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The (Adverse) Effects of Expanding Higher Education: Evidence from Italy

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Abstract

Over the period 1995-1998 Italy experienced an expansion of its higher education supply with the aim of reducing regional differences in educational attainment. This paper evaluates the effects of this policy on enrolment, drop out and academic performance. The paper combines differences across provinces in the number of campuses constructed with differences across cohorts of secondary school leavers. A sequential model of educational choices with uncertainty is derived and estimated. Findings suggest that enrolment rose, particularly among middle ability individuals from less favorable backgrounds, as well as the probability of being retained in the university system. The decline in passed exams, especially experienced in Southern regions, casts doubts on the policy effectiveness in reducing regional disparities.

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1 Introduction

Higher education is an important political and social issue in developed countries. The past decades have seen sheer expansion of the demand of higher education, which lead to the establishment of new institutions in many developed countries. The process of expansion took place either by setting up new universities, new types of institutions (poly-techniques) or by increasing the role of the private sector. Although a number of researchers have analyzed the determinants of the demand for higher education, little attention has been placed on the role of supply factors on educational choices.

Research on the effects of supply is problematic because universities, besides being often differentiated along the quality dimension, are not randomly allocated across regions. The ideal experiment would be to allocate universities randomly to some regions and not to others in a homogenous centralized higher educational system and then compare educational choices across regions. This paper exploits the sharp increase in the supply of universities over a period of just few years at the end of the 1990's in Italy to evaluate the impact of the expansion on educational choices. From the beginning of the 1990's, the political government implemented a supply side policy that resulted in a widespread increase in local institutions, uniformly scattered across the country, and in an expansion of existing universities, which increased the range of degrees offered. This paper evaluates the effects of the expansion that took place over the period 1995-1998, after which some provinces increased their campuses while others maintained the same universities' provision, by means of a difference in differences estimation strategy.

The outcomes of interest are enrolment, drop out and academic performance. These outcomes are informative on higher education performance and indirectly on graduates labor market outcomes. Labor markets reward youngsters with higher education by entitling them to higher employment opportunities and a wage premium. In fact, graduates stand a stronger chance of getting a job: 86 percent of graduates in the age bracket 25-64 are employed against 77 percent among those with upper secondary education. They also earn 27 percent more.[1]

The enrolment rate in higher education in Italy at the end of the Nineties was 46 percent, whilst the same statistic for the US was 74 percent.[2] Moreover, enrolment in Italy does not always lead to successful graduation: in 2000, only 42 percent of the students who enrolled actually earned a degree. The same statistic for US was 66 percent.[3] Among those, the majority complete their degree well beyond the expected time. This means that a large fraction of young people is still in education, whereas it should be in the labor market. In 2000, the fraction of students in the age bracket 25-29 still in university and not employed was 13,5 percent in Italy and 2,9 in US.[4]

The policy offers a unique quasi experimental research design. The Italian higher educational system has traditionally been organized at the national level, which guarantees that titles of higher education attainment are legally valid throughout Italy, independently of the

[1]Source: OECD, Education at a glance, 2002.

[2]Source: EUROSTAT, 1998. The fraction measures the number of students with ISCED 5-6 qualification as a percentage of 20-24 years old in the population.

[3]Source: OECD, Education at a glance, 2002. Drop out is computed as the complement of the ratio between the number of graduates and the number of new entrants in the typical year of entrance.

[4]Source: OECD, Education at a glance, 2002.

institution that issues them. Universities are indeed perceived as substitutes and individuals enroll in the one nearest to their place of residence.[5] Moreover, the Italian political situation at the beginning of the process of expansion offers an ideal setting for evaluating the impact of the program that limits the possible concerns about endogeneity of the policy one might have. The lack of institutional arrangements allowed the dominant party system to implement public policies without defining clear instructions and objectives. In fact, the increase in higher education supply was hardly driven by an economic rationale and the allocation rule was not clearly spelled out. Rather, the expansion followed an indiscriminate allocation of public funds across Italian regions.

The policy was explicitly justified by the need to balance higher education supply across the national territory with the aim of reducing disparities in educational attainment between the North and South of the country. The range of enrolment and drop out rate were especially wide across regions: for instance, in 1994 the enrolment rate in the North was as high as 67 percent, whilst in Southern regions it was nearly 10 percentage points lower; drop out rates showed similar differences: close to 65 percent in Northern regions, and to 76 percent in Southern ones.[6]

Evaluating the effects of this program is helpful for three reasons. First, it allows measuring how supply factors shape the demand for higher education. Second, it assesses whether instituting a new campus in a less economically advanced area has an effect on closing the gap in educational attainment with more developed ones. Third, it has external validity since reforms of this type were carried out in many other European countries that share similar centrally organized higher educational system.

To better understand the channel through which the expansion affects schooling decisions, a sequential model of educational choices is developed, with uncertainty over individual ability. The main effect of having access to nearby higher education is to reduce the investment cost of entering university. The investment is expected to become more appealing for more disadvantaged groups in the society and educational opportunities more equalized across different social backgrounds. However, local universities might exert a negative impact on aggregate academic performance because of the enrolment of marginally less able individuals.

Results show that the higher education supply expansion increases university enrolment, especially among individuals with middle schooling ability and less favorable family backgrounds, without increasing their probability to quit university. However, academic performance worsens, especially in Southern regions, where only new scientific faculties are set up. Therefore, the policy spurs prolonged duration in university in the least developed area of the country, without achieving its objective of reducing gaps in educational attainment between the North and South of the country.

The remainder of the paper is organized as follows: section II briefly reviews the economic literature on the supply expansion of education. Section III displays the conceptual framework using a sequential model of schooling choices. Section IV describes the implementation of the Italian policy and presents the identification strategy. Section V is devoted to the estimation of the effects of the policy on a set of outcome indicators. Section VI performs

[5]Only 15 percent of students enroll in a university placed in a region different from the one of residence (Source: ISTAT).

[6]Source: ISTAT (1994) "Investigation on Higher Education".

some robustness checks and section VII concludes the paper.

2 Literature

Economic research on the effects of political changes, such as the expansion of education supply, is modest and quite recent. Duflo (2001) evaluates the effects of a major primary school construction program launched in Indonesia between 1973 and 1978 using a difference in differences methodology. She exploits the fact that the exposure to school construction varied exogenously by date and place of birth to estimate the impact of the expansion on years of education. Results point towards a significant increase in the proportion of the population with more years of primary education.

Using a similar estimation strategy, Berlinski and Galiani (2007) assess the impact of a large construction of pre-primary school facilities program in Argentina on pre-primary school enrolment and maternal labor supply. Their identification strategy relies as well on the heterogeneous intensity of program exposure across provinces and cohorts induced by the timing of the policy. They find that the construction program has a sizeable impact on pre-primary school enrolment among children aged 3-5 and increases maternal employment.

Few papers evaluate the effects of a tertiary education expansion program. Holzer (2006) investigates the impacts of the expansion of higher education supply in Sweden, where at the end of the 1970's new regional university colleges were established. The author provides some support that the expansion increases equality of opportunities in entering higher education.

For Italy, Bratti et al. (2008) study the effects of the expansion of universities and faculties provision in Italy over the decade 1990-2000. Using data from the Bank of Italy Survey of Households Income and Wealth, they focus on the likelihood of holding a university degree and of being a university student. Exposure to the program depends on cohort of birth and actual region of residence, with the assumption that current region of residence coincides with the region of residence at age 19. Results show robust evidence of a positive effect of higher education expansion on student's enrolment and retention, but no significant impact on the probability of graduation. Di Pietro and Catullo (2008) evaluate the effects of the 2001 Italian University reform, which introduced greater flexibility in the degree program structure, on drop out behavior. Using the Oaxaca decomposition method on repeated cross sectional data, the authors find that the reform is associated with a decline in the predicted probability of dropping out.

The novelties of this paper are three. The first is methodological. The quasi experimental design tries to answer the counterfactual question: what would have happened to students' behavior if they had not been subject to the policy? With respect to Bratti et al. (2008), the paper improves the identification strategy by using another database with information on the province of residence at the age of 19 and the year of enrolment into university.[7] With respect to Di Pietro and Catullo (2008), it identifies the coefficients of interest net of possible unobservable trend effects. The second and the third novelties are substantive. The paper, enriched by the intuition from the model, provides explanations for the policy partially ineffectiveness found by Bratti et al. (2008) by measuring the effect of the change in the composition of enrolled students and the impact of the type of faculties instituted.

[7] Provinces are administrative sub-division of a region, which is the first order administrative subdivision of the Italian state. Italian provinces consist of several administrative municipalities.

Finally, it provides a wider evaluation of the program as it assesses also the effect of the policy in reducing across regional disparities.

From a policy perspective, the findings are relevant for European countries that feature a higher educational system with a low degree of differentiation along the quality dimension.

