Higher Education Choices, Students' Risk Aversion and Learning-to-learn

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Abstract

We model students' decisions regarding higher education curricula as a decision under uncertainty. Uncertainty originates in the probability of not obtaining the diploma because of academic failure. We focus on the binary choice between university and higher education vocational training. In this context, the attitude of students towards risk contributes to explain education decisions. We show that when the costs of the various curricula are comparable, students displaying a lower degree of risk aversion are more prone to choose university degrees. Moreover, when students who failed at university are allowed to enrol in higher education vocational training at the same cost than first generation students, there exists a bias towards university which benefits to students exhibiting a low risk aversion.

1 Introduction

It is widely acknowledged by now that enrolling into higher education is a valuable investment for individuals. Recent estimates such as those of Card (1999) for the United States report returns per year of schooling ranging from 8 to 13 percent. However, starting such higher education curricula is also a risky decision. This is clearly attested by the high failure rates that characterizes higher education programs, especially at the end of the first year, and in particular accross continental Europe. As a matter of fact, many individuals do not enter into higher education when they finish their secondary degree, and when they do, only a fraction of them opts for university.

Several arguments have been explored in the literature in order to explain these last facts: households may face borrowing constraints due to imperfect

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credit markets[1] or they might hold misleading expectations on the salary levels associated to the different options (Borghans et *al.*, 1996). As pointed by Rochat and Demeulemeester (2001), students choices sometimes look "irrational" in that they reveal preferences for fields in low demand on the job market or fields which give bad expected economic returns. However, a recent study by Webbink and Hartog (2004) shows that students actually predict almost perfectly the starting salaries.

This seemingly irrational behaviour of students is explained by Rochat and Demeulemeester (2001) who informally argue that students do not only take into account the economic returns but also their chance of academic success. As argued by Shen (2003) attending higher education involve some risk originating in the quality of teaching, unanticipated changes in market conditions and the probability of failure. In the present paper, we explicitly focus on the risk involved in the higher education choices. We are in particular interested in identifying the role of risk aversion as a determinant of students' decisions.

Notice that while there exists an already vast literature relating human capital investment and uncertainty of labour incomes throughout the working career,[2] very little attention has been paid to the role of uncertainty in the immediate outcome of education choice among different education opportunities. Actually, few studies have analyzed this question from an empirical point of view (Weiss [1972] and Levhari and Weiss [1974]). More recently, Shew (2003) addressed this question by considering the presence of selection bias. His main result is that risk differentials between the several education options are significative, implying that schooling choices are risky investments. Accordingly, students' attitude towards risk, *i.e.* risk aversion, becomes an important determinant of realized choices. In addition, when we consider the negative correlations between risk aversion and parent's income (Brunello, 2003), an analysis of schooling choice as a decision under uncertainty might also entail some significant redistributive implications.

In order to focus on the risk component of schooling decisions, we assume that students perfectly anticipate the various flows of future incomes associated with their education decisions, as well as their probability of success in the various curricula. In this context, they make their decisions by comparing the uncertainty involved in the various opportunities they face. A first question we address is the extent to which students' decisions reflect their risk aversion? Then, we consider the extent to which the specification of the

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[1] See for instance Becker (1993) and Hanusek et *al.* (2003).
[2] See for example Eaton and Rosen (1980).

outside option in case of failure biases students' decisions. In particular, we focus on the (often observed) case where after failing at university, students are allowed to enter into higher education vocational training while bearing the same cost as a first generation student.

When considering the case of a student who contemplates to enrol in higher education training after some initial failure at university, we shall assume that these students are characterized by a lower probability of failure than fresh students (i.e. students attending vocational training right after their secondary curriculum). It is indeed empirically established that the pass rate in first year vocational training is higher for students that already attended university before starting at superior level. For instance, in the French Speaking Community of Belgium, the total average pass rate in higher education vocational programs amounts to .40 whereas this pass rate jumps to .61 when first generation students are withdrawn from the sample. Even though they actually failed at university, those students seem to have learned "something", they have developed a better know-how. We call this phenomenon "*learning-to-learn*". [3] Several questions come then to mind: To what extent does the possibility of switching, combined with the learning to learn effect bias choices towards university? And does this bias depend on risk aversion? To what extent the high failure rates we observe for first year students at university might be a consequence of this learning-to-learn effect? The issue is particularly important in European countries where higher education is heavily subsidized. High failure rates in the first year of academic life might indeed impose a too high cost to the society. As a response, political pressure towards diminishing failure rates through various schemes are pervasive.

