considering the whole system, had a positive effect on individuals from medium cultural capital, which was higher on the probability of enrolling than on the probability of completing this level of education; secondly, when only university level is taken into account, the effect of the increase in the supply of HE is positive only for students from high cultural capital families, both for the probability of enrollment and graduation; thirdly, the

<sup>13</sup> This might seem quite high. However, *ceteris paribus* it would be the effect produced only by HE expansion. The actual enrolment or graduation rates will then be determined by the other individual's characteristics as well.

increase in the HE supply had no impact on the probability of being a HE student and/or holding a HE degree for individuals from the lower educational background or for individuals with parents who have no formal education.

According to these results, the relative advantage of individuals from well-off families was increased in terms of access to HE due to the expansion of supply in the nineties. Likewise, the expansion had an equality of opportunity-enhancing effect just for individuals from medium cultural capital families. By contrast, the expansion of mass access to HE institutions seems to have no benefit in this sense to individuals from the lowest levels of cultural capital. This result is in agreement with sociological studies on social stratification and mass education, and the empirical works commented in section 1.3.

### ***3.5 Checking for endogenous migration***

As it was mentioned before, the available data does not record the region of residence at age of 18 years, when the decision to enroll in HE is typically made; this introduces a potential problem of endogenous mobility. Individuals may have changed their region of residence between the age of 18 years and the age at which they answered the surveys used in this analysis. In particular, some of them might have moved to regions in which the expansion of HE supply was greater, precisely because they were looking for better opportunities to enroll in HE or because these regions offered more employment opportunities. If this is the case, the effect of HE supply would be likely overestimated due to positive self-selection.

Following Bratti *et al* (2008), this problem can be overcome by replicating the baseline specification on the sample of individuals for whom the current region of residence coincides with the region of birth. For this purpose, only individuals who answered in the respective ECV wave that they always have lived in the same region are taken into account, i.e. the *stayers*, as they are called by the Italian authors. Given the relatively high geographical mobility in Colombia, this sample is reduced roughly to half. This robustness check is limited to the regressions using the supply of new undergraduate programs as a measure of HE expansion including all regional control variables. The results are shown in Table 4.

The first column exhibits the effect of the increase in the supply of degree programs on the four different dependent variables considered for individuals from high cultural capital backgrounds. It is noteworthy that the only significant coefficient coincides in sign and roughly in magnitude with that one in the table 3 when only the university level is considered and it reveals a positive effect on the probability of holding a university degree. The second column shows that the increase in the number of undergraduate programs had a significant and positive effect on the probability of holding a HE degree or being a HE student from medium cultural

capital level; this result coincides with the results presented in table 1. Finally, the results in the third and fourth column confirm that in all regressions the supply of new HE programs had no effect on the probabilities of getting into HE institutions and/or completing a HE degree for students with the lowest cultural capital or for those whose parents had no education. Results are consistent with those of the previous tables.

Table 4. Effect of increase of undergraduate programs – only "stayers"  
Coefficients of the interactions of HE supply with posttreatment dummy and family background

| Effect of expansion by cultural capital                                     | High              | Medium            | Low              | No education     | R-squared | N     |
|---|-------------------|-------------------|------------------|------------------|-----------|-------|
| a. Probability of holding a HE degree or being a HE student                 | 0.024<br>(0.24)   | 0.305**<br>(0.15) | 0.084<br>(0.06)  | -0.114<br>(0.19) | 0.306     | 4,947 |
| b. Probability of holding a HE degree                                       | 0.191<br>(0.25)   | 0.139<br>(0.14)   | 0.080<br>(0.12)  | -0.131<br>(0.17) | 0.148     | 4,947 |
| c. Probability of holding a university degree or being a university student | 0.468<br>(0.85)   | 0.569<br>(0.42)   | -0.019<br>(0.27) | -0.112<br>(0.32) | 0.263     | 4,947 |
| d. Probability of holding a university degree                               | 1.444**<br>(0.59) | 0.203<br>(0.26)   | -0.018<br>(0.19) | 0.053<br>(0.22)  | 0.144     | 4,947 |

Notes: All regressions include year of birth dummies, region of residence dummies, gender dummy, parental education variable, the interaction between parental education and posttreatment dummy, and three regional control variables. Heteroskedasticity robust standard errors in parenthesis. \* significant at 10 per cent, \*\* significant at 5 per cent, \*\*\* significant at 1 per cent.