3 A sequential model of schooling choices

In this section a simple sequential model describes the youngster's decision of entering university, dropping out and the optimal human capital investment choice using a human capital model with uncertainty over individual ability.[8]

Consider a risk neutral individual with uncertainty over his individual ability. The information set is described as follows. Let α_i be a measure of the unknown individual ability. Students have prior beliefs over α_i; specifically, assume that this prior is normally distributed with mean μ_α and precision, which is the inverse of the variance, σ_α. Beliefs about α_i change as a function of an observed signal. The individual observes two signals, one before deciding whether to enter university or not and one after university enrolment. The first signal could be observable parental education or the mark from high school. The second might indicate the result of exams taken, either in terms of success or failure or of the grade scored. More formally, following Jovanovic (1979), the signal of individual i at time τ, takes the following expression:

$$s_{i\tau} = \alpha_i + \zeta_{i\tau} \tag{1}$$

where $\zeta_{i\tau}$ is noise at time τ, independent of α_i and normally distributed with mean 0 and precision σ_ζ.To add realism to the model, σ_ζ could vary over time or across provinces. In the former case, the first and the second signal would capture different information acquired; in the latter, skills may be distributed in a non-homogeneous way across the territory or the quality of revealed information may not be geographically uniformly distributed. Here, as I am unable to separately identify these different sources of information with available data, I consider a baseline model with constant precision. Since both α_i and $\zeta_{i\tau}$ are normally distributed and independent, the conditional mean of α_i given $s_{i\tau}$, that is, the posterior about α_i, is a linear function of the observed signal. After the first signal has been received, beliefs are updated according to:

$$E(\alpha_i|s_{i0}) = \frac{\sigma_\alpha}{\sigma_\alpha + \sigma_\zeta}\mu_\alpha + \frac{\sigma_\zeta}{\sigma_\alpha + \sigma_\zeta}s_{i0} \tag{2}$$

Once students enter university, they receive a second signal s_{i1} and update their beliefs as follows:

$$E(\alpha_i|s_{i0}, s_{i1}) = \frac{\sigma_\alpha}{\sigma_\alpha + 2\sigma_\zeta}\mu_\alpha + \frac{\sigma_\zeta}{\sigma_\alpha + 2\sigma_\zeta}(s_{i0} + s_{i1}) \tag{3}$$

The conditional value of α follows a random walk with incremental variance that declines deterministically to zero as $\tau \to \infty$. Learning through experimentation reduces the degree of uncertainty on the value of ability.

[8]The reduced form model is preferred to a structural model as the quasi randomness of the experiment allows for identification of the parameters of interest without relying on the assumption of a structural model.

The timing of the model is the following. At time $\tau = 0$ the individual chooses whether to enroll in university or enter the labor market according to the first prior about his ability.[9] At time $\tau = 1$ the student receives a further signal correlated with his true ability, updates his beliefs and chooses whether to continue university or to drop out. Finally, at time $\tau = 2$, if enrolled, he decides the optimal amount of human capital to attain.[10]

The expected utility function of individual i, born in province j, in cohort t, at time τ takes the following form:

$$U(Z,x)_{ijt\tau} = B(x)_{ijt\tau} - C(Z,x)_{ijt\tau} \tag{4}$$

where $B(x)$ is the income earned by an individual with higher education x and $C(Z,x)$ is the expected cost of the human capital investment. I assume that returns to graduation for an individual i born in province j are linear and discounted by a factor $\beta^{2-\tau}$, with $\frac{1}{2} < \beta < 1$:

$$B(x)_{ij} = \beta^{2-\tau} \left(\mu_j + \rho x_i\right) \tag{5}$$

Returns to higher education are affected by local economic conditions μ_j and the premium ρ to the stock of human capital x_i. The ability α_i is an input of the educational production process, whilst x_i is the result of the educational process on innate ability: the stock of competencies and knowledge acquired during university attendance (see Ben-Porath, 1967).

Individuals in the data are interviewed three years after secondary school completion and wages earned after university graduation are not observed. Thus, with the available information, the effect of the policy can be estimated only in the short term.[11] The expected cost of education $C(Z,x)$ is a function of two monetary components of schooling and a non-monetary one. In particular:

$$C(Z,x)_{ijt\tau} = \delta_\tau Z_{jt} + \frac{x_i^2}{2E(\alpha_i|s_{i\tau})} \tag{6}$$

The first component is modeled as a linear function of the number of universities (Z_{jt}) in province j for cohort t and captures the most important modification induced by the program. The institution of a university in the province of residence reduces travelling distances,

[9] Arcidiacono (2004) and Arcidiacono et al. (2009) show that, besides selection into college, self-selection into degree, driven by expected wages and unobservable ability, is an important aspect of the educational process. Their results are derived under the assumption that all degrees are always available at all colleges. In contrast, in this paper, new universities might offer only a subset of degrees. The monetary cost of attending a particular degree depends on its availability nearby or faraway. Under the standard assumption that individuals choose the degree that maximizes the difference between benefits and costs, individuals at the margin between attending a degree available nearby or another one faraway are affected by the institution of new degrees nearby. In this setting, the choice of degree can be formally disregarded without loss of generality.

[10] In reality students do not decide sequentially whether to drop out and then the optimal human capital investment; rather, the two decisions may occur simultaneously. This simplified assumption makes easier the analytical solution of the model, but will be relaxed in the empirical implementation.

[11] As noticed by Heckman, Lockner and Taber (1998) and Angrist (1995), policies that reduce the monetary cost of education might, as an indirect effect in the long run, change the equilibrium in the market of skills. Moreover, as Brunello and Cappellari (2008) show, college attended matters for employment and early earnings in Italy. The expansion may as well affect the skill price of graduates from new universities versus that of graduates from old ones.

thereby lowering the investment cost. The coefficient δ_τ is allowed to vary according to the time at which the decision is taken and is expected to have a negative sign. The second term indicates the non-monetary cost of human capital acquisition that is lower the higher the expected conditional ability $E(\alpha_i|s_{i\tau})$. The hypothesis of convex cost, usual in this literature, ensures that a given amount of investment is less costly when spread out over multiple periods than when it is concentrated in a single period. Finally, I define the utility derived from entering the labor market as a linear function of μ_j, which summarizes labor market conditions for unskilled labor and represents the outside option of education. It is taken to be constant over time. The assumption might not be fully realistic if labor market outcomes are characterized by some degree of uncertainty, which would call for time varying local labor market conditions, but is coherent with information available. The model is solved backward, starting with the optimal choice of exams in the last period.

Working backward, I look for the optimal number of exams at $\tau = 2$ for an individual who has decided to continue higher education in the previous period:

$$\underset{x}{Max} \;\; U(Z,x)_{ijt2} = \mu_j + \rho x_i - \delta_2 Z_{jt} - \frac{x_i^2}{2E(\alpha_i|s_{i1})} \tag{7}$$

The optimal number of exams is:

$$x^*_{ijt2} = p_0 + p_1(s_{i0} + s_{i1}) \tag{8}$$

where $p_0 = \rho\frac{\sigma_\alpha}{\sigma_\alpha+2\sigma_\varsigma}\mu_\alpha$ is a constant term representing the average number of exams taken by the population of enrolled students, and $p_1 = \rho\frac{\sigma_\varsigma}{\sigma_\alpha+2\sigma_\varsigma}$ weights the individual deviation from the national average. The optimal amount of exams is increasing in individual conditional ability and in the labor market premium to skills.

To characterize the optimal stopping criterion at time 1, after information on individual ability has been updated, the optimal number of exams x^* is substituted in the utility function and $E(\alpha_i|s_{i\tau})$ replaced with equation (3):

$$U(Z)_{ijt1} = \beta\mu_j - \delta_1 Z_{jt} + \pi_0 + \pi_1\left(s_{i0} + s_{i1}\right) \tag{9}$$

where $\pi_0 = (\beta - \frac{1}{2})\rho^2\frac{\sigma_\alpha}{\sigma_\alpha+2\sigma_\varsigma}\mu_\alpha$ is a constant term that incorporates the premium for skills and the characteristics of the ability distribution at time 1 and $\pi_1 = (\beta - \frac{1}{2})\rho^2\frac{\sigma_\varsigma}{\sigma_\alpha+2\sigma_\varsigma}$ is the coefficient of the sum of the two signals.[12] At time $\tau = 1$, the student chooses the maximum between university continuation and the outside option in the labor market. Students are indifferent between drop out and continuing if $U(Z)_{ijt1} = \mu_j$. The individual propensity to drop out d^*_{ijt1} is indeed:

$$d^*_{ijt1} = \mu_j(1-\beta) + \delta_1 Z_{jt} - \pi_0 - \pi_1\left(s_{i0} + s_{i1}\right) \tag{10}$$

Only actual drop out is observed, so the outcome of interest is a dummy variable $d_{ijt} = I(d^*_{ijt} > 0)$ equal to one when individual i quits university. Consistently with economic theory, the propensity to abandon university increases the higher is the opportunity cost μ_j,

[12]The result relies on the assumption that $\frac{1}{2} < \beta < 1$. The assumption is realistic as students are expected to be impatient about short term outcomes like the wage earned at the end of their academic career.

whilst it decreases the higher is the premium for graduation ρ and the lower the monetary cost of attending university (high Z_{jt}).

I now turn to define the optimal entry choice at time 0. The expected utility at $\tau = 0$, after having replaced x with x^* and $E(\alpha_i|s_{i0})$ with equation (2) is expressed as follows:

$$E_0[U(Z)_{ijt1}] = \left(\beta^2\mu_j - \delta_0 Z_{jt} + \pi'_0 + \pi'_1 s_{i0}\right)[1 - E_0(d_{ijt1})] + \beta\mu_j E_0(d_{ijt1}) \quad (11)$$

where $\pi'_0 = (\beta^2 - \frac{1}{2})\rho^2 \frac{\sigma_\alpha}{\sigma_\alpha + \sigma_\zeta}\mu_\alpha$ is the modified constant term that embeds information known at time 0, $\pi'_1 = (\beta^2 - \frac{1}{2})\rho^2 \frac{\sigma_\zeta}{\sigma_\alpha + \sigma_\zeta}$ the coefficient of s_{i0} and $E_0(d_{ijt1})$ the expected probability of drop out next period. At time $\tau = 0$, the student chooses the maximum between the expected value of university entry and the outside option in the labor market, $[E_0(U(Z)_{ijt1}); \mu_j]$. By imposing indifference between the two terms in squared brackets, exploiting the fact that μ_j is constant over time and neglecting discounting over one period ($\beta \approx 1$), the propensity to enter university e^*_{ijt0} reads as follows:

$$e^*_{ijt0} = (\beta - 1)\beta\mu_j - \delta_0 Z_{jt} + \pi'_0 + \pi'_1 s_{i0} \quad (12)$$

The outcome of interest $e_{ijt} = I(e^*_{ijt} > 0)$ equals one when $e^*_{ijt0} > 0$ and zero otherwise. The fraction of students that enroll at university is increasing in the number of campuses.