We establish three main results. First, while it is not possible to unambiguously rank the various curricula as a function of risk aversion, it is possible to show that when the cost of education, as borne by the students, do not differ significantly across curricula, those students exhibiting a low risk aversion typically engage into university, whereas students with a large risk aversion engage into higher education vocational training. Second, the possibility of switching from university to higher education vocational training after an initial failure, combined with learning to learn effect, does not necessarily bias choices towards university. However, when it does, it is always to the benefit of the students with limited risk aversion. Third, we show that in presence of learning to learn effects, a increase in the pass rates

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[3] Obviously learning to learn effects are not the only possible explanation. For instance, self-selection bias must play a role.

of students enrolling into higher education vocational training may actually increase enrolment in the university curricula.

Section 2 presents the basic model. Section 3 considers the case where education choices are mutually exclusive. This section aims at highlighting the specific insights of the uncertainty approach to our understanding of students decisions. Section 4 is devoted to the analysis of learning-to-learn effects and their implications on students' choices. We conclude in section 5.

2   Assumptions and notations

Any prospective student chooses among three options which are characterized by the different monetary flows they lead to accross the states of nature:

1. On-the-Job Training: this option is characterized by certain wealth L, thereby involving no uncertainty.

2. Vocational Higher Education (or Two-Year College).[4] This option yields a gross wealth B in case the degree is completed. It also involves a direct cost c_s which is borne *ex ante*. Accordingly, in case of degree completion, the net wealth is $B - c_s$ whereas the option yields a level of wealth $L - c_s$ in case of failure.

3. University Degree: This option yields a gross wealth A in case of degree completion and involves a cost c_u (thereby yielding a net wealth of $A - c_u$). In case of failure, the resulting wealth is therefore $L - c_u$.

These various levels of wealth are ranked as follows:

H 1 $L - c_s - c_u < L - c_u < L - c_s < L < B - c_s - c_u < B - c_s < A - c_u$

The particular ranking we assume in H1 is quite natural. We clearly expect $A > B > L$. This captures the fact that, on average, people with university degrees earn more than those who graduated from superior. Similarly, people obtain higher income when they have graduated in superior rather than going to work directly. In the same vein it seems natural to require $c_u > c_s$. For instance, University programs are typically longer than Superior ones. Moreover, attending university often requires moving to larger cities (thereby inducing additional indirect costs). Finally H1 assumes $B - c_s - c_u > L$. Accordingly, students who fail at university do

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[4] We shall refer to this option as "*superior education*", for simplicity.

not reject a priori the possibility of repeating the experience in the superior curriculum. This assumption conforms to casual observation.

The preferences of prospective students are summarized by the following utility function:

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\begin{aligned}
u(w) & = & w & \quad \text{if } w < L \\
& = & \alpha w + (1 - \alpha)L & \quad \text{if } w \geq L
\end{aligned}
$$

The particular function we retain is piecewise linear. Notice that the kink in the utility function occurs at the certain wealth level L. Parameter α offers then a measure of risk aversion. When $\alpha = 1$, the representative student is risk neutral. On the other hand, $\alpha < 1$ captures the presence of risk aversion. The smaller α, the larger the risk aversion.[5] While this function is quite specific, it is instrumental in conducting comparative statics analysis because the degree of risk aversion is fully captured by the unique parameter α.

The second building block of the analysis consists of introducing uncertainty into the picture. To this end, we characterize the university and superior options by a probability of success in the degree completion. A key feature of the model is that this probability might differ according to whether the student is a "first generation" student or not. By definition, only "*first generation*" student enters tertiary education at the time the decision we consider is to be made. The actual cohort of students attending the first year of tertiary education courses is actually made of first generation students and of students who already failed at least once. In this model, we focus on the case of those students who contemplate the possibility of switching to to superior programs after failure at university.