#### 4. Interpretation of Results

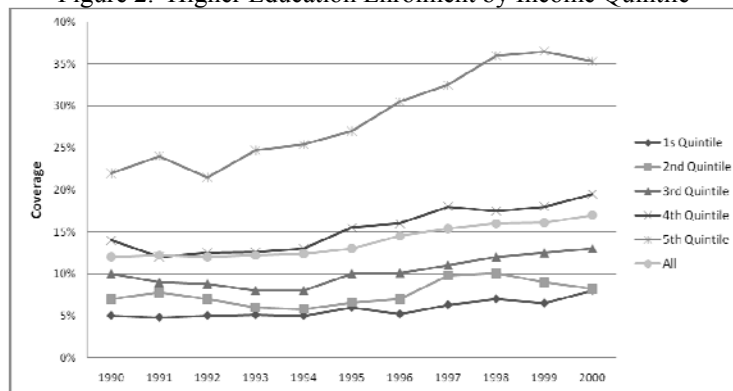
These results can be interpreted as a persistent inequality in HE opportunity despite the vast supply expansion. Tertiary education still represented a discriminating factor between students from different family backgrounds at the end of the analyzed period. Such persistent inequality can be explained by several factors. First, the inequalities in the basic education; students who can afford to pay for high-quality private primary and secondary education are often much better prepared for university entrance exams. In Colombia, some studies expose the systemic link between the fact that poor regions have inefficient primary schools and student learning outcomes, and that National examination (ICFES) results are positively influenced by the students' socioeconomic backgrounds (Gaviria and Barrientos, 2001; Sánchez *et al*, 2002; Gaviria, 2002). Since access to higher education depends on finishing high school and ICFES results, then it should be of no surprise that there is very unequal and limited access to HE.

A second explanation lies in the higher tuition levels in the HE private system and the existence of restrictions in the credit market. The private sector offers courses that are affordable only to well-off segments of the population or those who have access to financial aid.



Tuition levels vary according to institution and type of enrolment<sup>14</sup>. Private universities charge the highest yearly fee, followed by the newer University Institutions. The least expensive tertiary option is the non-university institutions which charge less than half the fee of the universities. As a consequence, access to HE remains highly unequal, as enrollment of the students from low-income families has increased whilst the enrollment of groups is already overrepresented in the system, particular in the university programs (World Bank, 2003).

Figure 2. Higher Education Enrolment by Income Quintile



Source: World Bank (2001) based on Encuesta de Hogares from DANE.

In addition, the overall aid structure in Colombia has been biased towards the middle class because a large proportion of the aid provided is devoted to credit rather than to scholarships, which helps to explain in part the finding that HE supply expansion benefited students belonging to medium cultural capital. However, this financial aid is clearly inadequate. In 2002, only 5 percent of students had access to ICETEX loans (public student loans institution)<sup>15</sup>. The reduced demand for loans in Colombia is linked to the declining attractiveness of borrowing resources. For instance, the real interest rate on ICETEX loans, which reached 13 percent in 2001 (World Bank, 2003:55) and is the lowest in the Colombian credit market, is substantially above real interest rates charged on the student loan schemes around the world (Ziderman and Shen, 2008). Additionally, applicants must find two collateral guarantors to be eligible for such offers. While these instruments are important for high repayment rates, they severely hinder the access and attractiveness of the credit, especially to the poor. Furthermore, in order to reduce the fiscal costs of the student loans, some programs limit them to cover tuition expenditures solely and do not cover the living expenses, accounting for the fact that expansion in HE supply had a higher effect on the probability of enrolment than

<sup>14</sup> There is a large heterogeneity within each group of institutions. For instance, the most expensive university course charged Col\$8.6 million per year in 1999 compared to the least expensive at Col\$299,000 per year. The vocationally oriented Technical Training Institutions that charge less than half the fee of universities (Col\$1.3 million) are the least expensive.