Following Duflo (2001), individuals' outcomes for the two cohorts of youngsters are aggregated and difference over time computed. Consider an old cohort denoted by 0 and a younger cohort denoted by 1. Average educational outcomes are computed by substituting s_{i0} and $(s_{i0} + s_{i1})$ with their expected value. However, as drop out is observed only if the student enrolls university and performance if he does not quit it, the aggregate values of these outcomes have to account for self-selection. The analytical expressions are easy to compute due to the normality assumption.[13] The differences between cohort 0 and 1 in the average propensities to enroll in university, drop out and the average number of exams take the following form:

$$e^*_{j1,\tau=0} - e^*_{j0,\tau=0} = \delta_0(Z_{j1} - Z_{j0}) \quad (13)$$

$$d^*_{j1,\tau=1} - d^*_{j0,\tau=1} = \delta_1(Z_{j1} - Z_{j0}) - \pi_1\left[\left(\frac{1}{\sigma_\alpha} + \frac{1}{\sigma_\zeta}\right)^{\frac{1}{2}}(\lambda(\alpha^{e^*_1}) - \lambda(\alpha^{e^*_0}))\right] \quad (14)$$

$$x^*_{j1,\tau=2} - x^*_{j0,\tau=2} = p_1 2\left(\frac{1}{\sigma_\alpha} + \frac{1}{\sigma_\zeta}\right)^{\frac{1}{2}}[\lambda(\alpha^{d^*_1}) - \lambda(\alpha^{d^*_0})] \quad (15)$$

[13] The expected value of the sum of the two signals in the drop out equation is $2\mu_\alpha + \left(\frac{1}{\sigma_\alpha} + \frac{1}{\sigma_\zeta}\right)^{\frac{1}{2}}\lambda(\alpha^{e^*_0})$ where $\lambda(\alpha^{e^*_0}) = \frac{\phi(\alpha^{e^*_0})}{1-\Phi(\alpha^{e^*_0})}$ is the correction for selection and $\alpha^{e^*_0} = \frac{\sigma_\alpha+\sigma_\zeta}{\sigma_\zeta}\left(\frac{2[\mu_j(1-\beta^2)+\delta_0 Z_{j0}]}{(2\beta^2-1)\rho^2} - \frac{\sigma_\alpha}{\sigma_\alpha+\sigma_\zeta}\mu_\alpha\right)$ is the critical point above which realizations of s_{i0} lead to enter university. Similarly, the equation for the number of exams reads $x^*_{j0,\tau=2} = p_0 + p_1\left[2\mu_\alpha + 2\left(\frac{1}{\sigma_\alpha} + \frac{1}{\sigma_\zeta}\right)^{\frac{1}{2}}\lambda(\alpha^{d^*_0})\right]$ where $\lambda(\alpha^{d^*_0}) = \frac{\phi(\alpha^{d^*_0})}{1-\Phi(\alpha^{d^*_0})}$ is the correction for self selection into university at the end of the first period, whilst $\alpha^{d^*_0} = \frac{\sigma_\alpha+2\sigma_\zeta}{\sigma_\zeta}\left(\frac{2[\mu_j(1-\beta)+\delta_1 Z_{j0}]}{(2\beta-1)\rho^2} - \frac{\sigma_\alpha}{\sigma_\alpha+2\sigma_\zeta}\mu_\alpha\right)$ is the threshold below which realizations of $(s_{i0} + s_{i1})$ imply drop out.

The model predicts that the policy affects enrolment and drop out directly, and indirectly influences drop out and the human capital investment, due to changes in the ability composition of the enrolled students. More specifically, an increase in the number of universities is expected to increase university enrolment if it implies a reduction of the monetary cost of education ($\delta_0 < 0$). Changes in drop out instead reflect two opposite forces. On one hand, the increased supply should reduce the probability to quit university as continuing academic studies become less costly ($\delta_1 < 0$). Thus, the extensive margin increases. On the other, the policy increases the participation into university of marginal types, who are more inclined to abandon studies. In this case, the intensive margin decreases.[14] In fact, $\lambda(\alpha^{e^*})$ is a monotonic decreasing function of Z_j as a higher university supply lowers the thresholds above which realizations of s_{i0} induce enrolment. Therefore, in case of expansion, the difference $\left(\lambda(\alpha^{e_1^*}) - \lambda(\alpha^{e_0^*})\right)$ is negative. Which of the two effects prevails in equilibrium depends on the magnitude of the two forces and affects the direction of the change in the number of taken exams. If drop out increases because the composition effect exceeds the cost reduction induced by the policy, the number of exams is expected to increase, otherwise to decrease.

Rewriting the bivariate sample selection model, denote with Y^0 the participation equation (enrolment) and with Y^1 the outcome equation (drop out and number of passed exams). More formally:

$$Y_{ijt}^0 = \begin{cases} 1 \text{ if } Y_{ijt}^{*0} > 0 \\ 0 \text{ otherwise} \end{cases}$$

$$Y_{ijt}^1 = \begin{cases} Y_{ijt}^{*1} \text{ if } Y_{ijt}^{*1} > 0 \text{ and } Y_{ijt}^{*0} > 0 \\ 0 \text{ otherwise} \end{cases}$$

The strategy implemented in the paper consists in estimating equations (13)-(15):

$$Y_{ijt}^0 = a_j^0 + \eta_t^0 + \gamma^0 P_j T_{it} + \delta^0 X_i + \theta^0 T_i * R_{jt} + \varepsilon_{ijt}^0 \tag{17}$$

$$Y_{ijt}^1 = a_j^1 + \eta_t^1 + \gamma^1 P_j T_{it} + \delta^1 X_i + \theta^1 T_i * R_{jt} + \beta^1 \lambda(\alpha^{d^*,e^*}) + \varepsilon_{ijt}^1 \tag{18}$$

where equation (17) is used to estimate enrolment, whilst equation (18), which includes a non-linear term that accounts for self selection in the previous stage, is implemented to estimate drop out and exams. In particular, γ^0 is the equivalent of δ_0 in equation 13, γ^1 is the equivalent of δ_1 in equation 14 and β^1 of π_1 and p_1 in equation 15.

More specifically, Y_{ijt} is a variable indicating the outcome of interest for the individual i, resident in province j at the end of secondary school in period t; a_j is the province of secondary school fixed effect, η_t a cohort of graduation fixed effect, P_j is a dummy variable equal to one for provinces where a new campus has been instituted, and zero otherwise. P_j is a potentially endogenous variable, whose identification is described in Section 4.2. T_{it} is a "treatment dummy" which takes value of one for treated individuals and zero otherwise; the coefficient γ measures the effect of the treatment on the treated. X_i is a vector of individual variables related to family background and past schooling career. R_{jt} is a vector of provincial specific time varying controls. $\lambda(\alpha^{d^*,e^*})$ is the correction term for self selection into enrolment

[14] Carneiro and Lee (2009) formalize this concept and estimate it on US data.

or drop out. Finally, ε_{ijt} is a zero-mean stochastic error term, clustered at the province and cohort of graduates' level to account for correlation of errors within province and time.

The system of equation is jointly estimated using a non-recursive system of maximum likelihood when both selection in higher education and potential endogeneity of P_j, that enters the selection and the outcome equation, are accounted for.

Educational choices might be rationalized also with a theory of signaling. The model is derived under the uncertainty framework as the lack of information on graduate students' labor market outcomes would make difficult to test a general equilibrium theory of signaling. The human capital and signaling model have the same predictions in terms of enrolment and drop out choices and a different one on performance. Under a human capital model, new universities lower the cost of attending higher education and thereby increase enrolment and reduce drop out. The lower skill pool of enrolled should imply lower average academic performance. Under a signaling model, higher intake in university of less marginally talented individuals reduces the skill pool of drop out. The most able individuals among drop out have thereby incentives to achieve graduation in order to continue distinguishing themselves from the less productive. This implies lower drop out rates and higher performance under a signaling story (see Bedard, 2001). The effect of the policy on drop out rate does not allow distinguishing between the two theories, whilst the effect on performance should be more informative.

4 The program

4.1 Data

During the 1990's the Italian higher educational system featured a striking expansion of its supply. This expansion was driven by two broad rationales: first, the necessity to spread the accessibility to university homogeneously across the territory in order to increase equality of opportunities in human capital investments; second, the need to decongest universities' size when that size exceeded forty thousands students enrolled. The objectives triggered the birth of a number of smaller campuses. The law that regulated the process of expansion commanded that any variation in the existing university supply should be included in a development plan, to be approved by the Minister of Education every three years. Because of delays on resources assignment, some campuses, whose institution was forecasted at the beginning of the 1990's, were effectively established at the end of the decade. Over the period 1995-1998, which I focus on, the number of public campuses in Italy increased from 69 to 81. Figure 1 depicts the territorial distribution of the expansion.[15] There was an expansion in twelve provinces throughout the institution of a new campus (Aosta, Vercelli, Milano, Bolzano, Reggio Emilia, Ravenna, Forli', Ascoli Piceno, Isernia, Caserta, Taranto, Siracusa), while the number of campuses in the province of Napoli was even reduced because of the closure of the second University, which opened a subsidiary campus nearby. The remaining eighty-two provinces maintained the same number of universities. I define as "treated provinces" those where the number of campuses changed over the period 1995-98,

[15] In this process of expansion also private universities were founded. However, changes in the supply of private universities ruled by private enterprises are left out of consideration because procedures different from those applied for public universities were applied and because other dimensions, as family wealth, affect the choice of entering private universities.

while remaining ones are the control provinces.