Let p denote the probability of success at university. The probability of success in the superior for a first generation student is denoted by p' while kp' denotes the probability of success in the superior if the student spent already some time at the university but failed[6] before opting for superior. We assume further:

H 2 $k \geq 1$

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[5]For additional comments on this piecewise utility function, see Eeckhoudt et *al.* (1997).

[6]Obviously, the fact that the student passed or failed is actually irrelevant in determining the probability. However, we assume that a student who passes the first university year follows the complete program and succeeds.

Under H2 the probability of succeeding in a superior degree is higher or at least equal for a student having tried a university degree before than for first generation students. Accordingly, attending university courses during one year never reduces the probability of success in superior the next year if this option is chosen after failure at the university. This assumption - when satisfied as a strict inequality - will be referred to as the "*learning to learn*" effect and is meant to capture the fact that, despite of failure, a student might develop some useful know-how when attending university programs.

At the time a student makes his decision regarding the choices of his/her education degree, the probability of success or failure and the corresponding wealth levels are exogenous.[7] Moreover, we do not take into account the fact that students may differ in abilities (*i.e.* there is no heterogeneity and thus no adverse selection at work in the model[8]) and may alter their probability of success by working harder (*i.e.* there is no moral hazard either). Our probabilities should be viewed as the aggregate realized probabilities that are public information for students. In the present paper indeed we focus on students who end up secondary education, a time at which they have little information about their actual individual abilities in higher education programs. In other words, we assume that they base their decisions mainly on the public information available on wealth and probabilities associated to the different options rather than on some private knowledge about their abilities.

Notice thus that in our model, university and superior paths are related to each other in two ways. At a first level, they can be viewed as two competing options from the students point of view. However, since $k > 1$, the probability of success in the superior course may depend - at a second level - on the fact that university courses were chosen previously. Strictly speaking, it could make sense for a student to choose university as a first choice, even though he believes he will not succeed (in the model, it is the case when p takes an arbitrarily low value), simply because the learning to learn effect is very high (k is large).

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[7] In other words, we neglect the fact that the education choice made by a student very likely affects the variability of his income flow. The effect of education on future income flows is a traditional topic in the human capital literature where uncertainty is taken into account (Eaton and Rosen, 1980). We do not consider this issue here in order to focus on the uncertainty pertaining to the possibility of failing.

[8] See for instance Cremer and Gahavazi (1997) for a model where adverse selection plays a key role.

3 Education Decisions under Risk Aversion

Building on the above described model, we analyze the relationship between students' choice of education curricula and risk aversion. To this end, we shall focus first on the case where education decisions are strictly mutually exclusive. In other words we assume that in case of failure, the only outside option available to students is on-the-job training. Given the uncertain prospects associated to the university and superior options, the problem of a representative student can be summarized by the following decision tree:

Figure 1

In a decision tree, we identify the decisions to be made by the individual at the *nodes* of the tree. In this section, there is only one decision node, which we call node 0. At this node, the prospective student chooses either University, Superior, or On-the-job training.

Assume first that the reprensentative student is risk neutral. By definition, this student exclusively compares the expected value of his/her wealth in the various alternatives. These are respectively given by:

$$E_0^u = p(A - L) + L - c_u \tag{1}$$

$$E_0^s = p'(B - L) + L - c_s \tag{2}$$

$$E^o = L \tag{3}$$

A sufficient condition ensuring that only University and Superior curricula are relevant is the following:

H 3 $p' \geq \frac{c_s}{B-L}$, $p \geq \frac{c_u}{A-L}$

Under H3, the student's decision problem summarizes to the comparison of the expected wealth in the two upper branches of the decision tree at node 0. Clearly enough, because he/she maximizes expected wealth, a risk neutral student attends university rather than superior whenever

$$p(A - L) + L - c_u \geq p'(B - L) + L - c_s$$

A necessary and sufficient condition for choosing the university option is therefore:

$$p \geq \frac{p'(B - L) + c_u - c_s}{A - L} = p^N \tag{4}$$

Suppose now that the student is risk averse. In this case, the mere comparison of expected wealth is not sufficient. By definition indeed, a risk

averse agent is not necessarily indifferent between two uncertain prospects which exhibit the same *expected value*. Instead, the agent compares the *expected utility* associated to the various wealth states. In this case, condition H3 is not sufficient anymore to ensure that a risk averse student prefers the superior curriculum, or the university curriculum, to on-the-job training.

