



UNIVERSITÀ DEGLI STUDI DI ANCONA

---

DIPARTIMENTO DI ECONOMIA

MASS TERTIARY EDUCATION, HIGHER  
EDUCATION STANDARD AND UNIVERSITY  
REFORM: THEORY AND EMPIRICAL EVIDENCE  
FROM ITALY

Massimiliano Bratti, Chiara Broccolini  
and Stefano Staffolani

*Mimeo*

June 2007

## Abstract

After the «3+2» University reform in Italy there has been a fast increase in the number of students. A common wisdom is that this result was partly achieved by reducing the standard of Higher Education (HE). In this paper we first build a theoretical model in which individuals decide whether to enrol in HE along with their optimal course quality, and whether to drop-out. Then, we use the model to analyse the effect of a reduction in the standards of HE courses available in the educational system on overall enrollment and drop-out. We show that a reduction in HE standard helps achieving a mass tertiary education by increasing both the number of students and that of university graduates but it does not necessarily increase the overall efficiency of the HE system measured in terms of drop-out or graduation rates.

**JEL Class.:** I21  
**Keywords:** Ability, Drop-out, Enrolment, Italy, Reform, Standard, University

**Address:** Massimiliano Bratti: DEAS, Università degli Studi di Milano, via Conservatorio 7, I-20122, Milano, Italy, and CHILD (Turin), IZA (Bonn), wTw (Milan). Email: [massimiliano.bratti@unimi.it](mailto:massimiliano.bratti@unimi.it)  
Chiara Broccolini: Università Politecnica delle Marche, Piazzale Martelli 8, I-60121 Ancona, Italy. Email: [c.broccolini@univpm.it](mailto:c.broccolini@univpm.it) (corresponding Author)  
Stefano Staffolani: Università Politecnica delle Marche, Piazzale Martelli 8, I-60121 Ancona, Italy. Email: [s.staffolani@univpm.it](mailto:s.staffolani@univpm.it)



# Mass tertiary education, higher education standard and university reform: Theory and empirical evidence from Italy\*

*Massimiliano Bratti, Chiara Broccolini  
and Stefano Staffolani*

## 1 Introduction

The Italian system of Higher Education (HE, hereafter) has been recently targeted by an extensive reform that, among other things, introduced in 2001 a unitary two-tier system replacing the old one-tier architecture where most degrees duration was four years. In the new system, often called «3+2», secondary school leavers can enrol in a First level degree, whose duration is three years,<sup>1</sup> and after completing it they can decide to enrol in a Second level degree (i.e. graduate studies), whose duration is two years.

The primary objectives of the reform were to increase the number of graduates, since the Italian HE system was characterised by very high drop-out rates, and to reduce the age at graduation, given the excessive actual duration of university studies well above the legal one (the phenomenon of the so called *fuori corso* students). Indeed, most Italian students used to graduate in their late twenties before the reform.

The «3+2» reform has been accompanied by a complete rethought of university curricula. The reduction of one year of length determined the need to reduce degree contents in First level degrees and to move some undergraduate courses (often the most complex) to Second level degrees.

---

*\*This paper represents work in progress, comments are welcome. We acknowledge funding from MIUR, project PRIN 2003 "Performance accademica e tassi di abbandono: un'analisi per alcune università italiane e confronti col Regno Unito". The authors wish to thank participants at the final workshop (Ancona, 2006) of the PRIN project, Fabio Fiorillo and an anonymous referee for useful suggestions. The usual disclaimers apply.*

<sup>1</sup>Except for degrees in a small number of fields.

Moreover, in the last few years there has been a proliferation of new university degrees, which have been created by HE institutions in the attempt to attract new students.

A first effect of the reform has been an increase in the number of students. Bondonio (2006), for instance, uses data from the Italian Ministry of University and Research (MIUR) and finds a strong effect of the reform on the number of enrolled students, which increased in the range of 8.3-9.6 percent points in the first year and in the range of 12.2-14.7 percent points in the second year of application of the reform. Moreover, Bondonio also finds a statistically significant effect of the increase in the supply of university degrees on enrolment rates: for each new degree set up by an institution, the enrolment increased by between 2.6 and 2.8 percent points.

The increase in enrolment determined by the reform per se (net of the increase in the supply of degrees) can be interpreted in several ways. HE institutions may have increased their marketing efforts (e.g., orientation activities) after the reform and raised in this way the number of students. Another possibility is that the reform has increased the enrolment of those students who were credit constrained before the reform, i.e. those coming from low social classes, by shortening degree length and the direct and opportunity costs of studying. Last but not least, the reform might have lowered the academic requirements of students, so as now also less academically oriented students are likely to succeed in HE studies. The lower requirements can be the result of a reduction in the standard of HE, which in our theoretical analysis is a general feature of HE courses that raises the cost of education.

Some evidence consistent with the last explanation is provided in Bratti, Broccolini and Staffolani (2006), who focus on first year students in the Economic Faculty of Marche Polytechnic University, and show a huge reduction in course workloads required to pass exams and a sizeable increase in student performance after the «3+2» reform. These effects are very unlikely to be totally explained by gains in universities' efficiency after the reform, especially because the reform did not change the overall organization of the didactic activity apart from reducing course contents. Evidence that is consistent with a reduction in HE standards after the reform is also provided, in our opinion, by Di Pietro and Cutillo (2006). The authors make a decomposition of the impact of the reform on drop-out rates between changes of the characteristics of the student intake and change in what they call 'student behaviour'. They find that while the change in students' characteristics after the reform (mainly a reduction in academic ability) would have increased drop-out rates, the change in 'student behaviour' (i.e. in the coefficients estimated from the model)

has more than compensated the former and determined a net decrease in drop-out rates. While the authors maintain an 'optimistic' interpretation for this result, such as an increase of the matching quality between HE courses and students (through pre-university guidance or the increase in course supply) or a relaxation of liquidity constraints, the same effects might also have been produced by a reduction in HE standard.<sup>2</sup>

Indeed, the wisdom that the reform was accompanied by a reduction in the standard of HE is common in the academic profession (see Ranieri, 2006).

The concern that a stronger competition among HE institutions may have produced incentives towards the reduction of HE standards, in particular grading standards, is also expressed in Bagüés, Sylos-Labini and Zinovyeva (2006) who use data on Italian graduates, although before the reform,<sup>3</sup> and find that grade standards decreased (i.e. grades rose) in those Departments where enrolment fell. This may be a perverse incentive created by the Italian HE funding system, where public funds are partly allocated to HE institutions on the basis of the number of students and universities were facing declining student numbers in the early 90s (see Perotti, 2002, and Bratti, Broccolini and Staffolani, 2006).