I use data collected from the "Survey on School and Work Experiences of Secondary School Graduates" a cross-section of a representative sample of secondary school graduates interviewed three years after graduation. The data contain a wide range of information on the school curriculum and on the post-school experiences, either in college or in the labor market. Moreover, information on personal characteristics, family background, province of residence during secondary school, region of university attendance and year of enrolment is available. The Italian school system of secondary education is mainly structured into tracks that are either college oriented (high schools) or labor market oriented (technical and vocational schools). A minor share, between 7 and 8 percent, is composed of schools intended for individuals aiming at artistic professions. Given the specificity of this minor track, students coming from these secondary schools are excluded from the estimation sample.[16]

The estimation sample includes 37.053 observations, 17.325 of which belong to the 1995 cohort and the rest to the 1998 one. Some relevant variables in the data suffer from non-response (the number of exams, the score at exit of secondary school, paternal and maternal education). To avoid dropping observation, missing data are imputed using the multiple imputation method.

The 1998 and 2001 repeated cross sections of individual data are pooled and information matched with provincial-level data on the supply of the higher education supply, both in 1995 and 1998 (years in which secondary school graduates were interviewed). Information about the provincial supply of higher education, including campuses, faculties and degrees courses, is taken from the annual ISTAT report "Statistics of Higher Education".

Table 1 shows baseline summary statistics for treatment and control groups in terms of individual level data before the policy implementation to assess whether the program creates comparable groups. In Table 1, the first column shows summary statistics of individuals' resident at the end of secondary schools in provinces that kept locations' supply unchanged, while the second column shows those of individuals living in provinces where campuses' provision has changed. The third column presents average differences between treatment and control groups with standard errors in parenthesis. There are no statistically significant differences between individual observable characteristics of treatment and comparison group, except for the fraction of students whose fathers obtained secondary and primary education, slightly lower in control provinces the first, higher the latter.

Slightly more than half of respondents are female; average respondent's age is about 22.8; roughly two thirds are composed of children whose parents have primary education, one third of children whose parents obtained a secondary school diploma and less than 10 percent have college graduated parents. Marks at the end of lower secondary school are almost equally distributed among all respondents, with a prevalence of individuals who obtained a low D mark. Almost 30 percent of students attained the diploma in a high school, 54 percent in a technical secondary school and 15 percent in a vocational one. College enrolment is slightly higher among comparison individuals, whilst the number of exams is slightly lower. The fact that most of observable individual characteristics are similar across the treatment and comparison group provides evidence that the policy was somewhat randomized.

[16] As a robustness check I have also estimated the model including this sub sample of students. Results are very similar to those reported.

Figure 1: Changes in university supply between 1995-1998

Performance outcomes are observed in the data only up to the third year of college. This might affect the external validity of the analysis as Italian students take on average seven years to complete their degree instead of four. Looking at Census data, 25 percent of students drop out before entering the second year, 10 percent do not enter third year and only 5 percent do not enter the fourth year; thereby, considering drop out up to the third year should not substantially affect the external validity of the results.[17] As concerns the number of passed exams, descriptive statistics in Table 1 show that students pass on average 3 exams per year, half the number observed in case their course work would be completed on time, implying twice the time needed to obtain the degree. This value slightly overestimates the number of exams that would assess performance beyond the third year of college, without thereby undermining external validity of the estimates. The next section discusses in detail the assumptions of the identification strategy.

4.2 Identification strategy

An individual's exposure to the program is jointly determined by his year of graduation from secondary school and his province of secondary school attendance. The young people who left secondary school in 1995 did not benefit from the program, since the higher education expansion only came into force between 1996 and 1998, whilst individuals who terminated

[17] Source: MIUR, (1998) "The evolution of higher education demand: students, graduates and equivalent students".

	Comparison	Treatment	Comparison-Treatment
	Mean (s.d.)	Mean (s.d.)	Mean (s.e.)
Female	0,52	0,52	0,00
	(0,01)	(0,01)	(0,01)
Age	22,80	22,94	- 0,14
	(0,03)	(0,08)	(0,09)
Father with college degree	0,10	0,11	- 0,01
	(0,00)	(0,01)	(0,01)
Mother with college degree	0,08	0,08	0,00
	(0,02)	(0,07)	(0,01)
Father with secondary degree	0,30	0,32	- 0,02
	(0,01)	(0,01)	(0,01)
Mother with secondary degree	0,27	0,28	- 0,01
	(0,00)	(0,01)	(0,01)
Father with primary education or lower	0,59	0,57	0,02
	(0,00)	(0,01)	(0,01)
Mother with primary education or lower	0,65	0,64	0,01
	(0,01)	(0,01)	(0,01)
Junior school mark A	0,22	0,22	0,00
	(0,00)	(0,01)	(0,01)
Junior school mark B	0,20	0,21	- 0,01
	(0,00)	(0,01)	(0,01)
Junior school mark C	0,26	0,26	0,00
	(0,00)	(0,01)	(0,01)
Junior school mark D	0,31	0,30	0,01
	(0,00)	(0,01)	(0,01)
High school	0,30	0,30	0,00
	(0,01)	(0,01)	(0,01)
Technical secondary school	0,55	0,54	0,01
	(0,00)	(0,01)	(0,01)
Professional secondary school	0,15	0,16	- 0,01
	(0,00)	(0,01)	(0,01)
College enrolment	0,52	0,51	0,01
	(0,01)	(0,01)	(0,01)
College drop out	0,16	0,16	0,00
	(0,00)	(0,01)	(0,01)
Number of exams	8,62	9,01	- 0,49
	(0,08)	(0,34)	(0,35)
Observations	14,613	2,326	

Note: Observations are weighted

Table 1: Baseline descriptive statistics (1995 survey) - Individual level data (N=16,535)

secondary school in 1998 were fully exposed.

Delayed university enrolment could lead to mistakenly consider as non-treated students that took advantage from the program; in that case, estimates would suffer a downward bias. Similarly, an erroneous value of the program intensity could be assigned to those who graduated in 1998 and delayed enrolment, since higher education expansion had continued after 1998. In that case, the effect of the policy would be overestimated. To avoid these problems, I drop from the pooled sample individuals who entered higher education in different years from 1995 and 1998.

A second source of variation arises from the expansion of higher education supply across provinces. Evaluating the enrolment decision and the academic performance according to the supply of higher education in the province of secondary school could downward bias the coefficient estimate of the policy because migration introduces measurement errors. On the contrary, assessing enrolment and performance according to the supply of higher education in the province where university was attended could give positively biased estimates because of endogenous selection. To rule out bias induced by endogenous migration, educational choices are evaluated on the basis of the exogenous supply of higher education in the province of secondary school.

Identification of the parameters of interest relies on the differential intensity of the program expansion across provinces and differences in exposure across cohorts of graduates induced by the timing of the expansion.

The basic idea behind the identification strategy can be illustrated using a simple two-by-two table. Table 2 shows differences of outcomes' means, computed at the provincial level, between 1995 and 1998 by control and treatment groups and provides an empirical counterpart of equations 13-15.[18] It presents the main experiment providing an illustration of the identification strategy. A list of outcomes of individuals who had no exposure to the program is compared to those of individuals who were exposed to the program. Outcomes of interest are the following: enrolment, a dummy equal one when the individual entered higher education and zero otherwise; drop out, a dummy that takes value of one whenever the individual quit university;[19] finally, the average number of exams taken during the first three years of academic studies as an indicator of individual performance.[20]

The first block in Table 2 presents the change in enrolment over the period for the two groups of provinces. In both groups the average enrolment dropped over the years. However, it decreased less in provinces that set up more universities. Considering changes in withdrawal behavior for the population of students that entered higher education, it emerges that drop out diminished in all provinces, but more in treated ones. The number of exams declined in both groups of provinces, but more where new universities were opened. The simple differences in Table 2 suggest that higher education expansion led to increase enrolment across Italian provinces, decrease drop out and, interestingly, caused a reduction in the number of exams. However, none of these differences is statistically significant. Changes

[18] Students resident in the Napoli province in 1998 are in the control group for this descriptive analysis.

[19] Students who drop out leave the higher educational system. Thus, students who enrol in a different university to complete the same or a different degree are considered as enrolled.

[20] Unfortunately, information on grades scored at university is not available. However, this is a minor problem as in Italy universities strategically adjust grading standards to affect enrolment (see Bagues et al., 2006).

