Higher education in Italy: parking lot or human capital investment?

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Abstract

Young Italians in the age bracket 20-29 feature two distinctive marks: a low labour market partecipation rate and, parallely, a significant enrolment rate in higher education. Despite this, academic performance turns to be poor: half of students drop out and several others graduate well beyond the legal completion time. The aim of this paper consists in rationalising these facts through a model that mixes human capital and signalling models by assuming that completing university enhances individual productivity. The idea developed is that students choose academic performance as a way to signal their talent. Separating equilibria allowing for parking strategy exist when labour market are characterised by high wage compression or by a remarkable non monetary cost implied in completing education. The characterization of results gives useful policy insights and provides several empirical implications to be tested.

1 Introduction

Over the last two decades, Italy experienced an under performance in the growth rate of Gdp with respect to other Oecd countries. The average growth rate of Italy in the 1985-2005 period was 1.9 percent against an average growth rate of 2.7 in Oecd countries.

One immediate explanation for this poor performance is the low labor force participation rate. The unemployment rate in Italy, besides being very high and persistent, is very unevenly distributed across generations: in the last years youth unemployment has consistently been almost three times higher than the average unemployment rate.

Furthermore, the higher educational system has shown a rapid expansion, whilst enrolment rates has sharply risen in the last decade. However, an ever growing enrolment does not necessarily nor always leads to proportionally successful graduations; rather, most of the enrolled students drop out before achieving graduation, many others extend their permanence into university well beyond the legal completion time and only a low percentage get their degree within the legal time. Lastly, the effect of educational attainment on post university employment probability and on relative wage gains are not particularly significant.

Some of these peculiarities are shared by others Oecd countries: youth unemployment is very high and persistent in Spain, France and Greece as well, while it is extremely low in Anglo-Saxon countries. Enrolment into higher education has been steady high in North European and Anglo-Saxon countries, where nearly 80% of young enters university, whilst it has been rapidly increasing in Spain, Greece, Denmark and Portugal, where the percentage of young enrolled has reached approximately 60%. Academic performance varies a lot across countries: the percentage of students extending their studies beyond the legal time ranges from nearly 30% in Sweden and Italy to close to zero in the United Kingdom and Ireland. Swiss and Portuguese are close to the Anglo-Saxon pattern, while French and German students lie in between these extremes. The percentage of drop out from higher education follows a similar pattern. Finally, graduation premium is impressively low also in Spain and Denmark, while particularly high in United States and the United Kingdom.

Basically, Spain features the same Italian peculiarities, both in terms of labour market imperfections and schooling choices, while others Oecd countries share only some of the depicted aspects.

These peculiarities lead us to wonder whether higher educational choice in Italy, and indeed in Spain, can be considered not only as a human capital investment decision, but also as a preferable parking option. Indeed, if young struggle to find a job, education can play a dual role: it may represent a parking lot whilst waiting to enter the labour market and, at the same time, an investment aimed at increasing labour market opportunities.

We argue that, in studying this matter, we need to focus on two main macroeconomic relevant dimensions: academic institutions and labour markets. The spirit of the paper is to rationalize the stylized facts, detecting the relative role of these two dimensions.

The Italian labour market features some imperfections that affect educational choices. When youth unemployment rate is strikingly high, young tend to wait for a job offer and feel like staying in the schooling system proves to be a preferable option of how to structure their wait.

The institutional dimension features peculiarities that deserve attention: the university system in Italy is characterized by no requirement restriction on admission and on exam-taking as well as by low tuition fees. These peculiarities facilitate or even encourage extended student status. But also, higher Italian institutions supply fairly homogenous education across the territory. Noticeably, students do not move away from home looking for the best university to apply to (as detailed shown in Brunello and Cappellari, 2004), but enter the nearest local institution. In Anglo-Saxon countries the supply of higher education is widely differentiated along the quality dimension, students move away looking for the best institution and they are selected according to their individual ability. The lack of a differentiated higher educational system incentives students to differentiated themselves along the individual academic performance dimension rather than along the university quality dimension.

Thus, the idea that we formally derive in this paper is that student status serves as a signalling device for potential employers. If imperfect information prevents firms from observing the true productivity of a potential employee, educational status gives useful information to infer ability. Absent any other mechanism of selection, the performance and time spent in the schooling system can be used as a way to communicate individual own type along the ability dimension. In order to add realism to the model, we work it out with the hypothesis that the signal acquired is productive only in case university is completed.

We look for separating equilibria allowing students to differentiate themselves according to the academic performance in such a way that ablest students choose the more costly action and less able students choose the less tough. Firms set contracts on the basis of the observed signal, thus paying higher wages when the more costly action is observed and lower ones when the less tough occurs.

Our findings show a very straightforward interpretation: both the institutional dimension and the labour market one are proven crucial in determining prolonged permanence into university; moreover, the two dimensions interplay one with the other and the parking equilibrium exists for specific values of both.

The empirical test supports the existence of such a separating equilibrium. Running a standard wage equation emerges that individuals are ranked according to their schooling performance: others things being equal, students graduated on time receive a mark up with respect to those graduated with delay and drops out receive a premium relative to those not even enrolled. Obviously, those graduated are remunerated for the increased productivity due to schooling completion. This result proves that employees use students' educational choice as signal to infer unobservable individual heterogeneity.

The structure of the paper is as follows. Section 2 documents the stylized facts motivating the paper, Section 3 presents relevant literature around the choice of acquiring education, Section 4 develops the theoretical framework, Section 5 tests the theoretical implication and Section 6 contains final remarks.

2 Stylized facts

2.1 Youth labour forces participation

Italy features a surprisingly small number of young active in the labor market. The employment rate represents the proportion of employees over the population in the corresponding age brackets excluding full time students. Looking at the data relative to labour forces participation rates, they are strikingly lower than those of European Union's countries, both in the age group 20-24 and 25-29. As table 1 shows, in the age brackets 20-24 years, almost 44% of young is employed, 6 percentage points below the average value displayed by others Oecd countries; in this age group the Italian participation rate is low, but France and Finland display an even lower participation rate.

In the age bracket 25-29 Italian labour force participation is remarkable as well: it is among the lowest in the Oecd, 7 percentage point lower than the average Oecd countries value, which is as high as 76,1%. This statistic is second lowest only to that of Finland and as high as the value displayed by Germany.

Table 1. Percentage of the youth population not in education employed in age group 20-24 and 25-29 (2002)

	20-24	25-29
Belgium	48	83,5
Denmark	41,1	64,3
Finland	28,5	59,9
France	37,6	76,4
Germany	49,6	69,1
Greece	50,2	81
Ireland	64,8	85,8
Italy	**43,8**	**69,2**
Netherlands	58,3	86,2
Norway	57,5	79,1
Portugal	60,1	82,3
Spain	49	73,3
Sweden	50,9	73,5
United Kingdom	60,6	81
Country Mean	**50**	**76,1**

Source: Education at a glance

2.2 Enrolment rates

Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of higher education. As depicted in table 2, in few years the Italian higher educational system expanded sharply, passing from 52% of young enrolled in 2001 to 63% of enrolled in 2004. This increment is second only to those of Denmark and Greece, while the growth rate of enrolment in other Oecd countries has been well lower. In this perspective, the university law approved recently by the Italian Parliament, which reduces to 3 years the length of first degrees (previously they used to last between 4 and 6) has surely contributed to this sharp upturned.

The fact that so many young enter higher education supports the argument that there are more than two signals, namely entering and not entering university. If it is not costly to enrol and the majority of students do easily enter academic institutions, they differentiate themselves by choosing how effort put into education acquisition. Thus, more signals can be observed in equilibrium, which are related to the observed academic performance and add information over individual talent.

Table 2. Gross enrollment into tertiary education

	2001	2004	Variation %
Austria	57	49	-14
Belgio	58	63	8
Denmark	60	74	23
Finland	84	90	6
France	53	56	5
Greece	59	79	35
Italy	52	63	**21**
Netherlands	56	59	7
Spain	60	66	10
Portugal	51	57	12
Sweden	71	84	19
United Kingdom	59	60	2
United States	70	82	18
Coutry mean	61	68	12

Source: World bank Indicators

2.3 Education performance

The education performance of enrolled students is noticeable within two respects. First, most young Italians do not reach graduation. As the table 3 shows, almost two thirds of students drop out without completing a degree. The average statistic for Oecd countries is one third.

Second, young Italian students are stuck in university for a remarkably long period. The average age at the time of finishing university is 27.7 years, which means that graduates studies extends well beyond the normal completion time. In fact, among those who get their degree, 64% obtain it *fuori corso* (source: Istat).