<sup>15</sup> Instituto Colombiano de Crédito Educativo y Estudios Técnicos en el Exterior.

on probability of completing a HE degree<sup>16</sup>. All these limitations can effectively bar the access for low cultural capital students.

In the third place, the effects of the deep short-term recession experienced by Colombia at the end of the nineties had a negative impact on equity as well. The GDP decreased to -4.5 percent in 1999 and by 2000 the unemployment rate was up at a rate of 20 percent. The poor employment performance hit unskilled workers hardest. It critically reduced enrollment and had serious repercussions on those who dropped out from the education system, since these individuals were less likely to re-enter. It appears that the three year consecutive decline in entrants into private HE of 15 percent, 17 percent and 4 percent between 1997 and 1999 – amounting to 100,000 expected entries in total– can be attributed to the severe recession (World Bank, 2003:53). Moreover, the decrease occurred in the lower socio economic strata which couldn't set aside the required income for long term investment in tertiary education.

Finally, some determinants of the individual's choice process must be considered as well. A significant proportion of the under-represented students from the lowest levels of cultural capital in HE could be due to the choices that members of these groups make. Enrolling in HE could be perceived as riskier, more costly and less beneficial by these students than it is for their high or middle-class peers.

## **Conclusions**

The Law 30 led to an extraordinary increase in HE supply in Colombia during the nineties by providing incentives for the creation of new degree programs and a wider participation of the private sector. Using data from two living standards surveys carried out in 1997 and 2003, the effect of this expansion on two different outcomes has been assessed: the probability of holding a HE degree; and the probability of holding a degree or of being a HE student. Since the expansion of supply might have benefited individuals with different family backgrounds in a different way, different models were estimated allowing the heterogeneity of its effect across individuals.

The main impact of this expansion can be summarized under three main points: it increased the relative advantage of individuals from well-off families in terms of access to HE, in particular at the university level; it had an equality of opportunity-enhancing effect only on individuals belonging to medium cultural capital families. This effect was higher for the probability of enrolling as compared to the probability of graduating students; and it seems not

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<sup>16</sup> In the country, graduation rates are very low, nearly 50 percent, that is, only one in two admitted students graduates in Colombia.

to benefit the individuals from the lowest levels of cultural capital. These results confirm a persistent inequality in HE opportunity.

Although the limitations of the data and methodology signify that the analysis in this work should not be interpreted as conclusive evidence on the ineffectiveness of educational policies based on the expansion of supply in order to reduce inequality of opportunity in HE, it is nonetheless indicative of a potential problem with the way in which the expansion is carried out. The overall results suggest that an exclusive focus on the expansion of educational levels does not guarantee the equalization of opportunities. It is necessary to create conditions to allow the access to HE for the individuals with the lowest levels of cultural capital. Furthermore, not only the enrolment but also the effectiveness of the educational process should be the main purpose of a policy that seeks to equalize opportunities: that is whether or not a degree is being obtained, the quality of the education that is being received, therefore increasing the likelihood of having a successful entry into the labour market.