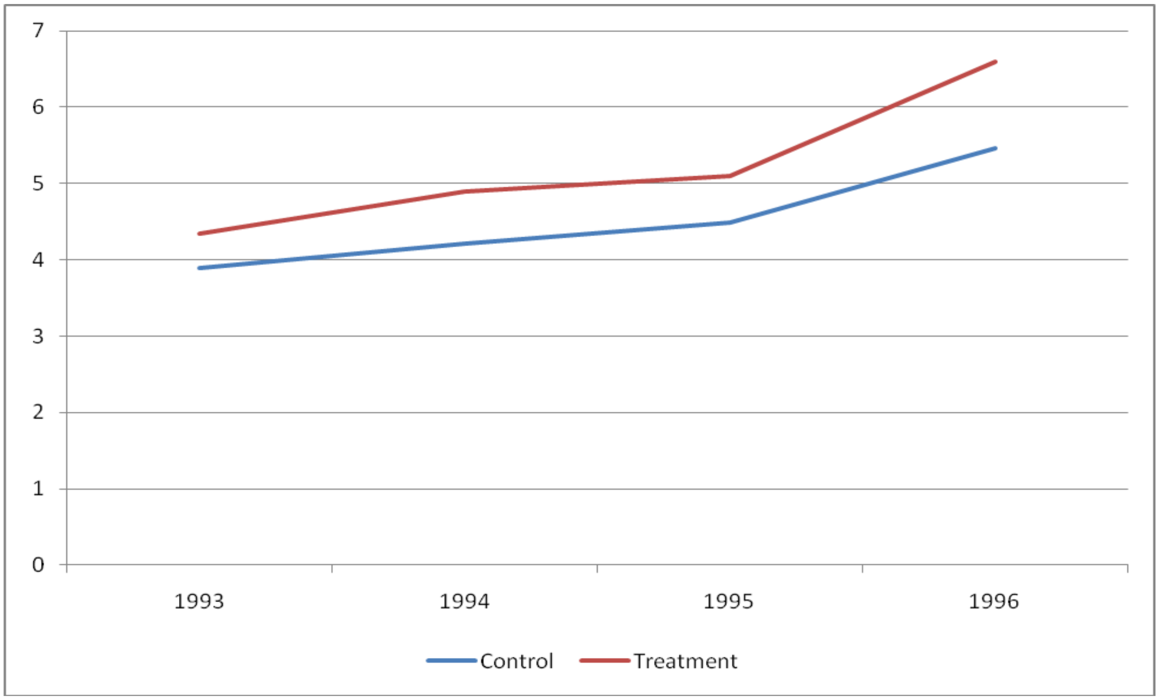

Figure 2: Time series of the provincial unemployment rate by control and treated provinces

in individual characteristics, background variables and labor market conditions between 1995 and 1998 could offset the effect of the policy on the outcomes of interest. In the regression analysis, by controlling for these other sources of variations, the effect of the expansion can be assessed more precisely.

The difference in differences between treated and control groups can be interpreted as the causal effect of the policy, under the assumption that in the absence of the higher education expansion, the trend of the variables of interest would have not been systematically different between control and treated provinces. To provide evidence in favour of this hypothesis, Figure 2 shows the trend of the unemployment rate by treated and control provinces before the policy was implemented.[21] Even if not exactly parallel, the two lines appear very similar and slightly diverge only after the expansion of higher education, supporting the parallel trend hypothesis.

To rely on this identification strategy and infer a causal effect of the program on university enrolment, drop out and performance, some comments are worth mentioning. As Rosenzweig and Wolpin (1988a) discuss, one should not downplay the possibility of a compensatory intervention, meaning a universities allocation rule that geographically distributes expansion in such a way to provide less endowed areas with higher public investments. If this were the case, the effect of the program would be overestimated. As discussed above, the allocation of funds to higher education investments was driven by two broad economic rationales: the necessity of rebalancing universities premises nationwide and that of splitting overcrowding

[21] ISTAT provides labour market statistics at the provincial level only since 1993. Moreover, until 1995, only the aggregate unemployment rate, not decomposed by age group or educational level, is available.

	Treatment		
	1	0	Difference
Enrolment			
Cohort 1998	0,365	0,327	0,038
	(0,024)	(0,009)	(0,025)
Cohort 1995	0,475	0,476	0,001
	(0,036)	(0,012)	(0,038)
Difference	-0,111	-0,148	**0,039**
	(0,044)	(0,148)	(0,046)
Drop out			
Cohort 1998	0,113	0,158	-0,045
	(0,018)	(0,007)	(0,020)
Cohort in 1995	0,157	0,180	-0,023
	(0,018)	(0,008)	(0,020)
Difference	-0,044	-0,022	**-0,022**
	(0,012)	(0,011)	(0,017)
Number of exams			
Cohort 1998	9,084	8,516	0,568
	(0,399)	(0,114)	(0,415)
Cohort 1995	9,361	8,747	0,614
	(0,334)	(0,163)	(0,371)
Difference	-0,277	-0,231	**-0,046**
	(0,387)	(0,414)	(0,412)

Note: Means and standard errors in brackets

Table 2: Means of outcomes of interest by cohort of graduation and treatment

universities. The first criterion is a form of a compensatory policy intervention; the second one goes in the opposite direction since overcrowded universities were principally located in areas that were already well endowed. However, a standard way to circumvent the possibility that some pre treatment observable characteristics affected the policy rule is to condition the outcome equations on provincial fixed effects (as proposed by Rosenzweig and Wolpin, 1988a). This method is appropriate if the outcomes of interest are not systematically different between treated and control provinces.

Another related but distinct issue regards the possibility that the policy was endogenous (Besley and Case, 2000). The allocation rule of new universities premises was not explicit. It might be the case that investments in higher education infrastructures reflected some political, demographic and economic variables, which were time-variant provincial specific. If these variables were also correlated with educational outcomes and are omitted from the outcome equation, the estimated effect of the policy would result biased. Although the allocation rule was not explicitly defined, the law, which established procedures for the opening of a new campus at the beginning of the 1990's, clearly stated its objectives. These were "...To ensure a balanced development and adjustment of higher education provision keeping into account local potential demand, big metropolitan areas, gaps between the North and South and national instructive needs."[22] I check whether the actual allocation rule decided upon by the universities and the Ministry of Education achieved the planned objectives. The log of secondary school graduates in 1992 at provincial level is used as a proxy for potential demand at the beginning of the 1990's.[23] Metropolitan area is controlled for with a dummy equal to one when the province was located in a region endowed with an overcrowded university and zero otherwise. Territorial disparities are controlled for by the log of the professors-students ratio computed at regional level.[24] The first column of Table 3 presents results from a probit of the policy dummy on the just described variables. Coefficients have the expected sign: potential demand and being located in a region endowed with an overcrowded university positively affect campuses' institution, whilst a proportionate teaching staff is negatively correlated with the expansion. This exercise shows that the policy could be endogenous as it might depend on variables that affect both the demand and the supply side of education, even though these variables are not significant and explain only four percent of provincial variation. In fact, politicians in the 1990's might have measured these factors differently. The assessment made by the Ministry of Education "...With respect to the development and rebalancing of university premises prevailed - at least for the most part - a non selective "all over the place" approach, inspired by a barely incremental purpose..." confirms the absence of explicit and clear criteria.[25]

To address the fact that the policy could be endogenous, an IV strategy is implemented. The instruments are two political variables: the first is a dummy taking value of one if at the beginning of the 1990's, when the law was enacted, the province was ruled by the same party that had the majority at the national Parliament over the same time period (the Christian Democrat Party, DC thereafter). The second variable is the interaction between this dummy

[22] Law 245/1990, art. 1 (a), my translation.

[23] Source: ISTAT. Data on secondary school leavers were not collected at regional level before 1992.

[24] Source: MIUR (1997) "Enclosure E - Verification universities' development plans 1986-1990 and 1991-1993". The information is available only at the regional level.

[25] MIUR (1997) "Verification of universities' development plan 1986-90 and 1991-93", doc. 4/97, pg.10.

and the fraction of provincial political positions (councilors) held by members of the DC's party. Political variables are expected to affect the allocation of public funds at the local level, whilst they should not influence individuals' educational choices. Control for the presence of a DC government at the regional level is included as well. The second column in Table 3 shows that being a province ruled by the DC's party positively and significantly affects the probability of increasing the supply of higher education, but at a rate decreasing with the concentration of power in DC's politicians. These signs are coherent with the idea that public expenditures were assigned to pivotal provinces in order to acquire their political consensus (Lindbeck and Weibull, 1987, Dixit and Londregan, 1995 and Brollo and Nannicini, 2010). The presence of a DC government at the regional level has a negative effect on the change in the supply of universities' campuses, but not significant. Provincial governments attracted resources beyond the power of regional administration because the procedure established for the institution of a new university campus required universities' proposal to be approved by central government and not by regional ones. The magnitude of the coefficients and their level of significance show that, as previously argued, political motives were more relevant than economic rationales in determining funds' allocation, providing support for the experimental setting of the policy.

A few further points are worth mentioning. First, local labor market characteristics, such as a high unemployment rate, might have influenced the policy rule. As a compensatory intervention, the government might have wanted to bring more resources to more depressed economic areas. Since labor market conditions affect the opportunity cost of schooling, it could also have played a role in shaping the demand for higher education. Second, students' educational outcomes, according to their province of origin, might have affected the policy rule if the selection of provinces where locating a new campus was determined by poor educational indicators at the provincial level. Finally, provincial economic performance might have implied both higher fiscal resources to institute a new campus and higher demand for tertiary education. To account for these possibilities, the third column of Table 3 presents the specification that includes the level of provincial unemployment rate in 1990, the fraction of the provincial population with a degree in 1991 and the growth rate of the provincial employment rate between 1981 and 1991. The signs of the coefficient of interest are coherent with the economic interpretation given above. In particular, the employment growth rate has a positive but not significant effect on change in campuses local supply, whilst the unemployment rate and the fraction of graduates have a negative and not significant effect. The inclusion of these controls does not undermine the identification strategy. In fact, political variables have lower coefficients but still significant at 5 and 10 percent level. To check for the validity of the identification strategy, the outcomes of interest are estimated instrumenting the policy with the set of provincial controls just described.

The quasi experimental research design could be invalidated in presence of lack of compliance at the province level. This may occur if after assignment, some provinces assigned to treatment did not institute the university or all the faculties forecasted. The realization of the development plans that included changes in the provision of universities' supply occurred after 1990, when funds were assigned. A specific commission was deputed to report on the realization of the development plans to the Ministry of Education. Their documents show that the actual plan realized in 1998 coincides with the content of the development plans, ruling out lack of compliance at the province level.[26]

The theoretical specification shows that individuals are non-randomly sorted into drop out and that the distribution could be truncated from below given previous self selection into enrolment, thus calling for the Heckman selection model. To identify the parameters of interest without excessive reliance on functional forms, it is necessary to instrument selection in enrolment with variables that affect the choice of entering university without directly influencing the individual decision to drop out. Instruments usually used in the literature are: indicators of higher education local supply, capturing the fact that students grown up in an area without a college or their preferred degree face higher costs of education; local unemployment rate, measuring the opportunity cost of the educational investment; and the number of siblings, a proxy of the resources available per capita given household characteristics (Card, 1995, Cappellari, 2004, Cinzano and Cipollone, 2007 and Di Pietro and Cutillo, 2008). These sources of variation implicitly assume that the effects of the direct costs of the investment are anticipated and included in the decision process when the enrolment choice is made. Therefore, drop out decision is determined by individual shocks (as an update of their ability to pursue academic studies) that are unrelated to the local supply of higher education, the opportunity cost of education at the time the enrolled decision occurred and family size.