This means that a large fraction of young is still in education, whereas they should be in the labour market. The enrolment of non employed students in Italy is 12.3% , while the same average Oecd countries percentage is 6.6% (table 4). This number is the other side of the coin of the first fact depicted: young in their late twenties should presumably be out of school and working, or looking for a job. But in Italy, this is not the case.

Table 3. Survival rates in tertiary education (2000)

Number of graduates divided by the number of new entrants in the typical year of entrance

	Tertiary-type A education	
	All programmes	3 to less than 5 years
Australia	69	77
Austria	59	74
Belgium	60	67
Denmark	69	69
Finland	75	
France	59	
Germany	70	
Italy	**42**	**58**
Netherlands	69	70
Spain	77	75
Sweden	48	
United Kingdom	83	
Country mean	**65**	**65**

Source: Education at a glance

Table 4. Percentage of the youth population in education and not in the labour force in age group 20-24 and 25-29 (2002)

	20-24	25-29
Belgium	34,4	2,3
Denmark	18,2	11,0
Finland	36,0	11,8
France	41,5	5,0
Germany	18,9	8,3
Greece	32,5	4,4
Ireland	22,8	2,8
Italy	**34,7**	**12,3**
Netherlands	12,5	2,4
Norway	19,8	8,5
Portugal	28,1	5,6
Spain	33,6	7,6
Sweden	27,1	11,8
United Kingdom	14,0	2,8
United States	13,1	2,9
Country mean	**25,8**	**6,6**

Source: Education at a glance

2.4 Graduate labour market outcome

The graduate labour market outcome does not feature substantial gains, neither in higher employment opportunities or education wage premium.

Contrary to the general case, graduates do not stand a much stronger chance of finding a job. The unemployment rates among graduates in the youth population is as high as the unemployment rate for undergraduate. This implies that, for youth cohorts, the relationship between education level and unemployment is positive, while in most countries this relationship is negative for all age cohorts. The unemployment rate among young between 20 and 29 years of age is absolutely impressive, being the second highest among the selected Oecd countries, lower only to that of Greece. In Italy, as well as in Greece and to a less extent in Spain and Portugal, the chance of being unemployed increases significantly after graduation. Besides, youth unemployment in Italy is an upturned phenomenon from the 70s, as detailed documented in Bertola and Garibaldi [2002].

Also, in the event one finds a job, relative wage gains are not particularly high and the evidence of wage compression is peculiar. In Italy, the relative earning of the graduate population employed is, on average, 37% higher than that of individuals with upper secondary education, but this earning advantage is below the Oecd average, which is as high as 57% (table 6). Boero, McNight, Naylor and Smith [2001] give specific empirical evidence on this point, comparing returns to graduation in Italy and in the United Kingdom.

Education premium rises when we consider the long time horizon, but still remains below the average values displayed by Oecd countries.

Table 5. Unemployment rates by educational attainment and age, 1998

	20-24			25-29		
	A	B	C	A	B	C
Belgium	21,8	8,3	6,7	12,8	6,8	2,3
Denmark	11,9	6,2	0,2	7,6	3,4	1,8
Finland	13,6	7,2	10	13,2	9,5	5,9
France	23,6	10,5	5,8	21,1	12,1	7,5
Germany	16,5	5,6	1	13,8	6	2,4
Greece	20	17,7	13,4	12,3	13,8	17,5
Italy	**18,5**	**13**	**17**	**12,5**	**11,3**	**16,7**
Luxembourg	2,4	4,2	0,4	3,3	1,9	0,7
Netherlands	4,5	2,4	1	5,1	1,7	1,9
Portugal	6,3	5,4	2,4	4,2	2,8	3,2
Spain	21,5	12,6	6,7	17,3	12,3	13,4
United States	7,9	5,2	0,9	6,5	4,3	1,9
Country mean	14,1	8,2	5,5	10,8	7,2	6,3

Source: OECD. See Annex 3 for national data sources .

Table 6. Relative earnings of population with tertiary (type A) attainment level by age

	Year of reference	25-64	30-44
Belgium	2003	148	148
Denmark	2002	126	123
Finland	2002	180	169
France	2002	167	165
Germany	2003	163	153
Ireland	2000	163	152
Italy	**2002**	**153**	**137**
Luxembourg	2002	166	171
Spain	2001	141	133
United Kingdom	2003	178	182
United States	2003	191	195
Country mean		161	157

Source: OECD

Related to these facts, the majority of young (73%) in the age bracket 25-29 still live in their parental home, as documented by Becker, Bentolila, Fernandes, Ichino [2006]. The subsidizing role of family is surely a key factor, which allows for prolonged student status. However, the analysis that follows leaves family's wealth out of consideration, so as to shut down other sources of interactions and focus on the relation between labour market and institutional features. We will consider family role as well in future works.

3 Literature

The literature provides two theories to address the choice of acquiring education: the standard human capital theory and the signalling theory. According to human capital theory education is an investment decision, where current income opportunities are renounced in exchange for better income prospects in the future (Becker, G.,1962); in this setting, people demand education up to the point where marginal benefits are equal to marginal costs of acquisition. Benefits are represented by the discounted value of future higher earnings due to the acquisition of education, which enhances individual productivity. They depend on labour market conditions and individual ability. Costs of acquiring higher education are represented by direct monetary costs, which consist of tuition fees; indirect costs, corresponding to forgone income due to school attendance; non monetary costs, which correspond to the effort put into education acquisition.

This standard explanation for the acquisition of human capital is not able to account for the high drop out rate and the prolonged permanence in the university system unless we derive the Becker model in a context of high uncertainty. Otherwise, extended student status and the attempt to undertake graduate studies translate neither into important relative wage gains nor into significant post-university employment probability.

The signalling theory considers the educational choice when information asymmetries prevent firms to observe employee's productivity (Spence, 1973). In this framework, individuals pursue education in order to signal own ability, without his studies modifying really his productivity. This interpretation accomplishes the possibility that young choose the academic performance to signal their ability, but the signal acquired is unproductive: thus, for given ability, the productivity of an individual with a degree is as high as the productivity of an individual without it. Nevertheless, it is possible to replace the hypothesis of unproductive signal with the productive signal case to get more interesting insights (Weiss, 1983).

Different from these standard explanations for the choice of acquiring education, is the idea that, when labour market are imperfect, universities are parking lots, where students hang out waiting for the proper job offers, but without increasing their productivity; it was firstly proposed by Dornbusch, Gentilini and Giavazzi [2000]. However, they present this idea with only a few arguments, without elaborating any formal analysis of them. Even though the arguments they proposed seem intuitive, there is clearly a need for a more formal analysis.

Sascha Becker [2001] made the first attempt to formalize the idea of parked students. His paper is mainly focused on the high drop out rate, that characterizes the Italian higher educational system. He identifies two main groups of dropper: first "disguised students", that are ill-prepared (by vocational secondary school) to obtain an academic degree, and then "parking lot students", who drop out as soon as they find the first suitable job offer, but obtain a degree in case they never receive a job offer throughout their studies. The author built a search model with education and no uncertainty on individual ability which cannot account for the group of students that obtain graduation with delay, but only for the second group. To this extent, this work rationalizes only partially some of the evidence presented in the previous section.

Related to this topic, but carried out with an empirical approach, is the recent work by Garibaldi, Giavazzi, Ichino and Rettore [2006]. They study the relation between speed of graduation and structure of tuition, suggesting that an upward sloping tuition profile may be efficient in reducing the probability of delayed graduation.

In principle, the arguments that can be used to explain and justify Italian young's educational choice rely on uncertainty or asymmetric information. We go throughout these main concepts by using the standard game theoretical syntax, presenting for each one the main referred arguments.

When we rely upon uncertainty, it means that Nature moves after any agent moves. For instance, the decision to enrol in the higher educational system features some uncertainty over the academic performance. If no test at entry is imposed, performance can be successful or unsuccessful according to some exogenous probabilities. A similar reasoning may be applied to the Italian labour market: given the high youth unemployment, job offers are not available at any time, but arrive at some rate.

We briefly list some arguments that rely on uncertainty. The Harris-Todaro model of migration to urban unemployment in developing countries can be a useful example to explain why people hang out in the schooling system. In this model uncertainty relies on labour market outcomes. The observation is that urban wages are higher than those in the country side by more than the cost of living adjustment, but at the same time there is a significant urban unemployment. The migration decision is efficient: migrants equate the expected urban wage to the wage in the country side.

Italian youth hanging out in university waiting for the proper job offer are the parallel of urban unemployment in poor countries. In this sense students may act efficiently.