In the light of this empirical evidence, in the current paper we build a theoretical model in which forward-looking secondary school leavers choose whether to enrol in a HE course and the 'quality' of the enrolled course. Course quality raises both the costs and the returns to HE. The standards of university courses (or HE) is centrally set by the government and educational costs are increasing in standards. This model enables us to examine the effects in terms of enrollment, drop-out and graduation of a change in overall HE standard. Our analysis shows that a reduction in HE standard, although raises enrollment rates, may have perverse effects on drop-out rates, reducing rather than increasing universities' efficiency, defined as the fraction of students who complete HE courses.

Therefore, mass tertiary education, i.e. an increase in the number of graduates (and the fraction of the population with a university degree), can be achieved by a reduction in university standards. However, this reduction does not necessarily raise the efficiency of the HE system: drop-out rates might indeed increase. The predictions of the theoretical model are consistent with the empirical evidence observed in Italy after the re-

---

<sup>2</sup>Unlike Bondonio (2006), Di Pietro and Cuttillo are not able to disentangle the separate effect of the increase in the supply of degrees from the other characteristics of the reform (i.e., a reduction in the length of studies).

<sup>3</sup>Data on graduates after the 2001 reform have not been released by the Italian National Statistical Institute (ISTAT) yet.

form, that is an increase in university enrolment that was not coupled with a substantial reduction in drop-out rates (see Di Pietro and Cutillo, 2006).

The structure of the paper is as follows. Section 2 describes the main features of a theoretical model of university enrolment and choice of course quality, which allows us to analyse the effects of an overall reduction in the standard of HE determined by the central government. Section 3 analyses an individual's enrollment and drop-out decisions while section 4 examines the changes in overall enrollment and drop-out determined by a change in HE standard that may be induced by a HE reform. Section 5 describes the data used in the empirical analysis of university enrollment before and after the «3+2» reform and section 6 its main findings. Finally, section 7 summarises the main findings.

## 2 The model

In this section we introduce a simple theoretical model to analyse an individual's choice (under uncertainty) of enrolling in HE, after completing secondary schooling.

The assumptions of the model are the following:

- in the HE system there is a continuum of university courses with different quality ( $\alpha$ ).<sup>4</sup> Therefore each course is uniquely identified by its level of quality;
- course quality ( $\alpha$ ) is rewarded in the labour market through wage premia;
- individuals are differentiated according to several characteristics (family background, type of secondary school, age, talent and so on), although we will consider only *ability* hereafter; the probability density function of ability ( $\theta$ ) in the population of secondary school graduates is  $f(\theta)$  with support  $[0, +\infty)$ .  $\theta$  is known to an individual and can be interpreted as an individual's assessment of her ability, which she can infer, for instance, from secondary school performance;
- ability does not affect wages, which are determined only by the educational level. Hereafter, graduates will be defined as "skilled" workers and  $w^U$ ,  $w^D$ ,  $w^S(\alpha)$  will represent the wages of unskilled

---

<sup>4</sup>This can also be interpreted either as the quality of different faculties or of different HE institutions.

individuals, individuals who drops out from HE courses and graduates, respectively. In our model only the wage of graduates is an increasing function of  $\alpha$ , that is the HE course quality;<sup>5</sup>

- the HE courses duration is two periods;
- if an individual decides not to enrol in HE and assuming that utility is temporally separable and linear in income (i.e. individuals are risk neutral), her utility is given by the discounted flow of unskilled wages ( $w^U$ ) over the life cycle:

$$V^U = \frac{w^U}{r} \quad (1)$$

where  $r$  is the discount rate;

- if an individual decides to enrol, the period cost of education, paid at the end of each of the two periods, is given by  $c(\theta_i, \alpha, \gamma, x)$ , where  $i$  stands for the individual and where:
  - $\gamma$  is an idiosyncratic stochastic shock, with known density function  $g(\gamma)$  and distribution function  $G(\gamma)$ , whose realization will be known to each individual at the end of the first period of enrolment. This shock affects the cost of education. Several interpretations are possible,  $\gamma$  may for instance represent the “toughness” of teachers or an imperfect self-assessment of one’s own ability;
  - $x$  is the standard required to all the educational institutions by the central government (i.e. the minimum number of exams to be passed, the minimum number of credits). We assume that  $x$  does not have a direct effect on wages (but only an indirect effect through the optimal choice of course quality  $\alpha$ ).

We assume that  $\frac{dc}{d\theta} < 0$ ,  $\frac{dc}{d\alpha} > 0$ ,  $\frac{dc}{d\gamma} > 0$  and  $\frac{dc}{dx} > 0$ . Thus, educational costs are decreasing in ability (e.g. abler individuals benefit from

---

<sup>5</sup> We are implicitly assuming that differences in earnings of unskilled, drop-out and graduate students can be explained both by the human capital theory (in that case, we should assume that  $w^D > w^U$  because of the accumulation of human capital in the first period of studies) and by the signalling theory (in that case, we should assume that  $w^D < w^U$  because of the bad signal arising from dropping out, which could be however excluded if employers do not observe drop-out and drop-out students can cheat on them). Furthermore, both theories explain that the highest wage is the one of graduates enrolled in the course with the highest quality.



fee waivers), are increasing in both course quality (e.g. higher fees) and the standard required by the central government.<sup>6</sup> Costs are also increasing in the level of the shock  $\gamma$ .

Given the above assumptions, the utility of individual  $i$  at time  $t = 0$  from enrolling in HE is given by:

$$U_{0,i}^E(\alpha) = \int_{-\infty}^{\bar{\gamma}(\theta_i, \alpha, x)} \left[ \frac{w^S(\alpha)}{r(1+r)^2} - \frac{c(\theta_i, \alpha, \gamma, x)}{(1+r)} - \frac{c(\theta_i, \alpha, \gamma, x)}{(1+r)^2} \right] g(\gamma) d\gamma + \int_{\bar{\gamma}(\theta_i, \alpha, x)}^{\infty} \left[ \frac{w^D}{r(1+r)} - \frac{c(\theta_i, \alpha, \gamma, x)}{(1+r)} \right] g(\gamma) d\gamma \quad (2)$$

where, for the sake of simplicity, we have assumed that capital markets are perfect and individuals can borrow against their future incomes. In this case the only thing that matters to individuals is the discounted value of lifetime wealth. The first integral represents the expected utility of obtaining the HE degree and the second one the expected utility of dropping out. Both depend on  $\bar{\gamma}(\theta_i, \alpha, x)$  that is the endogenous minimum level of the shock that pushes the individual  $i$ , who has chosen course quality  $\alpha$ , to drop out (see section 3). Indeed, since the net benefit of enrolling in education is decreasing in  $\gamma$  whereas the benefit of not enrolling is independent of it (see equation 1), at time  $t = 1$  for some realizations of the shock  $\gamma$  the individual will decide to drop out from HE. Utility depends on the HE course quality  $\alpha$ , that is the choice variable for the individual.