In this framework, the presence of a nearby university is the relevant explanatory variable in both the selection and the outcome equation and cannot indeed be used as a suitable instrument. However, the number of academic courses at the local level can be used as a proxy reflecting the variety of academic alternatives provided to potential students. The higher is the number of locally supplied courses the higher is the probability that an individual finds a course tailored to his abilities and interests. In turn, courses variability at the time the enrolment decision was made is not expected to affect drop out choices. Similarly, the provincial unemployment level at the time the enrolment decision occurred is expected to affect the opportunity cost of attending university but not the drop out decision later, conditional on the unemployment rate at the time the drop out decision occurs. Finally, number of siblings and mother housewife are a proxy for family permanent income and not transitory income shocks that could induce drop out. These four variables are used as instruments in the selection equation.

The last point concerns the set of time varying provincial controls to be included, the variation of the provincial unemployment rate and of the number of students who successfully terminated secondary school between 1995 and 1998. The first variable controls for possible changes in labor market opportunities that might be correlated with educational choices, whilst the second for variations of the potential demand for higher education. Finally, estimates rely on the identification assumption that there is no omitted time-varying and province specific effect that might be correlated with the program. This assumption will be violated if the allocation of other programs was correlated with the establishment of new campuses. Along with the new campuses' set up, the Legislator spurred the expansion of existing universities by allowing the institution of new Faculties and/or new degrees courses. Identification is achieved by controlling for this second source of expansion, probably a

[26]These documents can be downloaded at http://www.vsu.it/ website, under the "Publications and Documents" section.

substitute for the one under analysis.[27]

Allocation of new sites			
	New sites	New sites	New sites
Log of sec. school leavers, 1992	0,006	-0,031	0,013
	[0,061]	[0,043]	[0,048]
Overcrowded university in the region	0,001	0,029	-0,001
	[0,091]	[0,079]	[0,087]
Log of prof. for 100 students, 1990	-0,154	-0,116	-0,081
	[0,113]	[0,114]	[0,121]
DC at provincial government		0,722	0,544
		[0,331]**	[0,294]*
DC at provincial government*DC positions		-0,014	-0,011
		[0,006]**	[0,005]**
DC at regional government		-0,011	-0,003
		[0,099]	[0,091]
Provincial population with degree, 1991			-0,038
			[0,032]
Provincial unemployment rate, 1990			-0,002
			[0,003]
Growth rate provincial occupation, 1981-1991			0,855
			[0,699]
Observations	95	95	95
Pseudo R-squared	0,04	0,09	0,12

Note: Probit model. Marginal effects evaluated at 1 reported. Robust standard errors, clustered at the regional level in brackets.* significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Table 3: The allocation of sites

5 Results

5.1 College enrolment

The first set of results is presented in Table 4 that shows linear probability estimates of the effect of the higher education expansion on college enrolment. The dependent variable Y_{ijt} takes value of one if the individual is enrolled and zero otherwise. Following Duflo (2001) and Bratti et al. (2007), the new campus dummy is normalized to account for

[27] Other possible simultaneous policy interventions occurred at the end of the Nineties were the reform of the secondary school exit exam (Law n.425/1997) and the law that regulated admissions in faculties with numerus clausus (Law n. 264/1999). The first was implemented in 1999 for the first cohort of secondary school graduates, after the period during which the expansion of higher education under analysis took place. The second one, following the urging from the Constitutional Court, disciplined at the national level admission restrictions, previously regulated at the university level. Before the law was enacted, students who appealed against admission restriction because not admitted to degrees with numerus clausus, were reintegrated in their chosen degree. Even if some faculties introduced restrictions on admission between 1995 and 1998, the chance to appeal and being reintegrated exclude correlation with the policy under analysis.

heterogenous cohort size at provincial level, by dividing it for the number of individuals who get a secondary degree in that province in 1998 (in thousands). The baseline specification in column 1 includes controls for province fixed effects, cohort of graduates dummy and normalized program variable interacted with the treatment dummy.

The effect of the higher education expansion turns out to be positive, but not statistically significant as shown by the descriptive statistics in Table 2. The coefficient decreases slightly, but acquires significance after the inclusion of individual specific controls and time-varying provincial controls, suggesting that the effect of the policy is offset by changes over time of individuals and local characteristics. The estimated coefficient in the specification with the full set of controls indicates that the likelihood of entering university increases by 8 percent for each new campus per 1,000 secondary school graduates created at the provincial level. The effect of the policy is slightly lower than the effect of the 'Bologna process' estimated by Cappellari and Lucifora (2010), who found a 9 percent increase in enrolment due to the reform. Relative to average enrolment as displayed in Table 1, mean enrolment increases by 15 percent for each new university instituted every 1,000 secondary school graduates. To assess the validity of the identification strategy the treatment variable is instrumented with the set of provincial political variables described in Section 4.2. The coefficient of the policy corrected for endogeneity is slightly higher than the OLS estimates, indicating that the new campuses were instituted in provinces where enrolment would have been lower absent the policy. However, the estimated coefficient is not significant. Moreover, the overidentification test does not reject the hypothesis of orthogonal excluded instruments and the Hausman test does not reject the null hypothesis of exogeneity of the treatment variable, indicating that the coefficient in the OLS specification is not significantly different from the one obtained by instrumenting the policy. This test suggests that, as argued in Section 4.2, the allocation rule was almost random.

Having established that the reform increases significantly enrolment rates, it is important to assess whether this expansion attracts students hailing from less affluent backgrounds. The identification framework outlined above can be generalized to an interaction term analysis to assess the specific effect of higher education expansion by family background and individual ability. Ability is measured by the mark at the end of junior school, broadly defined in four classes: A, B, C, D.[28] Subsequent columns of the Table show the interactions between the reform and personal characteristics. The specification chosen is the third one, which includes the whole set of provincial time varying controls. Results show that the expansion mainly benefits middle ability individuals whose parents have secondary education: there is a positive and significant effect of the program on enrolment of students awarded with a C mark at the exit of lower secondary school; students whose fathers have secondary education increase their probability to enter higher education by on average 4 percent. These results show that the program, lowering the psychological cost of the investment, has improved educational opportunities.

[28]This variable is chosen as a proxy for individual ability instead of the mark at the end of upper secondary school because standards of the latter suffer high variability among different types of secondary school (a given mark in a vocational school does not convey the same information as the same mark in a high school), among schools of the same type in a given area and among different provinces.

	-1	-2	-3	-4	-5	-6
	LPM	LPM	LPM	IV	LPM	LPM
Treatment	0,122	0,095	0,083	0,112		
	[0,079]	[0,038]**	[0,037]**	[0,233]		
Junior school mark A* Treat					0,341	
					[0,307]	
Junior school mark B*Treat					-0,005	
					[0,022]	
Junior school mark C*Treat					0,051	
					[0,021]**	
Junior school mark D*Treat					-0,036	
					[0,023]	
Father college degree*Treat						-0,009
						[0,049]
Father secondary degree*Treat						0,038
						[0,017]*
Father lower degree*Treat						-0,003
						[0,015]
Controls	no	yes	yes	yes	yes	yes
Controls: Rj*Treatment	no	no	yes	yes	yes	yes
Hansen J statistic (overidentification test), chi(2)				7,84		
Hansen J statistic (overidentification test), p-value				0,25		
Durbin-Wu-Hausman (endogeneity test), chi(2)				0,44		
Durbin-Wu-Hausman test, p-value				0,51		
Observations	35661	34147	34147	34147	34147	34147
R-squared	0,02	0,37	0,34		0,35	0,34

Note: Linear Probability Model estimates (LPM). Robust standard errors in brackets; * significant at 10 percent; ** significant at 5 percent;*** significant at 1 percent. Standard errors clustered at province and cohort level. Observations based on population weights. Controls include: gender, parents education and occupation, siblings, past scores, type of sec school. Provincial controls include: variation of provincial unemployment between 1995-98, change in the number of sec. school graduates between 1995-98, variation in the number of degrees between 1995-98.

Table 4: Probability of college enrolment

5.2 College drop out

Results discussed in Section 5.1 indicate that part of the effect of the expansion works through a reduction of the impact of parental background on the choice of entering university. This result would imply an increase in intergenerational mobility only if this additional inflow of students is not more largely inclined to drop out university. Otherwise, changes at entry would not translate into equivalent changes at university exit, without reducing the role of family background on human capital investment.

The effect of the expansion on withdrawal can be directly assessed because in the survey respondents were asked whether or not they began and then interrupted academic studies. Since the question is answered three years after enrolment and since the majority of students generally quit university within the first three years, this variable is a good measure for drop out changes.

The theoretical specification suggests that learning over individual ability endogenously leads students to drop out if the signal acquired during university attendance reveals low talent. Also, the model shows that individuals are non-randomly sorted into drop out given previous self selection into enrolment. To identify the parameters of interest I use the four instruments described in Section 4.2: the number of available degree and the unemployment rate at the provincial level at the time when the enrolment decision is made, the number of siblings and a dummy for mother housewife.