A second important example is the parking lot analogy (Pindyck, 1988, 1991). This literature focuses on the optimality of waiting and delaying investment decision in conditions of high uncertainty. In particular, Pindyck [1991] studies the investment decision when investment expenditures have two characteristics: they are largely irreversible, a feature that makes the investment sensitive to various form of risk; and, secondly, investment can be delayed, giving the firm the opportunity to wait for new information to arrive about market conditions before it commits resources. In this case, the cost of delay, ex. forgone cash flow, must be weight against the benefits of waiting for new information. The irreversible investment opportunity is treated like a financial call option: it gives the holder the right, for some specified amount of time, to pay an exercise price and in return receive an asset that has some value. Once exercised the option, it is irreversible. In this setting uncertainty plays a crucial role: in fact, paying for the possibility of exercise the option is valuable just because the future value of an investment is uncertain.

The two features that make optimal delaying the investment decision are the irreversibility of the investment and the ability to invest in the future as an alternative to make it today. Human capital investment owns both features: the investment cannot be resold, it is individual specific and the option to delay graduation is allowed by the university system with a price corresponding to tuition fees. Also, as already discussed, the choice of the investment is made under uncertainty over academic performance and labour market outcome.

The effect of uncertainty on schooling choice has been formally considered by Altonji [1993]. He modelled sequential schooling decision and drop out when educational outcomes are uncertain. The emphasis of his paper, however, is on choice of major (humanities versus math) when individuals have different attitudes toward majors. We will abstract from the choice of major, focusing instead on selection into academic performance.

We now turn to discuss in detail the asymmetric information arguments. Asymmetric information arises when some agents have useful private information unknown to the other agent, as in the signalling game described. For instance, young know their ability level, which is unobservable to potential employers. Given this knowledge, they try to signal it to firms by undertaking some actions.

Several works in the existent literature use this argument. An example is Vishwanath [1989]: he studies the effect of unemployment stigma on hiring decision and therefore on unemployment spells. The stigma effect applies when a firm is less inclined to hire a work with longer unemployment duration. Unemployment duration is used as a signal for otherwise unobservable individual components of worker's productivity. In such an environment, it is progressively harder for an unemployed to obtain a job as his unemployment duration increases. Effects in terms of educational choices are intuitive: youth may find optimal to enrol in university rather than stay unemployed so as to escape unemployment stigma.

McCormick [1990] elaborates a theory of signalling during job search, which presumes unemployment stigma. He argues that when firms are faced by uncertainty about worker's productivity, they use the type of job held, which can be good versus bad or skilled versus unskilled, alongside unemployment duration, as a cheap indicator of worker's quality. The underlying hypothesis is that expected productivity persistently differs between workers hired from different circumstances.

In this paper we refer to this second framework, setting uncertainty aside. The intuition that we develop is the following: in an asymmetric information environment, mimicking to be a student rather than stay unemployed can be an optimal strategy. More precisely, we will develop the idea that young do want to differentiate themselves and signal their type, absent other standard selectivity devices, by choosing their academic performance.

Before presenting the model, it is worth to introduce the literature related to extensions of the original Spence's model and, in particular, contributions that add dynamics to the standard model.

An explicitly game-theoretic analysis of the Spence model was firstly provided by Cho and Kreps [1987], who analytically discussed the separating equilibrium of the game when commitment to an educational choice is assumed.

A first criticism to this equilibrium was pointed out by Weiss [1983], who removed the hypothesis that students commit themselves to an education duration. In fact, when a student arrives at school the first day of class, the separation has already occurred: the student who enrol is of high productivity. This first investment in education convinces the firms that the worker is talented: firms offer immediately the high wage. But if wages offered jump to the high level immediately after having enrolled in the education system, then also the low ability worker will choose to invest in education as well. Therefore, separation with education is upset by early wage offers, while separation between types is overturned by the incentive of low ability type to mimic high ability types.

Weiss tackles the problem by slightly modifying the model: he assumes that firms do not only care about a worker's productivity but also his success or failure in education, i.e. about whether he passed the final exam or not. Solving the model with this added hypothesis resorts the separating equilibrium.

Also Noldeke and Van Damme [1990] provide an answer. They analyze a multiperiod version of the Spence job market signalling model with no commitment to an education choice. The innovation of their model is splitting the educational level into many small periods; firms make wage offers after any period. As the period between job offers gets small, the worker has less ability to commit to education. In the setup of the model beliefs depend on past history of rejected wage offers and wage offers are public. To restrict the plethora of sequential equilibria they adopt the "never a weak best response" requirements which force firms to make unacceptable offers for some time following a wage offer rejection; therefore, the rejection of the first wage offer becomes an implicit commitment to terminate studies: the worker can signal that he is of a high ability type by rejecting the first offer, thus getting an even better offer next round. In this model, as the time between offers tends to zero, the separating outcome reapers.

Swinkels [1999] introduces the hypothesis that wage offers are private. This assumption breaks the informational link between periods and alters the Noldeke and Van Damme's results, leading to a unique pooling equilibrium with no education, when the signal is unproductive. The confidentiality of the offer prevents workers from behaving strategically to get higher wage offers. The separating equilibrium is restored introducing the hypothesis that education enhances worker's productivity.

Our model is related to these previous works. We allow for no commitment to an educational choice as well: students who enroll can spend some time in university without taking any exams and can choose not to terminate studies too. To this, we exploit the useful Noldeke and Van Damme's innovation and split the educational level into smaller units; nevertheless, we will not interpret educational level as an education duration, but as number of exams taken.

However, it differs from the cited works because no dynamics is involved, in the sense that job offers arrive only after the educational choice is undertaken. However, we argue that the introduction of dynamics in the game would not change the characterization of the separating equilibrium resulting from the static simplest version of the model.

4 The model

In this section we present a simple human capital model for the acquisition of higher education with the choice of the performance to undertake at university. The choice variable is represented by the number of exams given. The specification we introduce allows for the possibility that students can eventually hang out in university without necessary terminating it, or finishing it with some delay.

The section is organized as follows: at first, the model is derived under the perfect information hypothesis; next, we derive the same model assuming asymmetric information over individual ability and we compare the equilibrium outcomes with the previous version; lastly, we characterize the equilibrium and study how the equilibrium thresholds shift as the relevant parameters of the model change.

4.1 Benchmark: perfect information

This is a standard human capital model for the choice of acquiring higher education. Young have to choose whether to enrol in university ($s = 1$) or not ($s = 0$) and, in case they enrol, the number of exams they want to give ($e = 0, e_L, e_H$); to decide, they compare costs and benefits correspondent to each action, choosing the one that maximizes their utility.

Individuals differ according to the ability θ_j and we assume $\theta_j \sim U[0,1]$ with density function $f(\theta)$. This variable is perfectly observable in the first setting of the model.

Schooling acquisition is composed by two elements, a fixed cost k, which denotes the monetary cost of education and is independent upon individual ability and the non monetary cost e specified in such a way that the non pecuniary cost of acquiring education is lower for abler individuals.

The cost component e indicates the number of exams taken. It is a choice variable and it can assume three values: 0, e_L, e_H. When $e = 0$, it means that no exams are given: students enrol in the schooling system without taking any exams and drop as a job offer arrives; when $e = e_L$, students give few exams per year: this value captures students ending up being "*fuori corso*"; finally, when $e = e_H$, all exams are given and students achieve graduation. Human capital is rewarded in the labour market only in case the degree is completed, which means if $e = e_H$. The number of exams given are considered for unit of time.

Wages are linear in individual productivity, which is observable, plus a wage premium β in case schooling is terminated. A continuum of wages is thus observable, that map from individual ability to the interval space $[0,1]$. For graduates, the wage function shifts upwards by a factor β. For the sake of simplicity, the productivity due to schooling completion rises in the same amount independently of individual ability.

The individual payoff functions are defined as follows:

$$\begin{cases} U_1(s=0) = \theta_j & \text{if education is not acquired} \\ U_1(s=1, e_i=0) = \theta_j - k & \text{if no exams are given} \\ U_1(s=1, e_i=e_L) = \theta_j - k - \frac{e_L}{\theta_j} & \text{if few exams are given} \\ U_1(s=1, e_i=e_H) = \theta_j + \beta - k - \frac{e_H}{\theta_j} & \text{if all exams are given} \end{cases} \tag{1}$$

By comparing payoff functions for different educational choices, it comes immediately out that the utility derived by enrolling without sustaining any exams or just few of them, is always lower than the utility derived by no enrolment at all, since both sources of cost, k and e_L, are strictly positive:

$$U_1(s=0) > U_1(s=1, e_i=0, e_L)$$
$$\theta_j > \theta_j - k$$
$$\theta_j > \theta_j - k - \frac{e_L}{\theta_j}$$

The intuition is straightforward: if a partial human capital accumulation is not compensated by the prospect of future gains, there are no incentives to enter university without terminating it; therefore, the two actions, enrolment without taking any exams and enrolment giving only few exams are strictly dominated by the decision of no enrolment at all.