Our model describes the demand side of HE while, as to the supply side, we just assume that universities will offer a continuum of courses with different qualities which meet the standard centrally set by the government and for which there is a positive demand. Also firms' behaviour is not modelled, we just assume that firms pay higher wages to graduates for whatever reason (human capital or signalling) and that wage premia are an increasing function of course quality. We do not model here possible dynamic effects such as those produced on wages by the evolution of the demand and supply of graduates in the labour market. Indeed, the main aim of the model is to analyse the short-term effects of a university reform that reduces the standard required to HE courses and, in such time span, we think that both the evolution of supply and that of the demand of graduates in the labour market should play only a minor role.<sup>7</sup>

<sup>6</sup>For instance, a higher number of exams may determine higher costs both in terms of books and costs borne to attend lectures for students.

<sup>7</sup>Indeed, supply-side effects will be relevant only when more and more cohorts of new

In what follows, we assume that the cost of education  $c(\theta_i, \alpha, \gamma, x)$  can be written as  $c(\theta_i, \alpha, \gamma, x) = C(\theta_i, \alpha, x)G(\gamma)$  so that the shock enters multiplicatively in the cost function throughout its probability distribution function. Note that the above assumptions imply that the expected cost of education is bounded both upward and downward, and that, for  $-\infty \leq \gamma \leq +\infty$ , the cost is always between 0 and  $C(\theta_i, \alpha, x)$ .<sup>8</sup>

Equation 2, after some manipulations (see Appendix), can be written as:

$$U_{0,i}^E(\alpha) = \frac{1}{1+r} \left[ \frac{w^D}{r} - \frac{C(\theta_i, \alpha, x)}{2} + \frac{W(\alpha)G(\bar{\gamma}(\theta_i, \alpha, x))}{1+r} \right] + \frac{C(\theta_i, \alpha, x)}{(1+r)^2} \frac{[G(\bar{\gamma}(\theta_i, \alpha, x))]^2}{2} \quad (3)$$

where:

$$W(\alpha) = \frac{w^S(\alpha) - w^D(1+r)}{r} \quad (4)$$

is the lifetime expected wage premium of continuing studies in course  $\alpha$  after the first period.

Individuals enrol by comparing the utilities of equation 3 and equation 1, so that the condition to enrol in HE is:

$$V_{0,i}^E(\alpha_i^*) > V^U$$

where<sup>9</sup>, as we will see later,  $\alpha_i^*$  represents the optimal HE course quality for individual  $i$ .

### 3 An individual's enrollment decision

In this section we determine :

- the level of the shock  $\bar{\gamma}(\theta_i, \alpha, x)$  that induces a student to drop-out;
- her optimal course quality ( $\alpha_i^*$ );
- her indirect utility ( $V_{0,i}^E$ );
- her decision whether to enroll or not by comparing  $V_{0,i}^E$  with  $V^U$ .

---

graduates enter the labour market, while demand-side effects are generally of a long-term nature (e.g., skill biased technological change).

<sup>8</sup>This specification of the cost function, as we will see later, greatly simplifies the analytical solutions of the model.

<sup>9</sup>The letter  $V$  indicates the indirect utility derived from the maximisation of the utility function  $U$ .

The first point can be addressed by considering that at time  $t = 1$ , individuals will continue in higher education if  $U_{1,i}^E \geq V_1^U$ , that is equivalent to saying that, once the realisation of the shock is known ( $\gamma_R$ ), the individual will continue HE studies if the lifetime expected wage premium of continuing in course  $\alpha$  after the first period (see equation 4) is higher than the cost of one further year of education:

$$W(\alpha) \geq C(\theta_i, \alpha, x)G(\gamma_R). \quad (5)$$

Solving equation 5 with the equal sign, we obtain the maximum level of the shock inducing the individual  $i$  to continue studies in the HE course  $\alpha$ , that is  $\bar{\gamma}(\theta_i, \alpha, x)$  in equations 2 and 3.

From equation 5, we can easily obtain:

$$G(\bar{\gamma}(\theta_i, \alpha, x)) = \frac{W(\alpha)}{C(\alpha, \theta, x)}. \quad (6)$$

Substituting  $G(\bar{\gamma}(\theta_i, \alpha, x))$  in equation 3, we obtain the expected utility of enrolling:

$$U_{0,i}^E = \frac{w^D}{r(1+r)} + \frac{1}{2C(\alpha, \theta_i, x)} \left( \frac{W(\alpha)}{1+r} \right)^2 - \frac{C(\alpha, \theta_i, x)}{2(1+r)} \quad (7)$$

that, according to the specific functional forms of  $W(\alpha)$  and  $C(\alpha, \theta_i, x)$ , can have a maximum in  $\alpha$ , which is the optimal HE course quality for individual  $i$ .<sup>10</sup>

Thereafter, we use the following cost function:

$$C(\theta_i, \alpha, x) = \frac{\alpha + x}{\theta_i} \quad (8)$$

which respects the above assumptions, and we assume that the skilled wage is given by:

$$w^S(\alpha) = w^D(1+r) + \mu\alpha^{\frac{1}{2}}$$

with  $\mu > 0$ , that is graduates receive a wage premium, compared to individuals who drop out, which is increasing and concave in course quality

---

<sup>10</sup> Given the above utility function, a positive drop out rate exists only if the wage of individuals who dropped out is higher than the one of individuals that did not enroll multiplied by  $(1+r)$  so that human capital theory must hold (see note 5). In fact, to have  $U_{0,i}^E > \frac{w^u}{r}$ , after having substituted  $W(\alpha) = C(\theta_i, \alpha, x)G(\bar{\gamma}(\theta_i, \alpha, x))$  we obtain  $[G(\bar{\gamma}(\theta_i, \alpha, x))]^2 > \left[ 1 - 2\frac{w^D - w^U(1+r)}{rC(\theta_i, \alpha)} \right] (1+r)$ . But since the completion probability must not be greater than one, i.e.  $G(\bar{\gamma}(\theta_i, \alpha, x)) \leq 1$ , a necessary condition is  $w^D > w^U(1+r)$ .

$\alpha$ .<sup>11</sup> Therefore, given equation 4 we have:

$$W(\alpha) = \frac{\mu\alpha^{\frac{1}{2}}}{r}. \quad (9)$$

These assumptions make the expected utility of equation 7 concave in  $\alpha$ , so that we can calculate the optimal course quality for each individual substituting equation 8 and 9 into equation 7. The analytical form of the optimal HE course quality for individual  $i$  is the following:

$$\alpha_i^*(x) = \left(\frac{\mu}{r}\right) \left(\frac{x}{1+r}\right)^{\frac{1}{2}} \theta_i - x \quad (10)$$

so that more talented individuals (higher  $\theta_i$ ) will sort themselves into the courses with higher quality.