In the presence of risk aversion, the probability treshold identified in H3 should be revised upwards. Assume indeed that H3 is satisfied with equality, then the student is offered either a certain wealth L against a lottery with expected value L. A risk averse student will strictly prefer the certain wealth. Notice that in our particular case, on-the-job training actually involves no risk (expected utility equals expected wealth in this case) whereas superior and university are risky. This means that even if the expected wealth associated to the superior option is larger than L, depending on his/her risk aversion, a representative student might prefer the certain wealth L. It is obvious here that risk averse students are systematically biased against higher education when compared with a certain prospect.

Let us focus now in the comparison between university and superior. In the presence of risk aversion, the expected utility associated to university and superior curricula are respectively:

$$V_0^u = E_0^u + (\alpha - 1)p(A - L - c_u) \tag{5}$$

$$V_0^s = E_0^s + (\alpha - 1)p'(B - L - c_s) \tag{6}$$

where E_0^u and E_0^s are given by (1), (2) respectively.

A prospective student would choose to attend the university program if and only if $V_0^u \geq V_0^S$. Solving this inequality in p, we obtain a critical value for the probability of succeeding at university above which our student prefers this option to the superior one. Formally, this threshold is given by:

$$p \geq \frac{p'\alpha(B - L - c_s) - (1 - p')c_s + c_u}{\alpha(A - L) + c_u(1 - \alpha)} = h(p', \alpha) \tag{7}$$

It is *a priori* not obvious that condition (7) is tighter for a risk averse student than for a risk neutral one, i.e. we do not know whether $h(p', \alpha) > p^N$ holds. Indeed, when we compare university and superior, we compare two uncertain prospects which cannot be ranked in terms of risk degree. Even though university choice displays a higher expected wealth, it also displays a larger variance. Stated differently, assuming a risk neutral student is indifferent between the two options does not help us to predict which one should be preferred by a risk averse student.

Actually, the sign of $\frac{\partial h(.)}{\partial \alpha}$ is indeterminate. More precisely it depends on the exogenous parameters of the model. Straightforward computations indicate that

$$\frac{\partial h(.)}{\partial \alpha} > 0 \Longleftrightarrow p'[(B - L)c_u - (A - L)c_s] > (A - L - c_u)(c_u - c_s) \quad (8)$$

The indeterminacy might seem surprising at first sight. University is indeed often viewed as a more risky option that would typically be avoided by more risk averse individuals. However, this intuition seems to be based on the fact that the probabilty of failure is most often larger at University than in the Superior curricula. In this respect, the analysis simply recalls that a higher probability of failure is not equivalent to a more risky choice.

However, using equation 8 the following proposition is immediate:

Proposition 1 *Suppose $c_u = c_s$, then under H3, $\frac{\partial h(.)}{\partial \alpha} < 0$.*

It follows that when the cost to be borne in higher education curricula tend to be identical, the probability treshold above which university is preferred to superior depends positively on risk aversion. In other words, other things being equal, students with a low risk aversion are more prone to choose University than those with a large one when the cost of education does not depend on the type of curricula.

4 Optimal choices in the presence of learning to learn

In the above section, we have assumed that education choices were strictly mutually exclusive, i.e. once a prospective student has chosen a particular curriculum, his only option in case of failure is on-the-job training. This is clearly at odds with reality. In particular, many students who failed in one curriculum bifurcate to an alternative one afterwards. This is particularly the case from university programs to superior ones. In this section we focus on the implication of this possible path on students' decisions. Moreover, we also incoprporate into the picture a learning-to-learn effect aimed at capturing the fact that having attended university might have a positive impact on the probability of succeeding in superior curricula.

Figure 2

Formally, the possibility of redirecting from university to superior in case of failure transforms the decision tree by introducing an additional node, which we label by node 1. The relevant decision tree reads now as follows:

To what extent does the presence of this additional node in the university branch alter the decision made by a representative student at node 0?. We address this question in two separate steps. First we identify the conditions under which learning-to-learn bias choices (presumably) towards university curricula. Second we try to identify the extent to which the presence of a learning-to-learn effect alters the relationship that links university and superior pathes through pass rates.