Thus, we need to determine who enrols finishing graduate studies, comparing the utility deriving from the choice of no enrolment with the utility deriving from achieving graduation:

$$\begin{aligned} U_1(s=1, e_i = e_H) &\geq U_1(s=0) \\ \theta_j + \beta - k - \frac{e_H}{\theta_j} &\geq \theta_j \\ \theta^* &\geq \frac{e_H}{\beta - k} \end{aligned} \tag{2}$$

Individuals with ability $\theta_j > \theta^*$ will afford human capital investment, while those with $\theta_j < \theta^*$ will not. The condition derived compares costs and benefits of the investment: demand for education is higher when returns to education rise; it declines as the direct cost k of schooling attendance and the non pecuniary cost of education e_H grow.

When information is complete there are no benefits from enrolling in university without sustaining exams: therefore, the parking option is not an equilibrium.

4.2 Asymmetric information

Now we introduce the hypothesis that information is asymmetric. Employers do not observe young's ability, but they do know the distribution of abilities and they observe the young's educational status. Students know their ability level and choose strategically the optimal educational path.

We maintain the same framework specified in the previous subsection, except for the fact that now a game theoretical approach is introduced in order to define strategies and equilibrium. The previous model is modified in a signalling one, still preserving the hypothesis that individual productivity increases as university is completed.

We analyze the structure of the game. This is a Bayesian game with asymmetric information and without uncertainty. The private information that a player has at the start of the game is called the type of the player. To define the game, we must specify a set of players N and, for each player i in N, a set of possible actions C_i, a set of possible types T_i, a probability function P_i and a utility function U_i.

The players of the game are Nature, young and two employers. The timing is described as follows: Nature makes the first move, choosing realizations of the random variable that determines each player's ability type and each player observes the realization of only his own random variable.

Given this private information, at time one young moves, choosing between enrolment into university ($s = 1$) and not enrolment ($s = 0$). At time two they choose the number of exams they want to give ($e = 0, e_L, e_H$). The choices of s and e are a way for the young to communicate their type under incomplete information.

The set of strategies of the first player can be summarized as follows:

$$S_1 = \{(s = 1, 0), (e = 0, e_L, e_H)|\theta\}$$

At time three firms play. They offer a wage contract $w(s, e)$ based on the observed signal. The young accepts the contract or rejects it. Dynamic is not involved here, meaning that players do not choose actions over time: wage offers arrives after the signal has been observed, not before or meanwhile it is acquired.

The set of strategies for employers is define as follows:

$$S_2 = \{(w|s = 0), (w|s = 1, e_i = 0), (w|s = 1, e_i = e_L), (w|s = 1, e_i = e_H)\}$$

As before, there is a continuum of types, who differ according to ability θ_j. We assume $\theta_j \sim U[0, 1]$ with density function $f(\theta)$.

The output of the signed contract is θ if degree is not completed, and $\theta + \beta$ in case it is completed, $e = e_H$ because obtaining the degree enhances individual productivity.

Incomplete information prevents firms from observing the underlying parameter θ; however, they know that independently from individual ability, those who attain graduation increase their productivity by a common factor β.

All players are risk neutral. The payoff functions are now defined as follows:

$$\begin{cases} U_1 = w(\theta) - s\left[k + (\frac{e_i}{\theta_j})\right] & \text{if the young accepts the contract} \\ U_1 = 0 & \text{if the young does not accept the contract} \end{cases} \tag{3}$$

$$\begin{cases} U_2 = \theta + \beta e_H - w(\theta) & \text{for the employer whose contract is accepted} \\ U_2 = 0 & \text{for the other employer} \end{cases} \tag{4}$$

Acquiring the signal involves monetary cost k and non monetary costs. The latter are represented by the term $\frac{e_i}{\theta_j}$, with the standard form indicating that giving a high number of exams is more costly for an individual if his ability takes a lower value. This specification permits that in equilibrium separation among types occurs.

Usually, this cost component is interpreted as years of education or grade point average: if the sacrifice of a year of earnings is higher for a low ability worker, years of education can serve as a signal; equivalently, if less smart students must work harder in order to get a high grade, then grade point can also be a signal. But since number of exams given are observable as years of education and grade point, this interpretation does not change the spirit of the analysis.

We are looking for the following ability intervals corresponding to each strategies so as to characterize the separating equilibrium of the game:

$$SE = \begin{cases} s|\theta \in (0, \theta_1) = 0 \\ s|\theta \in (\theta_1, \theta_2) = 1, e|\theta \in (\theta_1, \theta_2) = 0 \\ s|\theta \in (\theta_2, \theta_3) = 1, e|\theta \in (\theta_2, \theta_3) = e_L \\ s|\theta \in (\theta_3, 1) = 1, e|\theta \in (\theta_3, 1) = e_H \end{cases}$$

We show that the separating equilibrium is a perfect Bayesian equilibrium by using the standard constraints that an equilibrium must satisfy. The set of separating contracts must maximize the utility of each type subject to two constraints: the participation constraint, which requires that firms can offer the contract without making losses; and the self selection constraint, which ensures that high ability types are not attracted by the contract offered to low ability types, and that low ability types are not attracted by the contract offered to high ability types.

The participation constraint for the employer requires that:

$$\begin{aligned} U_2((s,e), w|\theta) = \theta_j - w(s,e) \geq 0 \\ w(s,e) \leq \theta_j \end{aligned} \tag{5}$$

In particular, the wage schedule offered in the separating equilibrium, given the signal, is the following:

$$\begin{aligned} U_2((1, e_H), w|\theta) \geq U_2((1, e_H), 0|\theta) \\ w(1, e_H) \leq E(\theta|(\theta \in (\theta_3, 1)) \\ w(1, e_H) \leq \frac{\theta_3 + 1}{2} + \beta \end{aligned} \tag{6}$$

$$U_2((1,e_L),w|\theta) \geq U_2((1,e_L),0|\theta)$$
$$w(1,e_L) \leq E(\theta|(\theta \in (\theta_2,\theta_3))$$
$$w(1,e_L) \leq \frac{\theta_2+\theta_3}{2} \tag{7}$$

$$U_2((1,0),w|\theta) \geq U_2((1,0),0|\theta)$$
$$w(1,0) \leq E(\theta|(\theta \in (\theta_1,\theta_2))$$
$$w(1,0) \leq \frac{\theta_1+\theta_2}{2} \tag{8}$$

$$U_2((0),w|\theta) \geq U_2((0),0|\theta)$$
$$w(0) \leq E(\theta|(\theta \in (0,\theta_1))$$
$$w(0) \leq \frac{\theta_1}{2} \tag{9}$$

Wages depend on observable characteristic, the signal, plus a mark up remunerating the increased productivity due to schooling attainment. Moreover, competition between employers makes the constraint hold as equalities.

Now we proceed by solving the self selection constraints. For each ability interval we are looking for, it is sufficient to look at restrictions over the marginal individual, that is the one indifferent between the contract offered to those with an ability level slightly lower than his and the contract offered to types with an ability level slightly higher than his.

In particular, we start with the lowest ability interval, $\theta \in (0,\theta_1)$: it includes young that in the separating equilibrium do not enrol ($s = 0$). We need to show that the individual with ability $\theta = \theta_1$ is indifferent between following strategy $s = 0$ and strategy $s = 1$, $e = 0$

$$U_1(0,w|\theta=\theta_1) = U_1((1,0),w|\theta=\theta_1)$$
$$\frac{\theta_1}{2} = \frac{\theta_1+\theta_2}{2} - k$$

and solving the expression for θ_2:

$$\theta_2 = 2k \tag{10}$$

This expression can be interpreted as follows: the cost to acquire the signal, k, must not exceed the additional benefit following from holding such a cost, the marginal wage.

Then, we need to show that individual with $\theta = \theta_2$ is indifferent between the contract $s = 1$, $e = 0$ and the contract $s = 1$, $e = e_L$:

$$U_1((1,0), w|\theta = \theta_2) = U_1((1, e_L), w|\theta = \theta_2)$$
$$\frac{\theta_1 + \theta_2}{2} - k = \frac{\theta_2 + \theta_3}{2} - k - \frac{e_L}{\theta_2}$$

which is satisfied if:

$$\theta_2(\theta_3 - \theta_1) = 2e_L \tag{11}$$

Analogously, the threshold is define as the ratio between additional cost and marginal benefit.