**Remark 1.** *If the “standard” required to all HE institutions grows ( $dx > 0$ ), more talented individuals will choose higher course quality with respect to the past, less talented individuals will choose lower course quality.*

*Proof.* The first derivative of  $\alpha_i^*(x)$  with respect to  $x$  is positive if  $\theta_i > 2\frac{x}{\mu}[(1+r)x]^{\frac{1}{2}}$ . Therefore, the optimal course quality increases with  $x$  for individuals endowed with high ability whereas it decreases for less talented individuals.  $\square$

Substituting  $\alpha_i^*$  in equation 8 and the result of this substitution in equation 7, we obtain the maximum expected utility of enrolling for individual  $i$ :

$$V_{0i}^E = \frac{1}{r(1+r)} \left[ w^D + \frac{\mu^2\theta_i}{2r(1+r)} - \mu \left(\frac{x}{1+r}\right)^{\frac{1}{2}} \right] \quad (11)$$

which is increasing in  $\theta_i$  and decreasing in  $x$ .

In order to decide whether to enrol or not, individuals will compare the indirect utility of enrolling in their optimal course quality (equation 11) with that of not enrolling (equation 1). Given that the former is increasing in  $\theta_i$  whereas the latter is not dependent on it, there must exist some  $\theta_i$  that separates the population of secondary school leavers among those who enroll and those who do not enroll. Solving with the equal sign equations 11 and 1 we obtain this threshold level for  $\theta$ , which we will define  $\theta_m$ :

$$\theta_m(x) = 2\frac{r(1+r)}{\mu} \left[ \left(\frac{x}{1+r}\right)^{\frac{1}{2}} - Z\frac{r}{\mu} \right] \quad (12)$$

---

<sup>11</sup>This is an *ad hoc* specification which allows us to find analytical solutions.

where  $Z = \frac{w^D - w^U(1+r)}{r}$  is the expected premium of enrolling and dropping out and must be positive (see footnote 10).  $\theta_m(x)$  identifies the ability of the least talented individual who decides to enroll; we define her as the “marginal” student.

Using this last result we can also define the minimum quality of the courses offered by academic institutions (and demanded by students). In fact, plugging  $\theta_m(x)$  into equation 10, we obtain the optimal course quality for the marginal student which also represents the “worst” course available in the HE system:

$$\alpha_m^*(x) = x - 2Z \frac{r}{\mu} [x(1+r)]^{\frac{1}{2}}. \quad (13)$$

**Remark 2.** *An increase in the HE standard set by the central government, raising the ability required to the “marginal” student, also raises the “worst” course quality available in the HE system.*

*Proof.* Differentiating equation 13 with respect to  $x$  and rearranging terms we obtain:

$$\frac{d\alpha_m^*(x)}{dx} = \frac{1}{x} \left[ x - Z \frac{r}{\mu} [x(1+r)]^{\frac{1}{2}} \right] = \frac{1}{2x} [x + \alpha_m^*(x)] > 0.$$

□

Only students with ability higher than  $\theta_m(x)$  will enroll in HE. Once each student has chosen her optimal HE course, the probability of completing studies can be easily calculated using equations 6, 8 and 10:

$$G(\bar{\gamma}(\theta_i, \alpha_i^*(x), x)) \equiv G(\theta_i, x) = \left( \frac{\mu}{r} \left( \frac{1+r}{x} \right)^{\frac{1}{2}} \theta_i - (1+r) \right)^{\frac{1}{2}}. \quad (14)$$

However, not all students will risk to drop out. In fact, individuals with  $W(\alpha_i^*) > C(\theta_i, \alpha_i^*, x)$  will never drop out (see equation 5). Solving this inequality,<sup>12</sup> the maximum level of  $\theta$  for which individuals are at risk of dropping out is:

$$\theta_M(x) = \frac{r}{\mu} (2+r) \left( \frac{x}{1+r} \right)^{\frac{1}{2}}. \quad (15)$$

Therefore, if  $\theta_i > \theta_M(x) \Rightarrow G(\theta_i, x) = 1$ .

---

<sup>12</sup>This is also equivalent to computing the value of  $\theta_i$  for which  $G(\theta_i, x) \leq 1$ .

We can restrict the analysis of enrollment to those students with  $\theta_i > \theta_m(x)$  and restrict the analysis of drop-out to those students whose  $\theta_i$  is such that  $\theta_m(x) \leq \theta_i \leq \theta_M(x)$ .<sup>13</sup> According to our results, secondary school leavers can therefore be divided in three groups: individuals who do not enrol, individuals who enroll and have a positive probability of dropping out and individuals who enroll and are sure of finishing studies.

## 4 Overall enrollment and graduation

We are now able to evaluate the enrollment rate. Assuming that the ability  $\theta$  is distributed according to the density function  $f(\theta)$ , the number of students enrolled in HE is:

$$E(x) = 1 - F(\theta_m(x)) = \int_{\theta_m(x)}^{\infty} f(\theta)d\theta. \quad (16)$$

**Remark 3.** *The number of enrolled individuals depends negatively on the HE standard required by the government to HE institutions ( $x$ ).*

*Proof.* This result is derived immediately by considering that  $\frac{d\theta_m(x)}{dx} > 0$ . □

If we assume a population of secondary school leavers of unitary mass the above equation also provides the overall university enrollment rate.

Let us now consider the number of graduates  $\Gamma(x)$ , i.e people enrolled in HE that complete their studies. It is given by the sum of the number of students that are sure to finish studies and students who risk to drop out weighted by the probability of finishing studies:

$$\Gamma(x) = \int_{\theta_M(x)}^{\infty} f(\theta)d\theta + \int_{\theta_m(x)}^{\theta_M(x)} G(\theta, x)f(\theta)d\theta \quad (17)$$

where  $\theta_M(x)$  is defined in equation 15,  $\theta_m(x)$  in equation 12 and  $G(\theta, x)$  in equation 14.

**Remark 4.** *The number of graduates depends negatively on the minimum standard required by the government to HE institutions ( $x$ ).*

---

<sup>13</sup>An implicit parameter restriction in order to have students who drop out (i.e.  $\theta_m < \theta_M$ ) is  $Z > \frac{\mu}{2x(1+r)^{\frac{1}{2}}}$ .