As the institution of a new university is suggested to influence both the selection equation and the outcome, it is included as a regressor in the two stages of the model. The interpretation of the marginal effect for this variable must consequently be adjusted to correct for selectivity bias. Hoffmann and Kassouf (2005) derive this correction, which reads for equation 18:

$$\frac{\partial(Y_{ijt}^{2}|Y_{ijt}^{1}>0)}{\partial(P_j)} = \gamma^{1} - \beta_{\lambda}^{1}\left\{[\lambda_i(\alpha^{e^*})]^2 - \alpha^{e^*}\lambda_i(\alpha^{e^*})\right\}\left(-\frac{\phi}{\sigma_u}\right) \tag{19}$$

where ϕ is the effect of P_j in the selection equation and σ_u the standard deviation of the residual in the selection equation.[29]

Table 5 presents results from the Heckman two stages equation of a drop out indicator given self selection into higher education. Coefficients are reported according to the above correction showing γ and β_λ. In all specifications, supply expansion turns out to both negatively and significantly affect drop out decision. The average effect, statistically significant, is in order of -6 percent for each new campus per 1,000 secondary school graduates instituted and it is stable across all specifications. In all specification the composition term is positive and significant, indicating that the probability of abandoning academic studies increases as an effect of the change in the composition of students enrolled. However, the magnitude of this effect is very small (0,002-0,003 percent). The sum of the two coefficients shows that the prevailing effect of the higher education expansion is the cost reduction associated with university continuation, indicating that the composition effect is small with respect to the monetary cost reduction one. Relative to mean statistics displayed in Table 1, the policy implied a reduction in drop out rate of 37,5 percent relative to mean drop out. On the contrary, the 'Bologna process' increased drop out rate by 8 percent.

[29] Standard errors for the corrected marginal effects are computed using the Delta method.

Considering the selectivity issue, it emerges that all instrumental variables are significant in affecting the enrolment choices and that the null hypothesis of independent equations is always rejected. The last two columns report the estimates of the Heckman model corrected for potential endogeneity of the treatment variable, both at the outcome and at the selection equation. The coefficient γ is higher than in previous specification, but it is not statistically significant. As the conditional mixed process estimator implemented to estimate the system of equations does not allow to test endogeneity and overidentification hypothesis, I constructed the Hausman test statistics, that has a χ value of 0,079, whose p value is between $0,750-\ 0,900$. The test does not reject the null hypothesis of exogenous regressor.

The interaction term analysis (Table 6) shows that drop out reduction occurs especially among students marked C at junior school, who reduce by 6,6 percent their probability of quitting university. The interactions with parental education do not show a particular effect. The presented evidence proves that the additional intakes into university due to the expansion has not experienced higher drop out, being consistent with the idea that the policy has increased equality of opportunities.

	-1	-2	-3	-4	-5	-6	-7	-8
	Heckman	Selection	Heckman	Selection	Heckman	Selection	Heckman IV	Selection
Treatment	-0,054		-0,065		-0,062		-0,101	
	[0,028]*		[0,032]**		[0,030]**		[0,141]	
Beta	0,003		0,002		0,002		0,003	
	[0,000]***		[0,000]***		[0,000]***		[0,000]***	
Unemployment level		0,123		0,146		0,146		0,102
		[0,051]***		[0,054]***		[0,055]***		[0,070]
Number of degrees		0,005		0,005		0,005		0,002
		[0,003]*		[0,003]*		[0,003]*		[0,005]
Mother housewife		-0,448		-0,442		-0,442		-0,020
		[0,101]***		[0,103]***		[0,103]***		[0,010]*
Siblings		-0,086		-0,086		-0,096		- 0,031
		[0,015]***		[0,015]***		[0,015]***		[0,020]
Test rho=0, chi2(1)		632,9		9,5		9,7		
Test rho=0, p-value		0,000		0,000		0,000		
Controls	no		yes		yes		yes	
Controls: Rj*Treatment	no		no		yes		yes	
Observations	34167	34167	34167	34167	34167	34167	34167	34167

Note: Heckman Selection Model estimates. Robust standard errors in brackets; * significant at 10 percent; ** significant at 5 percent;*** significant at 1 percent. Standard errors clustered at province and cohort level. Observations based on population weights. Controls include: gender, parents education, past scores and type of sec school. Provincial controls include: variation of provincial unemployment between 1995-98, change in the number of secondary school graduates between 1995-98 and variation in the number of degrees between 1995-98.

Table 5: Probability of college drop out

	-1	-2
	Heckman	Heckman
Junior school mark A* Treat*(1+beta)	-0,011	
	[0,018]	
Junior school mark B* Treat*(1+beta)	0,015	
	[0,028]	
Junior school mark C* Treat*(1+beta)	-0,066	
	[0,022]**	
Junior school mark D* Treat*(1+beta)	-0,031	
	[0,038]	
Father college degree*Treat*(1+beta)		0,014
		[0,023]
Father secondary degree*Treat*(1+beta)		0,025
		[0,027]
Father lower degree*Treat*(1+beta)		-0,032
		[0,022]
Controls	yes	yes
Controls: Rj*Treatment	yes	yes
Observations	34167	34167

Note: Heckman Selection Model estimates. Robust standard errors in brackets; * significant at 10 percent; ** significant at 5 percent;*** significant at 1 percent. Standard errors are clustered at province and cohort level. Observations based on population weights. Specification 5 in Table 5.

Table 6: Probability of college drop out, interacted term analysis

5.3 Exams

An interesting effect of this higher education expansion concerns the impact on individual academic performance. A major failure of the Italian higher educational system is due to the extremely long period of time that many students take to graduate from university. Oddly, this prolonged permanence in university is not explained by a parallel activity in the labour market during the studies. Rather, the fraction of students employed in the age bracket 20-24 was, in 2001, roughly 3,3 percent in Italy, against an average 10,6 percent displayed by all the other OECD countries.[30]

The sequential model suggests that a reduction of the drop out rate implies lower academic performance. Indeed, changes in the composition of the stock of enrolled due to the higher intakes and the lower withdrawal should affect the overall composition of students' characteristics in provinces where the expansion occurred. Likely, since new enrolled are composed of individuals with middle ability, the students' body should feature a lower average ability after the policy implementation. This composition effect should negatively affect aggregate provincial performance. The data enable identification of the number of exams thanks to a direct survey question.

As for drop out, estimating number of exams requires to account for self selection in the group of students that continue university. However, as noticed in note 10, the choice of drop out and the amount of human capital investment are probably made simultaneously and not in a strict sequential order. In fact, the number of exams given is also observed in the data

[30] See: Education at a glance, 1999.

for a group of students who dropped out. To empirically account for this simultaneity, selection is applied to the enrolment choice using the same identification assumption described in section 4.2. Moreover, the theoretical model indicates that the effect of the policy on the human capital investment works throughout the non-linear composition term. However, in the empirical specification a linear term for the policy is added to capture possible complementary between the non-monetary (effort related) cost of education and the monetary one. Thus, the marginal effect of new universities' set up is estimated with the correction presented in equation (19).

The first set of results is presented in Table 7, which shows coefficient estimates from the Heckman procedure applied to the number of exams on a set of controls, which include the type of degree entered. The linear effect of the policy, almost stable across all specifications, indicates that the number of exams decreases by more than one exam because of the campuses' expansion, whilst the composition effect, although very small, is positive. In the attempt to understand why the expansion exerts a negative effect on individual performance, I add a control for the type of faculty instituted. To this, I define a dummy equal to one when more than 50 percent of faculties within the new instituted universities were scientific.[31] The idea is that the set up of a new campus specialized in tougher scientific subjects might negatively affect students' performance. By adding this control (column 7), the negative effect of the policy vanishes and is captured by the scientific faculty dummy. This finding suggests that performance lowers in provinces that institute scientific courses, which are more difficult to undertake. In particular, students enrolled in scientific subjects passed 2 exams less as an effect of the policy, 20 percent less than the average value displayed in Table 1. One possible reason why the sign of the composition effect is not coherent with the discussion done in the theoretical section might rely on the fact that new campuses could have more incentives to lower standards and facilitate academic students' progress in order to attract local demand (see Bargues et al., 2006). Considering the selectivity issue, it emerges that the hypothesis of independent equations is not rejected when individual and provincial controls are included. The last two columns report the estimates of the non-recursive system of maximum likelihood. Coefficients are not substantially different from those reported in the previous two columns; as for drop out, exogenity of the coefficient of interest is tested by constructing the test statistics, that has $\chi = 0,627$, with p value in between $0,250 - 0,500$. Also in this case, the null hypothesis of exogeneity cannot be rejected.

Looking at the interacted analysis (Table 8), it emerges a significant reduction in exams for students marked A at junior school (-0,7) and C (-2,2). Middle ability students reduce by more than 2 the number of exams taken. Children of parents with tertiary education pass 1,7 fewer exams. This evidence seems to hold up the idea that the composition effect plays a role. Indeed, individuals that slow their progress down are those who in the absence of the policy would not have entered university or would have dropped out.

Overall, it seems that the policy has gone in the direction of retaining students in the schooling system, but slowed their performance down, especially with regards to the institution of new scientific courses, thereby prolonging time passed in education. Another possible reason why a reduction of the educational progress is observed could rely on a more intensive

[31] The Italian Ministry of Education classifies faculties according to the following field area: medical, scientific, humanistic and social. Scientific faculties include Architecture, Engineering and Mathematics.

activity in the labor market. In fact, shorter travelling distances to university could leave more time to be allocated on working activities rather than on studies. However, by running a linear probability model on the likelihood of being a working student, it emerges that new campuses have no effects at all on the propensity to carry on academic activities along with working ones.