Finally, we show that the individual with $\theta = \theta_3$ is indifferent between following the strategy $s = 1$, $e = e_L$ and the strategy $s = 1$, $e = e_H$

$$U_1(1, e_L|\theta = \theta_3) = U_1(1, e_h|\theta = \theta_3)$$
$$\frac{\theta_2 + \theta_3}{2} - k - \frac{e_L}{\theta_3} \geq \frac{\theta_3 + 1}{2} + \beta - k - \frac{e_H}{\theta_3}$$

which is satisfied if:

$$\theta_3(1 - \theta_2 + 2\beta) = 2(e_H - e_L) \tag{12}$$

The conditions derived guarantee the separating equilibrium holds. Solving the equilibrium conditions for the three thresholds:

$$\theta_1^* = \frac{2(e_H - e_L)}{1 - 2k + 2\beta} - \frac{e_L}{k} \tag{13}$$
$$\theta_2^* = 2k \tag{14}$$
$$\theta_3^* = \frac{2(e_H - e_L)}{1 - 2k + 2\beta} \tag{15}$$

Unlike the pooling equilibrium, this equilibrium does not need to specify beliefs: either of the four educational choice might be observed in equilibrium, so Bayes' rule always tells to the employers how to interpret what they see. If an employer sees a young enrolled in university he deduces that his ability level is higher than the ability of the young that is not enrolled. The same reasoning holds for the number of exams observed: when a firm observes e_H, which means graduation, he recognizes that the worker's ability is in the highest interval.

This model elapses to the standard signalling model if e fails to be a choice variable and is forced to assume value e_H. In this case, commitment to terminate schooling is assumed and no drop out or *fuori corso* would be observed.

4.3 Existence of separating equilibria

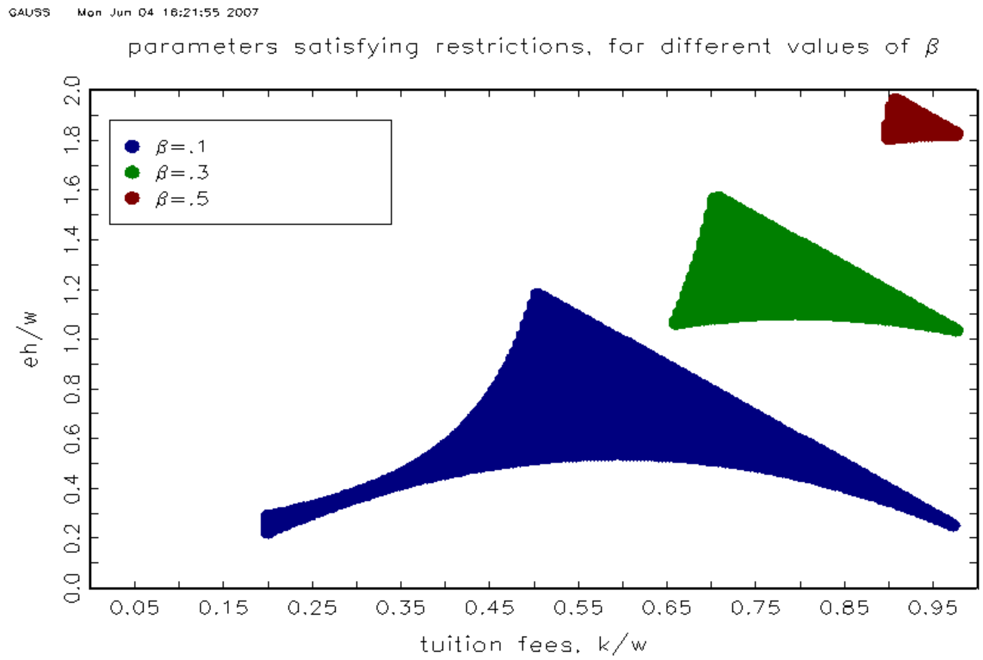
The model determines endogenously the three thresholds. To characterize the separating equilibria we need to specify the following ranking condition:

$$\theta_1^* < \theta_2^* < \theta_3^*$$
$$\frac{2(e_H - e_L)}{1 - 2k + 2\beta} - \frac{e_L}{k} < 2k < \frac{2(e_H - e_L)}{1 - 2k + 2\beta}$$

It imposes restrictions over the relationship between the two sources of cost, the direct monetary cost k and the non monetary costs e_H, e_L.

We solve the model numerically, fixing $e_L = 0.4e_H$ to rule out equilibria characterized by scaling effects. This value has been chosen because it gives separating equilibria for a complete range of β values without affecting the characterization of results. Our solution features existence of multiple separating equilibria.

The graph depicted below shows the region of values of the relevant parameters that satisfy restrictions. Tuition fees are normalized by the average wage net of graduation mark up, $\overline{w} = 0.5$ and are represented on the x-axis. The cost of terminating university (e_H) is normalized as well by the average wage and it is indicated on the y-axis. Inequalities are solved for different values of β, represented graphically by different colors.



The region of values that guarantee the existence of separating equilibria is decreasing in β and in $\frac{e_H}{\overline{w}}$. We can broadly identify two types of equilibria: one in correspondence of low values of β and one in correspondence of high values of β.

The first type of parking equilibria features low values of graduation premium, an entire range of exam taking relative cost and a large range of tuition fees values. The intervals of tuition fees and relative exam taking values supporting such equilibria are the largest the lower is β. Expressing them as a function of the average wage net of graduation mark up, $\overline{w} = .5$ and for $\beta = 0.1$, the values supporting this equilibrium are:

$$k \in [\frac{1}{5}\overline{w}, \overline{w})$$
$$e_H \in [\frac{1}{5}\overline{w}, \overline{w}]$$
$$e_L = 0.4 e_H$$

The second type of parking equilibria features high graduation premium, very high relative cost of obtaining graduation and high tuition fees. In particular, for $\beta \simeq \overline{w}$:

$$k \simeq \overline{w}$$
$$e_H \in [\frac{18}{5}\overline{w}, 4\overline{w}]$$
$$e_L = 0.4 e_H$$

This type of equilibria is mainly supported by a significant non monetary cost implied in completing education. The intuition is simple: if it is very difficult to terminate university, then the parking strategy is an inevitable outcome even in correspondence of relevant graduation mark up and high direct monetary costs.

Finally, for $\beta^* > \frac{11}{10}\overline{w}$ separating equilibria fail to exist: there are no values of k and e_H able to support the existence of such an equilibrium.

Our discussion is mainly concentrated on the first type of equilibria, that feature an entire range of tuition fees and exam taking cost values in correspondence of a low graduation premium. The reason relies upon the fact that this solution links institutional peculiarities and labour market characteristics, while the other depends on the individual specific non monetary cost of education. β, that represents reward to graduation in the labour market, can as well indicate the degree of wage compression: only when wage compression is high, there are rooms to support such a separating equilibrium. For β falling in the required interval, the range of tuition fees values supporting such equilibria is increasing in the degree of wage compression. Specially, these separating equilibria are not characterized by low values of tuition fees; noticeable, also significant values of fees support such equilibria.

The intuition of our results is straightforward: if labour market does not reward enough the degree, the opportunity cost of getting graduated is not so high to incentive students to finish university; on the contrary, if graduation premium is high, students make a better deal by terminating studies. If it is the case, the parking strategy fails to exist, unless it is too difficult to terminate university.

4.4 Comparative statics

We perform a comparative statics analysis to study the effect of the relevant parameters of the model, k, e_H and β on the three thresholds.

The effect of an increase in tuition fees over the proportion of students within each educational status is the following:

$$\frac{\partial\theta_1^*}{\partial k} = \frac{4(e_H - e_L)}{(1-2k+2\beta)^2} + \frac{e_L}{k^2} > 0 \tag{16}$$

$$\frac{\partial\theta_2^*}{\partial k} - \frac{\partial\theta_1^*}{\partial k} = 2 - \frac{4(e_H - e_L)}{(1-2k+2\beta)^2} - \frac{e_L}{k^2} \tag{17}$$

$$\frac{\partial\theta_3^*}{\partial k} - \frac{\partial\theta_2^*}{\partial k} = \frac{4(e_H - e_L)}{(1-2k+2\beta)^2} - 2 \tag{18}$$

$$1 - \frac{\partial\theta_3^*}{\partial k} = -\frac{4(e_H - e_L)}{(1-2k+2\beta)^2} < 0 \tag{19}$$

The sign of derivatives with respect to tuition fees are defined for the fraction of not enrolled students and the proportion of graduated on time. In particular, if tuition fees rise, enrolment rate decreases and the proportion of students that achieve graduation on time falls.