*Proof.* Equation 17 can be differentiated using the Leibniz's rule for the second integral, obtaining:

$$\begin{aligned} \frac{d\Gamma(x)}{dx} = & -\frac{d\theta_M(x)}{dx}f(\theta_M(x)) + \\ & + \int_{\theta_m(x)}^{\theta_M(x)} \frac{dG(\theta, x)}{dx}d\theta + \frac{d\theta_M(x)}{dx}f(\theta_M(x))G(\theta_M(x), x) + \\ & - \frac{d\theta_m(x)}{dx}f(\theta_m(x))G(\theta_m(x), x) \end{aligned}$$

that, considering that  $G(\theta_M(x), x) = 1$  by the definition of  $\theta_M(x)$  (see equation 15), simplifies to:

$$\frac{d\Gamma(x)}{dx} = \int_{\theta_m(x)}^{\theta_M(x)} \frac{dG(\theta, x)}{dx}f(\theta)d\theta - \frac{d\theta_m(x)}{dx}f(\theta_m(x))G(\theta_m(x), x) \quad (18)$$

where the first term is negative (see equation 14) and the second is positive (see equation 12) but with the minus sign. Therefore, the derivative is negative.  $\square$

The number of individuals who drop out ( $D(x)$ ) is given by the difference between the number of enrolled individuals and the number of graduates, so that:

$$D(x) = E(x) - \Gamma(x).$$

Unfortunately, it is not possible to obtain unambiguous results for the relationship between the number of drop out and the HE standard. Both  $E(x)$  and  $\Gamma(x)$  are decreasing in  $x$ , and, following the same procedure as the previous proof, we obtain:

$$\frac{dD(x)}{dx} = -\frac{d\theta_m(x)}{dx}f(\theta_m(x)) - \frac{d\Gamma(x)}{dx} \quad (19)$$

and, substituting equation 18:

$$\frac{dD(x)}{dx} = - \int_{\theta_m(x)}^{\theta_M(x)} \frac{dG(\theta, x)}{dx}f(\theta)d\theta - \frac{d\theta_m(x)}{dx}f(\theta_m(x))[(1 - G(\theta_m(x), x))] \quad (20)$$

that is the sum of two terms, the first negative and the second positive. Therefore the sign is undefined.

In fact, the increase in the HE standard required by the government:

- decreases the number of enrolled people; by this channel, the number of drop-out should decrease;

- affects the number of students at risk of dropping out; indeed, a higher HE standard raises the ability required to the “marginal” student ( $\theta_m(x)$ ) faster than the ability required for not being at risk of dropping out  $\theta_M(x)$  (see equations 12 and 15); the effect on the number of drop out depends on the distribution  $f(\theta)$ ;
- increases the risk of dropping out for each of the enrolled students with ability between  $\theta_m(x)$  and  $\theta_M(x)$  (in fact,  $\frac{dG(\theta_i, x)}{dx} < 0$  as emerges from equation 14) and the number of drop out should increase.

The sign of the net effect cannot be determined in our theoretical model. Therefore, there is no way to define a general result for the relationship between the number of drop out and the HE standard. This is not a surprising result: a higher HE standard pushes a lower number of more motivated students to enroll but they will incur in a higher probability of dropping out because of the higher standard.

From the above equations, we can define the drop-out rate as  $d(x) = \frac{D(x)}{E(x)}$  and the graduation rate, that is simply  $1 - d(x)$ . When we evaluate the derivative of the drop out rate (or the one of the graduation rate) with respect to  $x$ , for a general density  $f(\theta)$  we are not able to define its sign, as in the case of the number of drop out.

$$\frac{dd(x)}{dx} = \left( \frac{dD(x)}{dx} - \frac{dE(x)}{dx} \frac{D(x)}{E(x)} \right) \frac{1}{E(x)} \quad (21)$$

and, given the indeterminacy of  $\frac{dD(x)}{dx}$  we can state:

**Remark 5.** *If a higher HE standard raises the number of drop out students, the drop out rate must increase and the graduation rate must decrease. If a higher HE standard decreases the number of drop-out students, the drop-out rate and the graduation rate can both be increasing or decreasing with the HE standard.*

*Proof.* The results can be obtained from equation 21 once we consider that all the variables in level are positive and that  $\frac{dE(x)}{dx}$  is negative.  $\square$

We can highlight the theoretical results by using numerical simulations.

Let us consider a standard lognormal distribution of the ability in the population, with  $\sigma$  being the standard deviation.

The value of  $\sigma$  defines different shapes for the number of drop-out and for the drop-out rate.<sup>14</sup>

---

<sup>14</sup>Simulations are based on the following values for the parameters of the model:  $w^D = 1$ ;  $w^U = 0.8$ ;  $r = 0.10$ ;  $\mu = 0.20$ ; the average of the  $f$  distribution is 1.5.



Figure 1: Lognormal distribution ( $\sigma = 0.30$ ), Number of drop out, Drop-out rate

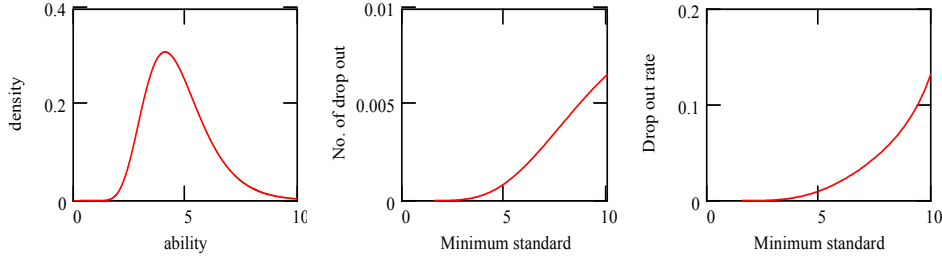
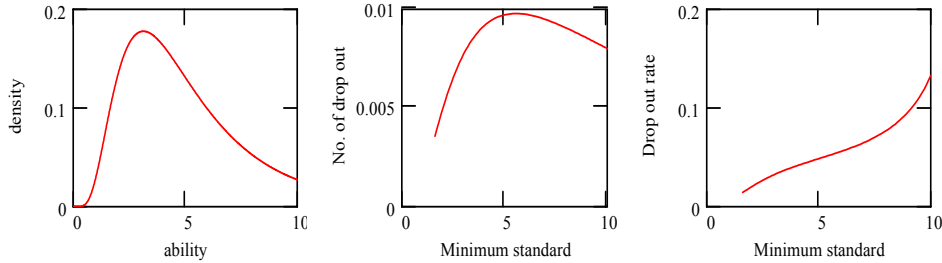


Figure 2: Lognormal distribution ( $\sigma = 0.60$ ), Number of drop out, Drop-out rate



For instance, with  $\sigma = 0.30$  we obtain that both the number of drop-out students and the drop-out rate are always increasing in the HE standard  $x$  (see figure 1).

For higher values of the standard deviation of the lognormal distribution the shape of the above variables change. For  $\sigma = 0.60$ , the number of drop-out students shows a maximum in  $x$  whereas the drop-out rate is always increasing (see figure 2).

For  $\sigma = 1.20$ , the number of drop out is always decreasing with respect to the HE standard  $x$  whereas the drop out rate shows a minimum in  $x$  (see figure 3).