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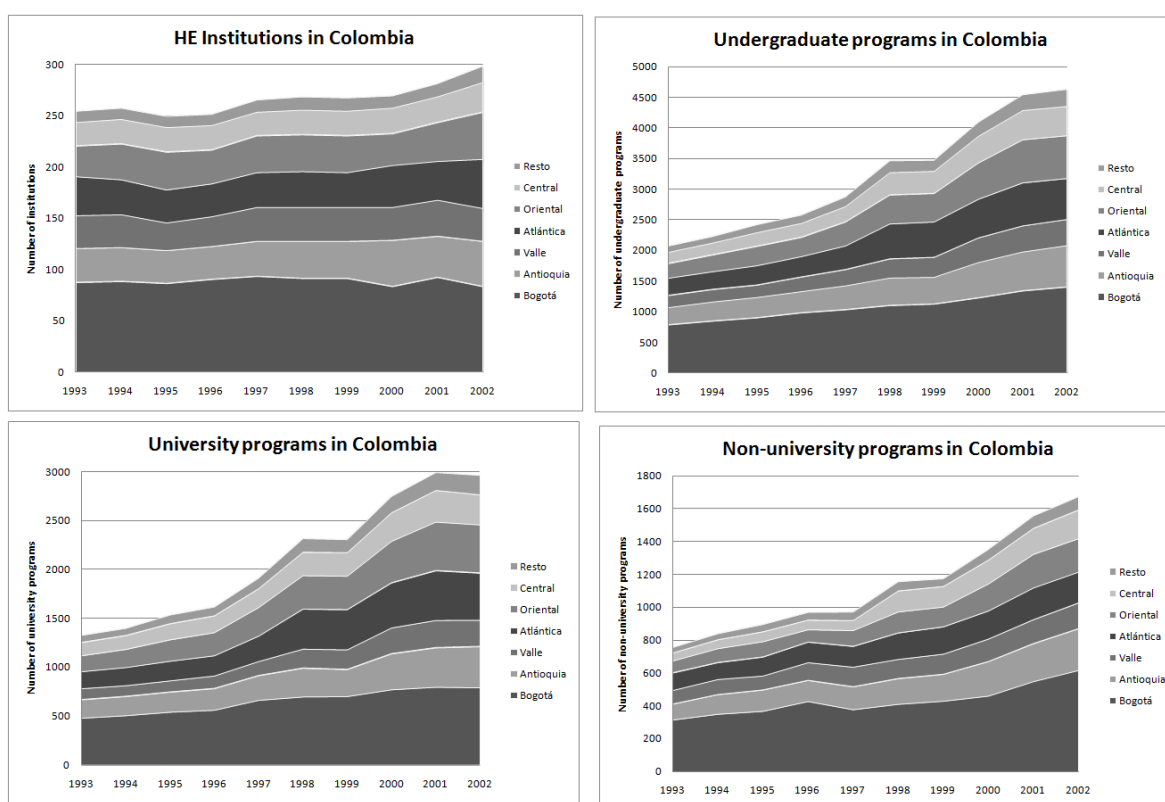
## Appendix 1. Some figures about higher education expansion in Colombia 1985 – 2002

|  | 1985           |              | 1993           |              | 1997           |              | 2002           |              |
|--|----------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|
|  | N              | % of total   | N              | % of total   | N              | % of total   | N              | % of total   |
| <b>Number of HE institutions</b>                             | <b>225</b>     | <b>100%</b>  | <b>255</b>     | <b>100%</b>  | <b>269</b>     | <b>100%</b>  | <b>319</b>     | <b>100%</b>  |
| Technical professional                                       | 62             | 27.6%        | 52             | 20.4%        | 52             | 19.3%        | 52             | 16.3%        |
| Technological  | 34             | 15.1%        | 55             | 21.6%        | 59             | 21.9%        | 65             | 20.4%        |
| University institutions                                      | 59             | 26.2%        | 61             | 23.9%        | 65             | 24.2%        | 97             | 30.4%        |
| Universities   | 70             | 31.1%        | 87             | 34.1%        | 93             | 34.6%        | 105            | 32.9%        |
| <b>Number of private HE institutions</b>                     | <b>156</b>     | <b>69.3%</b> | <b>178</b>     | <b>69.8%</b> | <b>187</b>     | <b>69.5%</b> | <b>216</b>     | <b>67.7%</b> |
| Technical professional                                       | 53             | 85.5%        | 42             | 80.8%        | 41             | 78.8%        | 41             | 78.8%        |
| Technological  | 22             | 64.7%        | 38             | 69.1%        | 41             | 69.5%        | 43             | 66.2%        |
| University institutions                                      | 41             | 69.5%        | 47             | 77.0%        | 51             | 78.5%        | 73             | 75.3%        |
| Universities   | 40             | 57.1%        | 51             | 58.6%        | 54             | 58.1%        | 59             | 56.2%        |
| <b>Undergraduate programs</b>                                | <b>1,554</b>   | <b>100%</b>  | <b>2,089</b>   | <b>100%</b>  | <b>2,948</b>   | <b>100%</b>  | <b>4,201</b>   | <b>100%</b>  |
| Technical professional                                       | 290            | 18.7%        | 324            | 15.5%        | 419            | 14.2%        | 591            | 14.1%        |
| Technological  | 247            | 15.9%        | 452            | 21.6%        | 617            | 20.9%        | 925            | 22.0%        |
| Universities   | 1017           | 65.4%        | 1313           | 62.9%        | 1912           | 64.9%        | 2685           | 63.9%        |
| <b>Private undergraduate programs</b>                        |                |              | <b>1,330</b>   | <b>63.7%</b> | <b>1,980</b>   | <b>67.2%</b> | <b>2,760</b>   | <b>65.7%</b> |
| Technical professional                                       |                |              | 283            | 87.3%        | 335            | 80.2%        | 472            | 79.9%        |
| Technological  |                |              | 298            | 65.9%        | 405            | 65.8%        | 598            | 64.6%        |
| Universities   |                |              | 749            | 57.0%        | 1184           | 61.9%        | 1690           | 62.9%        |
| <b>Enrollment by type of undergraduate programs *</b>        | <b>383,640</b> | <b>100%</b>  | <b>530,561</b> | <b>100%</b>  | <b>718,684</b> | <b>100%</b>  | <b>924,181</b> | <b>100%</b>  |
| Technical professional                                       | 31,802         | 8.3%         | 38,279         | 7.2%         | 34,925         | 4.9%         | 53,926         | 5.8%         |
| Technological  | 40,156         | 10.5%        | 81,231         | 15.3%        | 92,737         | 12.9%        | 127,928        | 13.8%        |
| Universities   | 311,682        | 81.2%        | 411,051        | 77.5%        | 591,022        | 82.2%        | 742,327        | 80.3%        |
| <b>Private enrollment by type of undergraduate programs*</b> | <b>230,619</b> | <b>60.1%</b> | <b>345,976</b> | <b>65.2%</b> | <b>484,560</b> | <b>67.4%</b> | <b>535,421</b> | <b>57.9%</b> |
| Technical professional                                       |                |              | 34,331         | 89.7%        | 29,739         | 85.2%        | 35,103         | 65.1%        |
| Technological  |                |              | 47,023         | 57.9%        | 57,217         | 61.7%        | 51,694         | 40.4%        |
| Universities   |                |              | 264,622        | 64.4%        | 397,604        | 67.3%        | 448,624        | 60.4%        |