For the proportion of students that drop out and that obtain graduation with delay, we need to discuss the sign. In detail, these proportions fall for a raise in k when the following inequalities are satisfied:

$$\begin{aligned} \frac{\partial\theta_2^*}{\partial k} - \frac{\partial\theta_1^*}{\partial k} &= 2 - \frac{4(e_H - e_L)}{(1-2k+2\beta)^2} - \frac{e_L}{k^2} < 0 \\ \frac{4k^2(e_H - e_L)}{(1-2k+2\beta)^2} &- e_L > 2k^2 \end{aligned} \tag{20}$$

$$\begin{aligned} \frac{\partial\theta_3^*}{\partial k} - \frac{\partial\theta_2^*}{\partial k} &= \frac{4(e_H - e_L)}{(1-2k+2\beta)^2} - 2 < 0 \\ \frac{4(e_H - e_L)}{(1-2k+2\beta)^2} &< 2 \end{aligned} \tag{21}$$

To discuss the effect of an increase in e_H, that is the non monetary cost of education, two thresholds are rewritten substituting $e_L = 0.4e_H$:

$$\theta_1^* = \frac{1.2e_H}{(1-2k+2\beta)} - \frac{0.4e_H}{k}$$

$$\theta_3^* = \frac{8e_H}{5(1-2k+2\beta)}$$

$$\frac{\partial\theta_1^*}{\partial e_H} = \frac{1.2}{(1-2k+2\beta)} - \frac{0.4}{k} > 0 \quad if \ \ (a)\ 1+2\beta < 5k \tag{22}$$

$$\frac{\partial\theta_2^*}{\partial e_H} - \frac{\partial\theta_1^*}{\partial e_H} = -\frac{2e_H}{1-2k+2\beta} < 0 \quad if \ \ (b)\ 1+2\beta > 2k \tag{23}$$

$$\frac{\partial\theta_3^*}{\partial e_H} - \frac{\partial\theta_2^*}{\partial e_H} = \frac{2e_H}{1-2k+2\beta} > 0 \quad if \ \ (b)\ 1+2\beta > 2k \tag{24}$$

$$1 - \frac{\partial\theta_3^*}{\partial e_H} = -\frac{2e_H}{1-2k+2\beta} < 0 \quad if \ (b)\ 1+2\beta > 2k \tag{25}$$

It turns out that conditions (a) and (b) are always satisfied. If cost of exam taking rises, enrolment rate, drop out and on time graduation fall, while graduation *fuori corso* raises. The recent reform, which reduces to 3 years the length of first degrees, can be represented by a decrease in e_H. As a consequence, enrolment, drop out and on time graduation should rise, while *fuori corso* should fall.

Lastly, we study the effect of an increase of β, the labour market premium for graduation:

$$\frac{\partial\theta_1^*}{\partial\beta} = -\frac{4(e_H - e_L)}{(1-2k+2\beta)^2} < 0 \tag{26}$$

$$\frac{\partial\theta_2^*}{\partial\beta} - \frac{\partial\theta_1^*}{\partial\beta} = \frac{4(e_H - e_L)}{(1-2k+2\beta)^2} > 0 \tag{27}$$

$$\frac{\partial\theta_3^*}{\partial\beta} - \frac{\partial\theta_2^*}{\partial\beta} = -\frac{4(e_H - e_L)}{(1-2k+2\beta)^2} < 0 \tag{28}$$

$$1 - \frac{\partial\theta_3^*}{\partial\beta} = \frac{4(e_H - e_L)}{(1-2k+2\beta)^2} > 0 \tag{29}$$

If wage compression decreases, enrolment rate, drop out and on time graduation should rise, while *fuori corso* should fall.

5 Empirical strategy

The derived model has a straightforward empirical application. It is indeed possible to rank young's wage according to the observed educational status: not enrolled, dropped, *fuori corso* and on time graduated as follows:

$$w(0) < w(1,0) < w(1,e_L) < w(1,e_H) \tag{30}$$

To this aim, we use the "2001 Survey on the school and work experiences of 1998 high school graduates" and the "2001 Survey on the school and work experiences of 1998 university graduates". Data originated from the first survey are a cross sectional sample of 20,208 high schools leaves interviewed by the National Statistical Office (ISTAT) three years after secondary school completion, while data from the second survey contain a sample of 26,006 university leaves interviewed three years after tertiary graduation.

The sample contains a wide range of information on post high school experiences, either in the tertiary education system, including whether drop out or *fuori corso* occurred, and the labour market. In addition, information on personal characteristics and family background is available.

Observations in the two databases are joined in one dataset. The entire sample has been reduced to nearly 21,000 observations by keeping those employed and declaring their wage.

Table 7 tabulates the distribution of young according to their educational status in the Istat sample and in the entire population (data refer to 2001): Istat under-represents the number of students that drop out and over-represents the number of students graduated on time. The reason for the first observation relies on the fact that the item concerning drop out is recorded among secondary school leaves within the three years after graduation period. Thus, it cannot take into account those who decide to drop later on. Concerning the amount of on time graduates, we believe that the difference can be explained by different definitions of *fuori corso:* we labelled as *fuori corso* those who took the degree more than one year beyond the normal completion time; while Miur labelled as *fuori corso* those who got graduation just beyond the normal completion time. These differences cannot be accounted for by the fact that our sample has been restricted to those earning a wage, because the distribution of young in the sample according to their educational status resembles that of those working and declaring their wage.

Table 7. Distribution of young according to their educational status

	Istat sample (workers)			**Entire population (source: Miur, 2001)**		
Educational status	Freq.	Percent	Cum.	Freq.	Percent	Cum.
Not enrolled	5,708	26.38	26.38	131,618	29.19	29.19
Drop out	1,000	4.62	31.01	152,182	33.75	62.94
Fuori corso	8,665	40.05	71.06	128,704	28.54	91.49
On time graduated	6,261	28.94	100	38,378	8.51	100
Total	21,634	100	100	450,882	100	100

Our empirical strategy is aimed to test whether young's wage can be ranked according to academic performance. To this, we run an OLS regression for the log of net monthly wage of employed graduates. We regress the logarithm of wage against all dummies identifying educational status: not being enrolled, being a dropper, a *fuori corso* and graduated on time. We control for individual characteristics such as gender, experience, potential experience, which corresponds to the difference between the age and the age at which degree was obtained, macro region of residence, mark at exit of secondary school, dummies for type of degree held and for post graduate studies and a dummy for marital status. Additionally, we also include a set of controls for job characteristics: tenure, type of contract, sector of job and a dummy for working more than 40 hours at week.

Results are presented in table 8. The coefficients of the four included dummies display values satisfying the expected ranking: controlling for other characteristics, students who get on time graduation are paid more than those that achieve graduation with delay, who earn an higher wage than those who drop out from the schooling system, which, finally, gain more than young not entered higher education. Obviously, those reaching graduation have a mark up due to increased productivity.

Table 8. OLS Wage regression

Dep variable	log of wage	
	coeff	t-statistics
Not enrolled	0.120	[7.34]***
Drop out	0.140	[7.44]***
Fuori corso	0.350	[8.15]***
Incorso	0.380	[8.89]***
Female	-0.120	[22.63]***
Sec sch score	0.000	[2.93]***
Pot exper	2.200	[229.31]***
Exper	0.020	[3.92]***
Part	-0.560	[56.57]***
Tenure	0.000	[1.38]
Tenure sqr	0.000	[0.93]
Nordov	0.100	[10.87]***
Nordest	0.100	[10.21]***
Center	0.060	[6.88]***
Isle	-0.010	[0.61]
Determ	-0.110	[9.36]***
Permanent	-0.080	[7.14]***
Collabor	-0.050	[5.04]***
Hweek_sup	0.070	[10.43]***
Transp	0.120	[10.91]***
Ind	0.070	[11.84]***
Finance	0.130	[12.17]***
Pubadedh	0.070	[8.63]***
Inform	0.050	[4.82]***
Married	0.040	[6.17]***
Postgraduate	0.010	[1.36]
Mathphy	0.010	[0.35]
Chim-pharm	0.110	[2.67]***
Geo-bio	0.020	[0.52]
Medic	0.210	[4.74]***
Engineer	0.070	[1.72]*
Archit	-0.020	[0.52]
Agric	-0.060	[1.29]
Econ	0.020	[0.53]
Polisc	0.010	[0.14]
Law	-0.080	[1.92]*
Letters	-0.050	[1.28]
Languages	-0.010	[0.19]
Teaching	-0.080	[1.84]*
Psycol	0.010	[0.12]
Observations	17583	
R-squared	1.000	

Robust t statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

As a robustness check, we test whether four coefficients are statistically ranked. To this aim, we perform a one side t-test following this strategy: at first, we test whether the difference between two consecutive dummies coefficients is negative, by performing the Wald test for the null hypothesis that this difference is equal to zero. The Wald test given is an F test with one numerator degree of freedom and n denominator degrees of freedom. We exploit the fact that the F distribution and Student's t distribution are directly related: the square of a value of the Student's t with n degrees of freedom is distributed as a F with one numerator degree of freedom and n denominator degrees of freedom.