## 5 Data

In the empirical analysis we use data drawn from the 2001 and 2004 surveys of Italian high school graduates (*Percorsi di studio e di lavoro dei diplomati*). The Survey is a sample survey which gathers information on education, work, training and family background of high school graduates three years after graduation. The two surveys refer to graduates of the 1998 and the 2001 cohorts, respectively. While the 2001 was the first year of general

Figure 3: Lognormal distribution ( $\sigma = 1.20$ ), Number of drop out, Drop-out rate

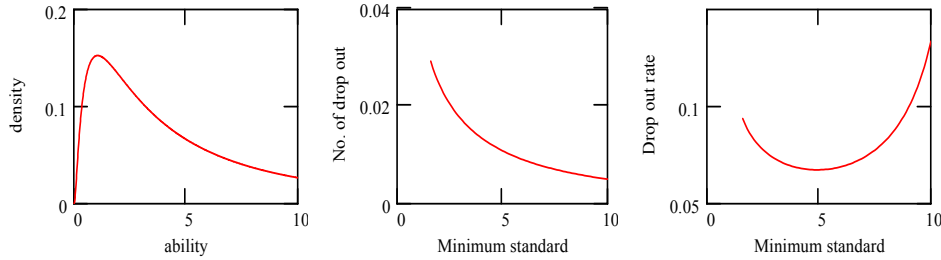


Table 1: University enrollment rates by family and school backgrounds

| Groups                    | 1998           |        | 2001           |        |
|---------------------------|----------------|--------|----------------|--------|
|                           | Enrolment rate | N.     | Enrolment rate | N.     |
| <i>Social class</i>       |                |        |                |        |
| working class             | 0.28           | 8,798  | 0.40           | 7,542  |
| petite bourgeoisie        | 0.33           | 4,046  | 0.44           | 3,702  |
| medium class              | 0.52           | 6,238  | 0.66           | 5,145  |
| bourgeoise                | 0.58           | 3,385  | 0.68           | 3,699  |
| <i>Parents' education</i> |                |        |                |        |
| lower than high school    | 0.27           | 12,253 | 0.37           | 9,039  |
| high school diploma       | 0.49           | 8,226  | 0.60           | 8,662  |
| only one has a degree     | 0.79           | 1,355  | 0.82           | 1,598  |
| both have a degree        | 0.89           | 633    | 0.93           | 789    |
| <i>High school type</i>   |                |        |                |        |
| vocational school         | 0.19           | 8,631  | 0.26           | 5,853  |
| technical school          | 0.39           | 8,035  | 0.51           | 8,156  |
| scientific lyceum         | 0.93           | 1,525  | 0.95           | 1,554  |
| classic lyceum            | 0.95           | 1,299  | 0.96           | 1,378  |
| other                     | 0.55           | 2,953  | 0.66           | 3,147  |
| Total                     | 0.40           | 22,467 | 0.53           | 20,088 |

application<sup>15</sup> of the '3+2' university reform, in 1998 the old university system was still in force. For this reason, the two waves are useful to provide some evidence on the effect of the university reform on university enrolment decisions. In particular, our main interest stands in the effect of the degree of pre-university academic readiness, proxied by the type of high school attended and the high school final mark obtained, on university enrolment, before and after the '3+2' reform.

The 2004 and 2001 waves gather data on 20,404 and 23,263 high school graduates, respectively, representing 4.5% and 4.9% of the Italian populations of 2001 and 1998 high school graduates.

A simple inspection of the descriptive statistics reported in Table 1 shows that after the reform there was a fast increase in participation rates

<sup>15</sup>A minority of universities introduced voluntarily the reform already in 2000.

in HE of students coming from less academically oriented high schools, such as vocational schools and technical schools.<sup>16</sup> This evidence supports one of the implications of our theoretical model: the increase in relative participation rates of less academically oriented students may be caused by the reduction in course standards of difficulty after the reform or by the creation of new courses with lower standards. However, this is a simple association in the raw data which does not take into account other students' characteristics, such as social class. Although in our theoretical model we have stressed the effect of changing HE standards and assumed perfect capital markets, in reality students might be subject to credit constraints. This is more likely to happen for students coming from low social class backgrounds. Indeed, a one-year reduction in course length might have had the effect of reducing liquidity constraints for low social class students, increasing their participation in HE. However, Table 1 does not support this speculation since it shows that participation rates in HE have increased in the same measure for all social classes (by 10-14%). Hence, evidence from raw data seems to support the idea that the reduction in HE standards of difficulty, rather than a relaxation of liquidity constraints, might be one of the primary reasons of the rise in student numbers after the '3+2' reform.

Although the descriptive statistics suggest that a reduction in liquidity constraints is not the main story explaining the increase in participation rates in HE,<sup>17</sup> in the econometric analysis it will be important to control for several students' characteristics simultaneously in addition to academic readiness. Namely, we will include parents' education and social class, in order to distinguish the effect of academic readiness (i.e. high school type and final mark) from that of social class<sup>18</sup> (over and above high school type and final mark), which may mainly reflect liquidity constraints.

## 6 Empirical analysis

In this section we describe the econometric model, the covariates used and the estimation results.

---

<sup>16</sup>The total size of the sample is reduced since observations with missing values have been removed.

<sup>17</sup>This is consistent with a rich literature which suggests that liquidity constraints are not important for the decision to enter HE, at least in the US. See for instance Cameron and Heckman (1999, 2001), Keane and Wolpin (2001), Carneiro and Heckman (2002), among the others.

<sup>18</sup>This is also important since in Italy low social class students are more likely to enrol in less academically oriented high schools (see Cappellari, 2004).

## 6.1 Econometric model

In order to estimate the likelihood of enrolling in HE we use a probit model. Let us assume that the utility of enrolling in HE for the individual  $i$  can be expressed as:

$$V_{iE} = x'_i \beta_E - \epsilon_{iE} \quad (22)$$

where  $x$  is a set of observable characteristics and  $\epsilon_E$  represents some unobservable characteristics affecting an individual's utility to enrol in HE. The utility of not enrolling in HE can be expressed as:

$$V_{iNE} = x'_i \beta_{iNE} - \epsilon_{iNE}. \quad (23)$$

Subtracting 23 from 22 we obtain the differences in the two utilities:

$$V_{iE} - V_{iNE} = x'_i (\beta_E - \beta_{iNE}) + \epsilon_{iNE} - \epsilon_{iE}, \quad (24)$$

that after defining  $V \equiv V_{iE} - V_{iNE}$ ,  $\beta \equiv \beta_E - \beta_{iNE}$  and  $\epsilon \equiv \epsilon_{iE} - \epsilon_{iNE}$  can be rewritten as:

$$V_i = x'_i \beta - \epsilon_i. \quad (25)$$

We assume that  $\epsilon_i$  is distributed as a standard normal and obtain the probit model. Let us define a dycotomic variable  $E_i$  which takes on value one if an individual enrol in HE and zero otherwise, then:

$$Prob(E_i = 1) = Prob(V_i > 0) = Prob(\epsilon_i < x'_i \beta) = \Phi(x'_i \beta). \quad (26)$$

Among the observable characteristics affecting university enrolment we include:

- parents' social class defined according to the occupation of the parent with the highest occupational status (working class, petite bourgeoisie, intermediate class, bourgeoisie);<sup>19</sup>
- parents' education defined using the highest occupational level of both parents (lower than high school, high school, one has a university degree, both have a university degree);
- geographic area of the high school (North-west, North-East, Centre, South, Islands);

---

<sup>19</sup>Parental social class and education were classified following the criteria used by ALMALAUREA a consortium of several Italian universities that regularly collects data on university graduates.