Source: ICFES, Estadísticas de la Educación Superior

\* In column 1989 total enrollment correspond to 1990

## Appendix 2. Higher education supply by region 1993 – 2002



Source: ICFES, Estadísticas de la Educación Superior

### Appendix 3. Sample descriptive statistics

|          | Parental education level                              |       |        |       | Total |              |
|----------|---|-------|--------|-------|-------|--------------|
|          | No education  | Low   | Medium | High  |       |              |
| ECV 1997 | Number of observations                                | 439   | 2,176  | 706   | 189   | <b>3,510</b> |
|          | Per cent in sample                                    | 12.51 | 61.99  | 20.11 | 5.38  | <b>100</b>   |
|          | Per cent with HE degree                               | 0.46  | 3.72   | 12.46 | 37.03 | <b>6.87</b>  |
|          | Per cent with HE degree or HE student                 | 1.82  | 8.87   | 30.87 | 79.36 | <b>16.21</b> |
|          | Per cent with university degree                       | 0.00  | 1.42   | 6.94  | 30.16 | <b>3.90</b>  |
|          | Per cent with university degree or university student | 1.37  | 7.94   | 25.35 | 72.49 | <b>13.25</b> |
| ECV 2003 | Number of obs.  | 513   | 2,887  | 1,516 | 876   | <b>5,792</b> |
|          | Per cent in sample                                    | 8.86  | 49.84  | 26.17 | 15.12 | <b>100</b>   |
|          | Per cent with HE degree                               | 3.31  | 7.82   | 21.44 | 44.52 | <b>16.54</b> |
|          | Per cent with HE degree or HE student                 | 5.65  | 16.18  | 41.82 | 83.44 | <b>32.13</b> |
|          | Per cent with university degree                       | 1.56  | 2.84   | 9.96  | 34.93 | <b>9.44</b>  |
|          | Per cent with university degree or university student | 3.70  | 9.18   | 27.18 | 71.12 | <b>27.77</b> |

### Appendix 4. Estimated probabilities

#### a) Summary of fitted values mean by region



#### b) Summary of fitted values mean by parental education

#### c)