We compute the p-values for the one-sided test using the reverse cumulative Student's t distribution function along with the returned results from the Wald test. Results are shown in table 9: the null hypothesis is that our coefficients are significantly ranked. We cannot reject the null for all dummies. Thus, the coefficients of our dummies are statistically ranked.

Table 9. Test rank for dummies

H_0: Drop> No enrolled	p-value=0.95
H_0: Fuori corso > Drop	p-value=0.99
H_0: On time grad. > Fuori corso	p-value=0.99

6 Conclusion

Our model is able to rationalize the facts depicted in the first section, by showing that when asymmetric information prevents firms from observing individual productivity it is optimal for students to adopt strategies with the aim to differentiate themselves. In particular, academic performance reveals useful information which would be otherwise unobservable. These incentives arise because of incomplete information: under complete information no gains are obtained by staying in university without increasing own productivity.

The derived model is a mixture of human capital investment and signalling model and leverages the interesting features of both models. In fact, investment in education has a direct effect on a person's ability to be productive if the period of schooling is completed. Partial human capital accumulation is not productivity enhancing, but useful for demonstrating individual ability to employers. The intriguing idea is that students entered university are not committed to terminating it (i.e. to choose e_H). Nevertheless, by choosing to entry, they differentiate themselves from those who do not even enrol.

The hypothesis that being a student is better than being unemployed gives rise to incentives for implementing the parking strategy: for some students it is optimal staying in the university without putting any or low effort instead of looking for a job while unemployed or graduate; the structured waiting is optimal since it sends a useful signal, but time is wasted without improving individual productivity if university is not completed.

The characterization of equilibria gives useful insights for policy. In fact, separating equilibria exist only for restricted values of graduation premium, a range of tuition fees and relative cost of exam taking values. The result links institutional features and labour market conditions: the intervals of tuition fees values supporting such equilibria is growing in the degree of wage compression. Thus, if the labour market is characterized by a high degree of wage compression, incentives for adopting the parking strategies are not ruled out by increasing tuition fees or decreasing the length of studies.

It is instead optimal to tackle this issue with policies that go in two directions: augmenting rewards to graduation on one hand whilst increasing direct costs of higher education on the other.

Besides this, our theory provides several empirical implications that we will test in the next paper at the level of Italians regions, provinces and universities. The aim is to measure the relative role of the two relevant dimensions, labour market and universities, in effecting university attainment and academic performance.

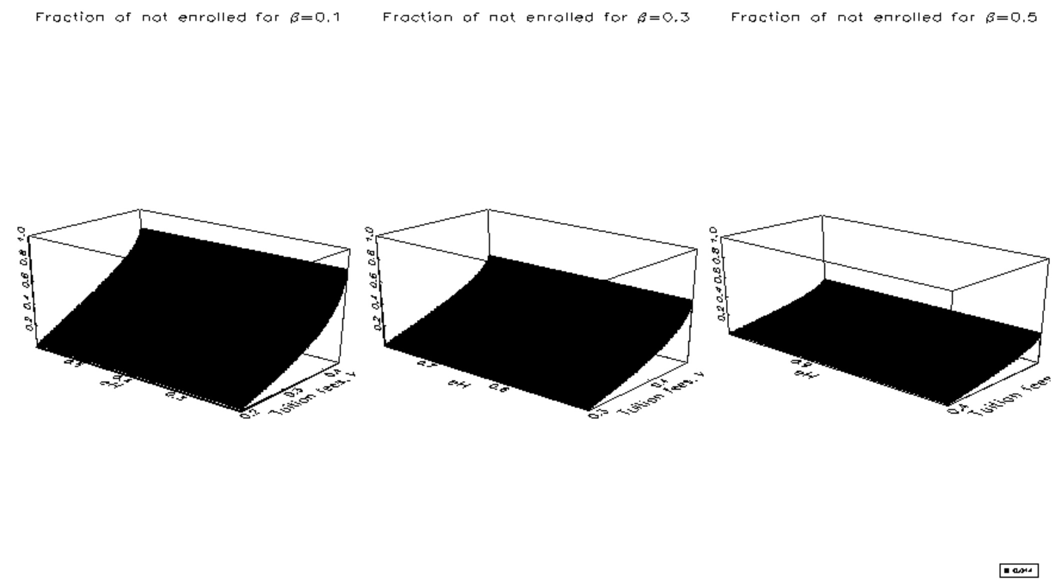
7 Appendix: graphical characterization of equilibria

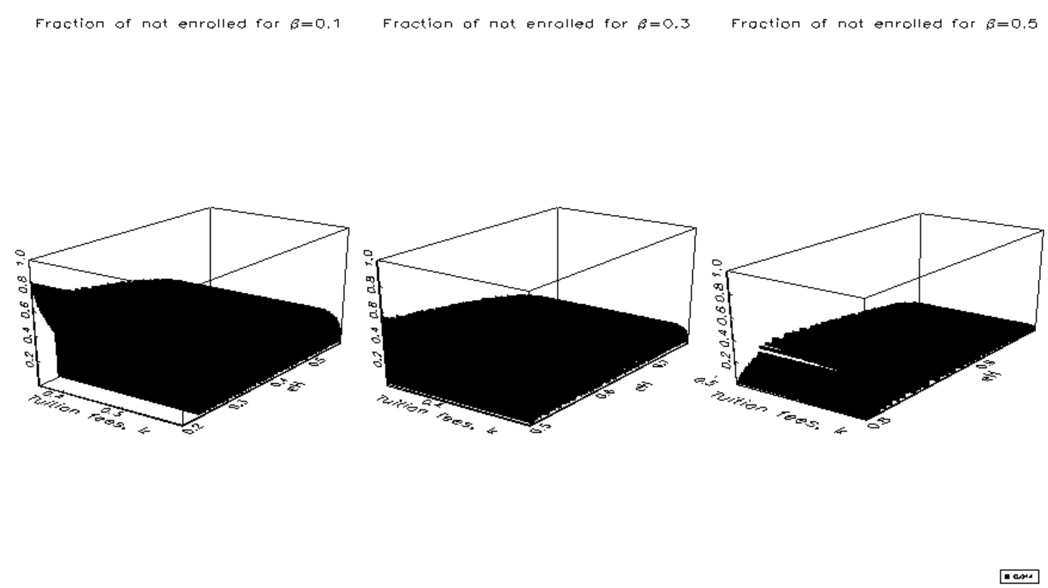
In this section we show the proportion of students within each educational status as a function of the parameters of the model. This appendix complements with a graphical inspection the comparative analysis section, confirming previous results.

The amount of young within each educational status can be easily identified thanks to the fact that θ is distributed according to a uniform distribution in the unitary interval. The proportion of students not enrolled is defined by θ_1^*, the proportion of drop out students is the difference $\theta_2^* - \theta_1^*$, *fuori corso* are identified by $\theta_3^* - \theta_2^*$; finally, $1 - \theta_3^*$ represents on time graduated students.

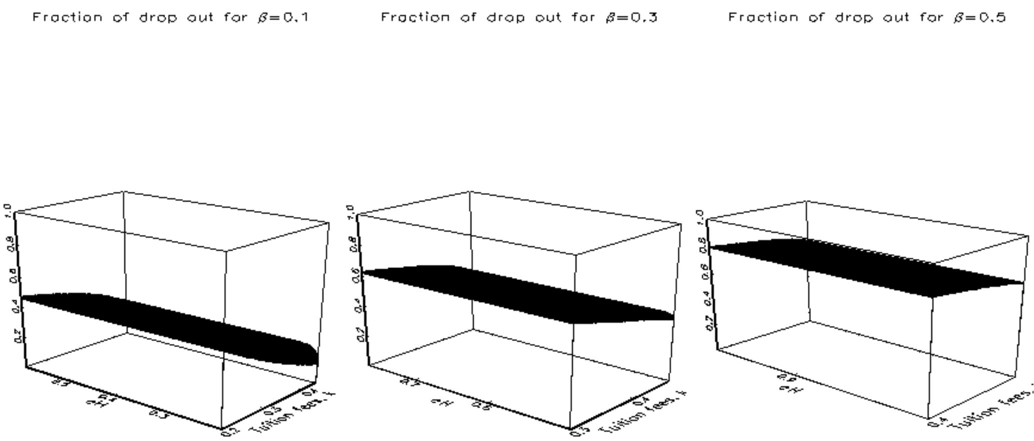
Surfaces are drawn both for increasing tuition fees (first graph, where tuition are represented on the x-axis and exam taking costs on the y-axis) and for raising cost of exam taking (second graph, where the reverse is done). In such a way, it is possible to graphically inspect the effect of the three relevant parameters, β, k and e_H on the proportion of young within each interval.