- high school type (vocational school, technical school, scientific lyceum, classic lyceum, other<sup>20</sup>);
- final mark at high school in four groups of the same size;<sup>21</sup>
- private or public school;
- gender;
- age group ( $\leq 21, 22, 23, \geq 24$  for the 1998 cohort and  $<21, 21, >21$  for the 2001 cohort);<sup>22</sup>
- number of university courses supplied at regional level. This variable has been included to capture university supply effects.

## 6.2 The choice to enrol at university

Tables 2 and 4 shows the estimates of the probit model of the choice to continue in HE. The estimates of the effect of social class show that in both waves there is a monotonic effect of social class on the likelihood to enrol in HE, and that the 2001 reform did not produce any substantial change in social class effects. As we anticipated, the dummies for social classes are likely to capture liquidity constraints effects, after controlling for parents' education and type of secondary schools, and they show no evidence of a relaxation of these constraints after the implementation of the reform. Table 3 shows in the two cohorts that while low social class individuals are over-represented in vocational schools, and high social class individuals in scientific and classical lyceum, all social classes are similarly represented in technical schools. Hence, the gain in the probability of enrolment of individuals coming from the latter schools is probably unrelated to social class effects and mostly reflect the effect of academic readiness.

The estimates also show a monotonic effect of parents' education on the probability of enrolment in HE, however the reform did not produce any

---

<sup>20</sup>This residual category is rather heterogeneous and includes teaching schools (*scuole magistrali* and *istituti magistrali*), art schools (*licei artistici* and *istituti d'arte*) and language lyceum (*liceo linguistico*).

<sup>21</sup>In Italy students at the end of higher secondary education have to pass an exam called 'Esame di Maturità' in which they receive a final grade ranging between 60 and 100. Before the reform of the 'Esame di Maturità' (Law n. 425/1997), the grade ranged between 36 and 60. While in the 1998 cohort the final mark is expressed in the old range, in the 2001 cohort it is computed in the new range.

<sup>22</sup>In Italy the typical age of a high school student at graduation ranges in the interval 18-19 years.

Table 2: Probit model of university enrollment, 1998 cohort (marginal effects)

| Variable                  | M.E.   |     | Std. Err. | z     |
|---------------------------|--------|-----|-----------|-------|
| <i>Social class</i>       |        |     |           |       |
| petite bourgeoisie        | 0.039  | *** | 0.008     | 4.72  |
| medium class              | 0.068  | *** | 0.008     | 8.56  |
| bourgeoisie               | 0.093  | *** | 0.010     | 9.43  |
| <i>Parents' education</i> |        |     |           |       |
| lower than high school    |        |     |           |       |
| high school diploma       | 0.092  | *** | 0.007     | 12.98 |
| only one has a degree     | 0.222  | *** | 0.017     | 12.79 |
| both have a degree        | 0.246  | *** | 0.030     | 8.32  |
| <i>School type</i>        |        |     |           |       |
| vocational school         | -0.657 | *** | 0.014     | -48   |
| technical school          | -0.483 | *** | 0.016     | -29.9 |
| classic lyceum            | -0.011 |     | 0.010     | -1.16 |
| other                     | -0.345 | *** | 0.020     | -17.2 |
| <i>Mark</i>               |        |     |           |       |
| 42-47                     | 0.085  | *** | 0.007     | 11.81 |
| 48-53                     | 0.164  | *** | 0.009     | 18.36 |
| 54-60                     | 0.295  | *** | 0.010     | 28.09 |

Note. Reference categories are working class (social class), less than high school (parents' education), scientific lyceum (school type), and 36-41 (secondary school final mark). The model also includes the covariates listed in section 6.1. The column M.E. reports average marginal effects.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 10%.

increase in relative participation of students with low educated parents, after controlling for school type.

The most important changes after the reform concern the type of high school of the individuals enrolling in HE. Compared to the period pre-dating the reform, after 2001 individuals with vocational and technical secondary education are relatively more likely to participate in HE. The gains in the probability of enrolling in HE after the reform, with respect to scientific lyceum, amount at 6.1 percent points for vocational schools, 10.4 percent points for technical schools and 7.5 percent points for other types of schools.

Our estimates show that the reform was successful in attracting in the HE system individuals with lower levels of academic readiness, coming from those high schools whose primary aim is not to prepare students for a university education.

## 7 Concluding remarks

In this paper we present a theoretical model in which secondary school leavers, who are differentiated by their ability levels, have to decide whether

Table 3: Sorting of students across high school types by social class

| Social class       | School type |           |                      |                   |       | total | N      |
|--------------------|-------------|-----------|----------------------|-------------------|-------|-------|--------|
|                    | vocational  | technical | scientific<br>lyceum | classic<br>lyceum | other |       |        |
| 1998               |             |           |                      |                   |       |       |        |
| working class      | 48.05       | 35.31     | 3.83                 | 2.38              | 10.42 | 100   | 8,798  |
| petite bourgeoisie | 43.66       | 36.81     | 3.86                 | 3.14              | 12.53 | 100   | 4,046  |
| medium class       | 28.58       | 37.76     | 10.6                 | 8.77              | 14.29 | 100   | 6,238  |
| bourgeoisie        | 25.47       | 32.25     | 11.01                | 12.34             | 18.93 | 100   | 3,385  |
| total              | 38.46       | 35.8      | 6.79                 | 5.79              | 13.16 | 100   | 22,467 |
| 2001               |             |           |                      |                   |       |       |        |
| working class      | 39.68       | 40.98     | 4.23                 | 3.12              | 11.99 | 100   | 7,542  |
| petite bourgeoisie | 35.58       | 41.22     | 4.97                 | 3.35              | 14.88 | 100   | 3,702  |
| medium class       | 17.65       | 41.09     | 12.48                | 10.71             | 18.08 | 100   | 5,145  |
| bourgeoisie        | 17.17       | 38.52     | 11.06                | 12.65             | 20.6  | 100   | 3,699  |
| total              | 29.14       | 40.6      | 7.74                 | 6.86              | 15.67 | 100   | 20,088 |