Finally, the fact that performance does not increase as an effect of the policy provides some evidence against the signaling model and in favor of the human capital theory. However, a better assessment of which theory applies would require analyzing also the effect of the policy on graduation probability and labor market outcomes of secondary school graduates who do not enroll in higher education. This assessment is left to future research.

	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
	Heckman	Selection	Heckman	Selection	Heckman	Selection	Heckman IV	Selection	Heckman	Selection
Treatment	-1,542		-1,835		-1,699		0,274		-0,126	
	[0,908]*		[0,764]**		[0,820]**		[0,452]		[0,678]	
Beta	0,020		0,026		0,026		0,026		0,027	
	[0,000]***		[0,001]***		[0,001]***		[0,001]***		[0,001]***	
Scientific faculty							-1,924		-2,312	
							[0,396]***		[0,486]***	
Unemployment level		0,099		0,120		0,120		0,120		0,155
		[0,038]***		[0,038]***		[0,038]***		[0,038]***		[0,034]***
Number of degrees		0,006		0,006		0,006		0,006		0,005
		[0,003]*		[0,004]*		[0,004]*		[0,004]*		[0,003]
Mother housewife		-0,464		-0,475		-0,475		-0,476		-0,441
		[0,114]***		[0,119]***		[0,119]***		[0,119]***		[0,114]***
Siblings		-0,092		-0,096		-0,096		-0,096		-0,086
		[0,017]***		[0,018]***		[0,018]***		[0,018]***		[0,015]***
Test rho=0, chi2(1)		110,63		2,89		3,00		3,02		
Test rho=0, p-value		0,000		0,086		0,083		0,074		
Controls	no		yes		yes		yes		yes	
Controls: Rj*Treatment	no		no		yes		yes		yes	
Observations	32385	31770	31770	31770	31770	31770	31770	31770	31770	31770

Note: Heckman Selection Model estimates. Robust standard errors in brackets; * significant at 10 percent; ** significant at 5 percent;***significant at 1 percent. Standard errors are clustered at province and cohort level. Observations are based on population weights. Controls include: gender, age, parents education, past scores, type of sec school, employment status and degrees dummies. Provincial controls include: variation of provincial unemployment between 1995-98, change in the number of secondary school graduates between 1995 -98, variation in the number of degrees between 1995-98

Table 7: Number of passed exams

	-1	-2
	Heckman	Heckman
Junior school mark A* Treat*(1+beta)	-0,734	
	[0,262]**	
Junior school mark B* Treat*(1+beta)	-0,193	
	[0,405]	
Junior school mark C* Treat*(1+beta)	-2,240	
	[1,095]*	
Junior school mark D* Treat*(1+beta)	-0,267	
	[0,463]	
Father college degree*Treat*(1+beta)		0,426
		[0,419]
Father secondary degree*Treat*(1+beta)		-1,784
		[0,455]***
Father lower degree*Treat*(1+beta)		-0,357
		[0,360]
Controls	yes	yes
Controls: Rj*Treatment	yes	yes
Observations	31770	31770

Note: Robust standard errors in brackets; * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent. Standard errors are clustered at province and cohort level. Observations are based on population weights. Specification 5 in Table 7.

Table 8: Number of exams, interacted term analysis

6 Robustness checks

In this section I perform some checks to assess the robustness of the results to other specifications. The first is the use of a different definition of treatment, which is extended to provinces located to a less than one hour distance from the treated ones.[32]

Table 9 presents results for the outcomes of interest, according to the specification that includes both individual controls and provincial time varying variables. Enrolment is estimated with a linear probability model, whilst drop out and exams are estimated with the Heckman selection model. For all the outcomes of interest, coefficients are qualitatively similar to those estimated with the smallest set of treated provinces. The impact on enrolment, drop out and number of exams is lower than the one estimated in the previous section. The lower significance of the coefficients of interest is due to the inclusion of individuals potentially exposed to the treatment in the treatment group.

Another useful test regards the sensitivity of results to the control and treatment group composition. Since the policy was implemented in regions located in the North and South of Italy, it could be useful to restrict the analysis to the group of regions sited in the same macro-area, which might be more likely to satisfy the parallel trend hypothesis. To this end,

[32] Distances from the treated regions were computed using Google Map. One hour as maximum limit was chosen because students from nearby provinces might realistically reach the new site one hour away. The new treatment dummy includes the following provinces among the treated ones: Novara, Asti, Alessandria, Como, Bergamo, Pavia, Trento, Parma, Modena, Bologna, Teramo, Campobasso, Avellino, Brindisi and Catania.

	-1	-2	-3
	LPM	Heckman	Heckman
	Enrolment	Drop out	Exams
Treatment	0,073	-0,043	-0,992
	[0,039]*	[0,018]**	[0,573]
Beta		0,002	0,026
		[0,000]***	[0,011]***
Scientific faculty			-1,598
			[0,397]***
Controls	yes	yes	yes
Controls: Rj*Treatment	yes	yes	yes
Observations	34167	34167	34167
R-squared	0,42		

Note: Linear Probability Model Estimates (LPM) and Heckman Model; Robust standard errors in brackets; * significant at 10 percent; ** significant at 5 percent;*** significant at 1 percent. Standard errors are clustered at provincial and cohort level. Observations are based on population weights. Each outcome is estimated including the whole set of individual and provincial controls.

Table 9: Outputs estimated including provinces located less than one hour away from treated provinces

two groups of regions are considered, Northern and Southern ones.[33] Four provinces are treated among the Northern regions, five among the Southern ones.

Table 10 shows results from estimating outputs of interest separately for the two sub samples of the population with the full set of controls, individual and time varying provincial specific. Enrolment rises in both macro area. The probability of being retained in university is higher in both macroarea, but significantly in the North. The composition term displays coefficient similar between the two groups of regions and with respect to the specification including the whole sample. The difference between the two areas concerns the effect of the policy on the number of exams, which does not change substantially in Northern provinces, whilst it significantly does in Southern provinces.

The reason why students with the same school curriculum make different educational choices between the two macro areas relies on the fact that the faculties instituted are different. In Southern regions the new campuses opened only scientific faculties (the only exception was the faculty of Psychology instituted in Caserta), whilst in the North, besides scientific faculties, new campuses opened also social and humanistic ones. As scientific courses are relatively tougher than others are, enrolling in such degrees might imply a lower propensity to being retained in university and a slower academic progress.[34]

[33] Northern regions include Piemonte, Val D'Aosta, Lombardia, Trentino Alto Adige, Veneto, Friuli Venezia Giulia, Liguria. Southern ones take in Molise, Campania, Basilicata, Puglia, Calabria and Sicilia.

[34] Mobility might have had an impact, but since all outcomes are evaluated considering the province of residence at the end of lower secondary school, the effects of endogenous migration do not translate into performance.

North

	-1	-2	-3
	LPM	Heckman	Heckman
	Enrolment	Drop out	Exams
Treatment	0,052	-0,113	-0,291
	[0,025]*	[0,044]*	[0,809]
beta		0,002	0,026
		[0,000]***	[0,011]***
Scientific faculty			-0,522
			[0,948]
Controls	yes	yes	yes
Controls: Rj*Treatment	yes	yes	yes
Observations	11322	11322	11322
R-squared	0,42		

South

	-1	-2	-3
	Enrolment	Drop out	Exams
Treatment	0,078	-0,028	-0,463
	[0,037]*	[0,067]	[0,549]
beta		0,002	0,028
		[0,000]***	[0,009]***
Scientific faculty			-2,384
			[0,348]***
Controls	yes	yes	yes
Controls: Rj*Treat.	yes	yes	yes
Observations	13975	13975	13975
R-squared	0,42		

Note: Linear Probability Model Estimates (LPM) and Heckman Model; Robust standard errors in brackets; * significant at 10 percent; ** significant at 5 percent;*** significant at 1 percent. Standard errors are clustered at province and cohort level. Observations are based on population weights. Each outcome is estimated including the whole set of individual and provincial controls.

Table 10: Outputs estimated for different subgroups of the population

7 Conclusion

In this paper I used pooled data on two cohorts of secondary school graduates to assess the impact of the campus expansion on a series of indicators related to human capital investments, exploiting the quasi-natural experiment nature of this policy.

I find that new campuses increase university enrolment and that the effect is largely concentrated among middle ability individuals with less favorable family background. This new flow of intakes significantly increases the probability of being retained in the university system. This evidence can be interpreted as an effect of lower psychological costs on the decision of investing in higher education.

However, local universities do not boost successful academic performance: rather, a decline in the aggregate number of exams is observed. A partial explanation relies on the fact that the change in the composition of the students' body induced by the policy due to the new flow of intakes into university and the reduced outflow of drop out lowers the average ability of the pool of students who enter university. Therefore, the performance of marginal students declines. However, the estimated effect of the change in the composition of students enrolled is shown to be very small. The variation in the performance is rather explained by the type of degree instituted, whether scientific or not. Indeed, the number of exams passed declines substantially in Southern provinces that mostly set up new scientific courses, without displaying substantial changes in provinces where other types of faculties are instituted.

The paper shows that instituting scientific faculties in less developed area does not always mitigate disparities in educational attainment. There are a few reasons why this type of policy partially failed. First, math competencies are already unevenly distributed nationwide at the lower secondary school: students resident in the South of the country display significantly lower levels of achievement (see Bratti et al., 2007). Besides the fact that such differences should be filled in previous stages of the educational process, this evidence suggests that investing in scientific higher education does not represent an efficient way to tackle disparities. Furthermore, new scientific faculties located in depressed areas would not lead development absent a complementary policy direct to create job opportunities for the scientific skilled labor force.

This university policy, which encouraged local institutions, on one side has increased equality of opportunities nationwide by opening access to more groups in the society and reducing the impact of family background on the decision to enter higher education. But on the other hand, it has gone in the direction of strengthening regional disparities, given wide negative effects on individual performance in less developed regions.

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