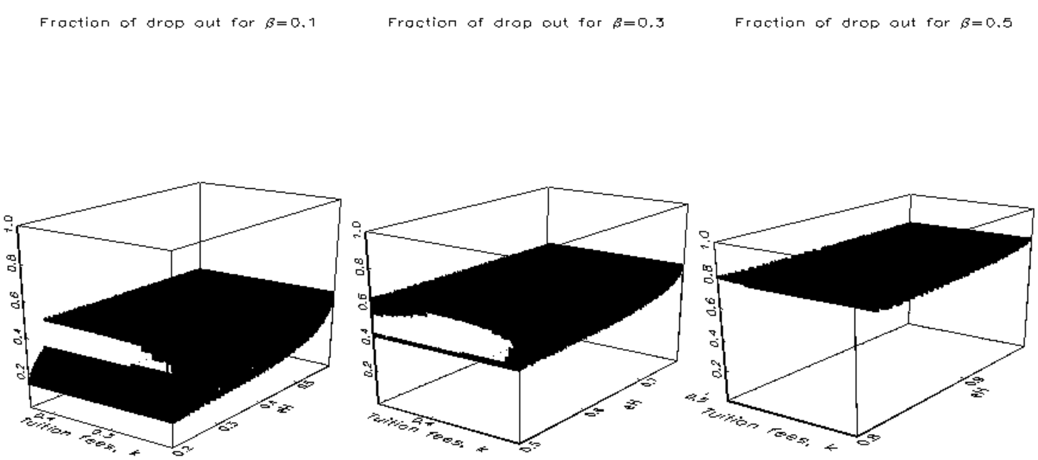
The following graph shows the fraction of young who do not enter university: this proportion is increasing in tuition fees and in the degree of wage compression. The relation between number of students not enrolled and cost of exam taking is not monotonic.





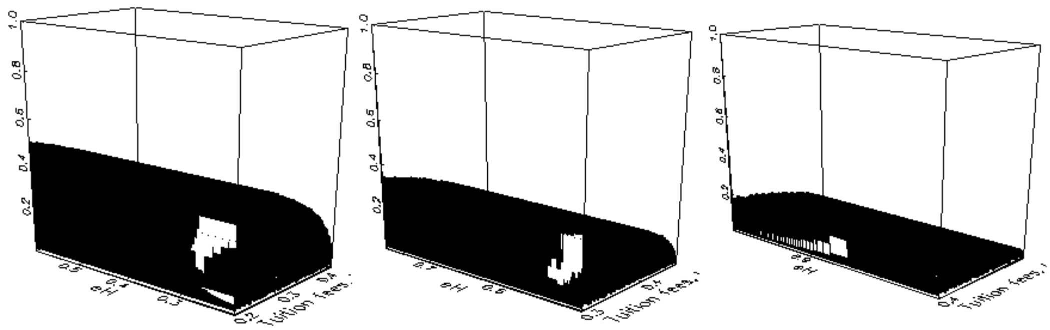
The next graph plots the proportion of young that drop out: this value is decreasing in tuition fees and in the degree of wage compression. The high proportion of drop out for $\beta = \overline{w}$ is a consequence of the fact that this separating equilibrium holds in correspondence of a high cost of terminating university. Thus, several students drop before graduating. The relation between drop out and cost of exam taking is not graphically clearly defined. We will discuss it in the comparative static section.



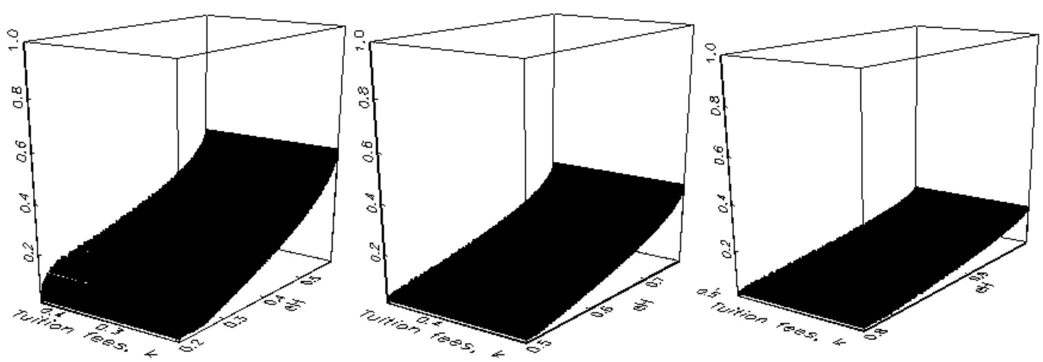


The fraction of students that achieve graduation with delay is decreasing in tuition fees and increasing in the degree of wage compression. It is also increasing in the cost of terminate university, as expected.

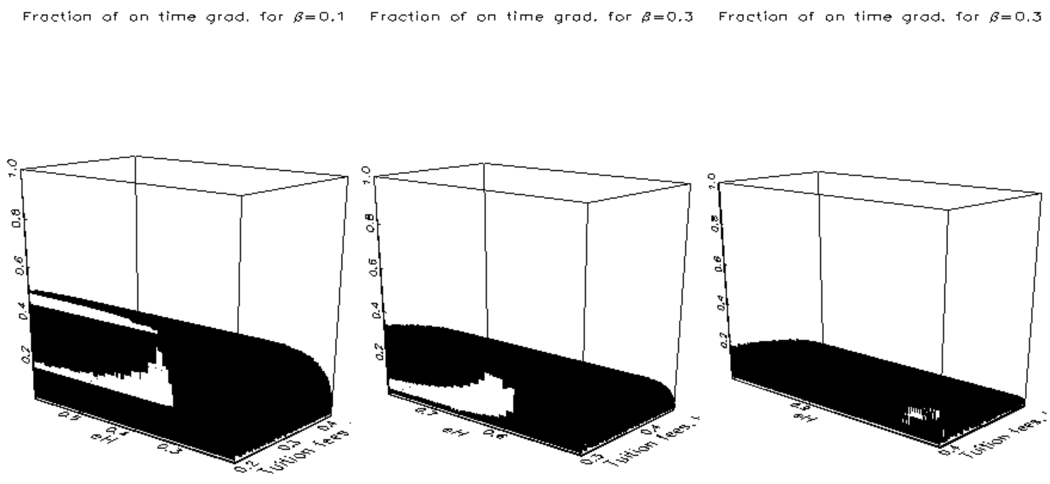
Fraction of fuori corso, for β=0.1 Fraction of fuori corso, for β=0.3 Fraction of fuori corso, for β=0.5

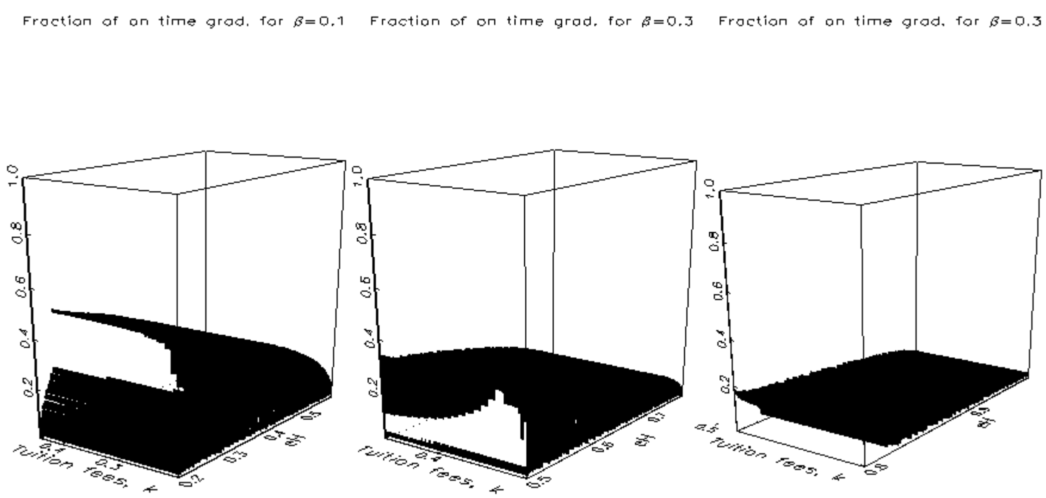


Fraction of fuori corso, for β=0.1 Fraction of fuori corso, for β=0.3 Fraction of fuori corso, for β=0.5



Finally, the fraction of students graduated on time is decreasing in tuition fees and increasing in the degree of wage compression. Also, it is decreasing in the cost of terminating university, e_H. The fraction of students that achieve graduation on time is not increasing in the graduation premium, as we would expect. As before, the reason relies upon the fact that the separating equilibrium for high values of β is supported by a significant cost of terminating university.





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