Table 4: Probit model of university enrollment, 2001 cohort (marginal effects)

| Variable                  | M.E.   |     | Std. Err. | z      |
|---------------------------|--------|-----|-----------|--------|
| <i>Social class</i>       |        |     |           |        |
| petitw bourgeoisie        | 0.020  | *** | 0.009     | 2.26   |
| medium class              | 0.063  | *** | 0.009     | 7.32   |
| bourgeoisie               | 0.088  | *** | 0.010     | 9.09   |
| <i>Parents' education</i> |        |     |           |        |
| high school diploma       | 0.092  | *** | 0.007     | 12.59  |
| only one has a degree     | 0.206  | *** | 0.016     | 13.18  |
| both have a degree        | 0.285  | *** | 0.026     | 10.77  |
| <i>School type</i>        |        |     |           |        |
| vocational school         | -0.596 | *** | 0.016     | -36.51 |
| technical school          | -0.379 | *** | 0.016     | -23.90 |
| classic lyceum            | -0.011 |     | 0.008     | -1.29  |
| other                     | -0.270 | *** | 0.019     | -14.48 |
| <i>Mark</i>               |        |     |           |        |
| 70-79                     | 0.107  | *** | 0.008     | 13.45  |
| 80-89                     | 0.222  | *** | 0.009     | 23.54  |
| 90-100                    | 0.329  | *** | 0.009     | 36.25  |

Note. Reference categories are working class (social class), less than high school (parents' education), scientific lyceum (school type), and 60-69 (secondary school final mark). The model also includes the covariates listed in section 6.1. The column M.E. reports average marginal effects.

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 10%.

to enroll in HE or not in an educational system in which two-period courses of different qualities are available. Both educational costs and graduate wages are increasing with course quality. Moreover educational costs are affected by the standard of HE set centrally by the government. Costs are also increasing in an idiosyncratic stochastic shock whose realisation is known only at the end of the first period. In the case the cost of education becomes too high individuals have an exit option: to drop out from the HE course after the first period. Therefore, we define the optimal course quality for each individual, her decisions to enroll or not and, in the second period, the choice to drop out or complete the HE course. Then we investigate how a change in the HE standard affects overall enrollment and graduation. Our model shows that an increase in the HE standard:

- reduces the enrollment rate and the number of students who graduate;
- depending on the values of the parameters of the model and on the distribution of ability, may reduce or increase the number of students who drop out and the drop-out rate.

Therefore, according to our theoretical analysis a reduction in HE standard helps achieving a mass tertiary education by increasing both the number of students and that of university graduates but it does not necessarily increase the overall efficiency of the HE system measured in terms of drop-out or graduation rates.

Italian data show that the most important change after the reform concerns the composition of HE students by type of school.

Our estimates show that the reform was successful in attracting in the HE system individuals with low levels of academic readiness, and helped achieving a mass tertiary education. This has of course some policy implications, since less prepared students require more effective teaching if one wants to retain them in the HE system, or, alternatively, a reduction in the standard of HE if maintaining the current standards is not a primary concern of HE institutions. One possibility is that after the reform new courses with lower standards were created to attract less able students. Another possibility is that the standard of pre-existing courses was adjusted (reduced) to match the new characteristics of the student intake (which is similar to a leftward shift in the distribution of standards in the theoretical model).



## Appendix

In order to simplify notation, we define  $\bar{\gamma} \equiv \bar{\gamma}(\theta_i, \alpha, x)$  and  $G(\bar{\gamma}) \equiv G(\bar{\gamma}(\theta_i, \alpha, x))$ .

Considering that  $c((\theta_i, \alpha, x, \gamma) = C(\theta_i, \alpha, x)G(\gamma)$ , we can write equation 2 as follows:

$$U_{0,i}^E(\alpha) = \int_{-\infty}^{\bar{\gamma}} \left[ \frac{w^S(\alpha)}{r(1+r)^2} - \frac{C(\theta_i, \alpha, x)G(\gamma)}{(1+r)} - \frac{C(\theta_i, \alpha, x)G(\gamma)}{(1+r)^2} \right] g(\gamma) d\gamma + \int_{\bar{\gamma}}^{\infty} \left[ \frac{w^D}{r(1+r)} - \frac{C(\theta_i, \alpha, x)G(\gamma)}{(1+r)} \right] g(\gamma) d\gamma.$$

Since  $G(\bar{\gamma}) = \int_{-\infty}^{\bar{\gamma}} g(\gamma) d\gamma$ ,  $\int_{\bar{\gamma}}^{\infty} g(\gamma) d\gamma = 1 - \int_{-\infty}^{\bar{\gamma}} g(\gamma) d\gamma$  and taking out of the integral all the terms not depending on  $\gamma$ , we obtain:

$$U_{0,i}^E(\alpha) = \frac{G(\bar{\gamma})}{r(1+r)} \left( \frac{w^S(\alpha) - (1+r)w^D}{(1+r)} \right) + \frac{w^D}{r(1+r)} + \frac{C(\theta_i, \alpha, x)}{1+r} \int_{-\infty}^{\infty} G(\gamma)g(\gamma) d\gamma - \frac{C(\theta_i, \alpha, x)}{(1+r)^2} \int_{-\infty}^{\bar{\gamma}} G(\gamma)g(\gamma) d\gamma$$

Using the definition of  $W(\alpha)$  given in equation 4, and considering that:

$$\int G(\gamma)g(\gamma) d\gamma = \int G(\gamma) \frac{dG(\gamma)}{d\gamma} d\gamma = \frac{[G(\gamma)]^2}{2} + k$$

where  $k$  is a constant, we obtain equation 3.

## References

- Bagüés, M., Sylos Labini, M. and Zinovyeva, N. (2006), 'Endogenous grading standards and labour market mismatch', paper presented at the *Brucchi Luchino* 2006 conference (Padua).
- Bondonio, D. (2006), 'La valutazione dell'impatto netto della riforma', in M. Bini, D. Bondonio e C. Crocetta (eds.) *Gli effetti della nuova riforma dei cicli e degli ordinamenti didattici*, Research Report to the Ministero dell'Istruzione, dell'Università e della Ricerca, Comitato Nazionale per la Valutazione del Sistema Universitario.
- Bratti, M., Broccolini, C. and Staffolani, S. (2006), 'Is «3+2» Equal to 4? University Reform and Student Academic Performance in Italy', DEA Working Paper no. 251, Università Politecnica delle Marche, Ancona.
- Di Pietro, G. and Cutillo, A. (2006), 'The impact of supply side policies on university drop-out: The Italian experience', paper presented at the EALE 2006 Conference (Prague).
- Perotti, R. (2002), 'The Italian university system: rules vs. incentives', mimeo, European University Institute.
- Ranieri, A. (2006), 'Quanto fa davvero «3+2»?', in Almalaurea (ed.), *L'università in transizione: laureati vecchi e nuovi alla luce della riforma*. Bologna: il Mulino.