4.1 Learning to learn and students' choices

Consider now the opportunity to undertake superior studies (with a possible learning to learn effect) after a failure at the university. Its implications are evaluated by considering the changes induced on expected utilities. We show that this opportunity does not necessarily introduce a bias in favour of university choice. However, when a bias is present, it is stronger when the learning to learn effect is strong and mostly affect those students exhibiting a small degree of risk aversion.

First, notice that, using Figure 3, we may characterize the expected wealth associated to university under risk-neutrality, given that superior would be chosen at node 1 by:

$$E_1^u = p(A - c_u) + (1 - p)[kp'(B - c_s - c_u) + (1 - kp')(L - c_s - c_u)] \quad (9)$$

The possibility to bifurcate, even in the absence of learning-to-learn effect ($k=1$), increases the expected utility associated to the university (this follows from H3) and thus creates a bias towards this option. This bias is strengthened in case of learning to learn effect. In particular, at the level of node 1, assumption H3 might be re-expressed as:

$$k > \frac{c_s}{p'(B - L)}$$

This last condition is sufficient to ensure that $E_1^u > E_0^u$ whereas the expected wealth associated to superior remains unchanged.

When students are risk averse, the increase in expected wealth is not sufficient to induce a positive bias towards university. Indeed, while it increases expected wealth, the learning to learn effect also increases the variance of this wealth.

Proposition 2 *In the presence of risk aversion, a learning to learn effect which increases the expected wealth associated to the university option does not necessarily induce more students to prefer university to superior.*

Proof: When comparing tree 1 and tree 2, the only difference comes from the fact that the certain outcome $L - c_u$ in case of failure at university has been replaced by a lottery. Under H3 this lottery has an expected value which exceeds the certain outcome in H1. Expected utility in the learning to learn case can be written as

$$V_1^u = E_1^u + (\alpha - 1)\left[p\left(A - L - c_u\right) + kp'(p-1)\left(B - c_u - c_s - L\right)\right] \quad (10)$$

where E_1^u is given by (9).

Solving the inequality $V_1^u > V_0^u$ in the case of our utility function, we obtain the following condition on k:

$$k \geq \frac{1}{p'}\frac{c_s}{\alpha(B - L) + (1 - \alpha)(c_u + c_s)} = g(p', \alpha) \quad (11)$$

It is immediate to check that $g(p', \alpha) > \frac{1}{p'}\frac{c_s}{B-L}$, where the right hand-side of the inequality defines the threshold for k above which the expected utility increases. ∎

Proposition 2 shows that the larger expected utility associated with learning to learn effects may not be sufficient to induce a risk averse student to opt for university as compared to the case developed in the previous section. Equation (11) tells that the effect should be large enough. It is then immediate that $\frac{\partial g(.)}{\partial \alpha} < 0$. Accordingly, we may state:

Proposition 3 *The learning-to-learn bias (if any) alters the decision of students displaying less risk aversion.*

The above proposition shows that those students who would see their choice biased by the learning-to-learn effect are students who display a lower risk aversion. Stated differently, given (p, p'), it takes a larger learning to learn effect to alter the student's choice from superior to university when the risk aversion of this student is larger.

All in all, we cannot argue that offering to the students a better prospect (in expected wealth terms) in case of failure at university induces more students to retain this option. In order to understand this seemingly counter-intuitive result, it must be realized that that the introduction of a bifurcation from university to superior curricula (coupled with a possible learning to

learn effect) replaces on a branch of the decision tree a certain result ($L - c_u$) by a lottery. The expected value of the lottery is higher than the certain result. While risk-neutral students are only interested in the result of the lottery (and are thus diverted to the university at node 0), risk-averse students are also concerned by the variance of the lottery. Therefore, if the new opportunity alters the choice of some students, these students are those displaying the a low risk aversion.

It is natural to relate the mechanism at work here to self-protection behaviour. Self protection takes place whenever an individual decides to bear some additional cost, provided that this cost leads to a decrease in the probability of a "bad" outcome. Suppose that the probability of success for University option is equal to 0. Then students who choose university make this choice exclusively because it improves their probability of success the next year in Superior. This kind of behaviour can be observed for instance in France for medical studies. A large proportion of students attempts the first year of medicine to improve their probability of success the next year in nursing, or paramedical studies. For specific fields such as engineering, students often attend a preparatory year which is exclusively motivated by the increased scope for success in the first year of their true curriculum. When the probability p is arbitrarily close to zero, attending university can be viewed as a self-protection activity in the sense that it generates a certain cost c_u compensated for by an increasing probability of success p'. Our analysis suggests that the self-protection component of the learning to learn effect is more relevant for people characterized by lower risk aversion. This monotonicity result is largely due to the specific utility function which belongs to the class of first-order risk aversion (Segal and Spivak, 1990).[9] Notice that in our present setup, there is more than self-protection at work in the learning-to-learn effect. Indeed, the probability of success at university is positive.

The implications of Proposition 3 as well as the result established in the preceding section are best understood when placed in perspective with the negative correlation which tends to be observed between households' wealth levels and risk aversion distributions.[10] This negative correlation actually means that other things being equal, wealthier students, i.e. less risk averse students, are more likely to benefit from the option opened when switching from university ot superior curricula. Our framework thus adds to the

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[9] Dionne and Eeckhoudt (1985) have shown that self-protection activities are not necessarily monotonic with respect to risk aversion.

[10] See (Brunello, 2003) for an estimation of this correlation in education.

traditional inverted redistribution argument that is often developed against public subsidies towards higher education. To some extent discriminatory subsidies could be implemented in order to compensate for this risk aversion effect. In particular, it is crucial for our result to hold that the cost borne by a student entering into superior higher education does not depend on history of this student.

4.2 Learning-to-learn and the comparative statics of pass rates

In this section, we perform a comparative statics analysis on the relation between students' decision and relative pass rates. It is indeed tempting to manipulate students' decisions and therefore modify enrolments in the various curricula by altering pass rates. In this respect, we show that in the presence of learning-to-learn an increase in pass rates in superior curricula may actuallly induce more students to choose university attendence.

When there are no learning to learn effect, failure rates at university and in superior are substitute instruments in allocating students to education programs. By "substitute", we mean that in order to induce more student to attend university curriculum, we might either decrease the failure rate in this curriculum or increase the failure rate in the other one. When failure rates are "complements", one can increase university enrolment by decreasing failure rate in superior education.

In the presence of learning to learn effects, as captured by $k > 1$, both p and p' enter in the definition of the expected utility associated to the university branch in figure 3. Obviously, the effect of an increase in p' on student's decisions depends now on the magnitude of the learning to learn effect (the value of k). A larger p' makes superior more attractive at node 0, but in all cases where the learning to learn effect is effective, a larger p' also makes university more attractive. Although the net effect is indeterminate in general, we are able to state the following proposition for the case of our specific utility function when university and superior education share an exogeneous number of students (i.e. on-the job training is only considered as an outside option after a failure at university or in superior curricula):

Proposition 4 *In the presence of learning to learn effect, failure rates at university and in superior are complements if only k is low enough. Moreover, university and superior failure rates are substitutes for a wider domain of parameters when students are risk averse.*

Proof:

Let us first establish this proposition for risk-neutral students. To do so we compare the relative variations of E_1^u and E_0^s with p' in order to determine which option benefits most from an increased probability of success in the superior. The expected wealth with the learning to learn effect at university and superior are respectively given by equations (9) and (2).

$$E_1^u = p(A - c_u) + (1 - p)[kp'(B - c_s - c_u) + (1 - kp')(L - c_s - c_u)]$$

And,

$$E_0^s = p'(B - c_s) + (1 - p')(L - c_s)$$

The slope of these two expectations with respect to p' are respectively:

$$\frac{\partial E_1^u}{\partial p'} = k(1 - p)(B - L) \tag{12}$$

And,

$$\frac{\partial E_1^s}{\partial p'} = (B - L) \tag{13}$$

Using a similar argument university and superior education are complements if an increase in p' leads to a redistribution of students towards university (at the expense of superior education) which happens as long as $k \geq \frac{1}{1-p}$.

Then, under risk neutrality, there exists a threshold value $\overline{k}^N = \frac{1}{1-p}$ such that $\frac{dp}{dp'} \gtreqqless 0$ if $k \lesseqqgtr \overline{k}^N$.

When a student is risk averse, his/her expected utility in the two same options are respectively (see expressions 10 and 6):

$$V_1^u = E_1^u + (\alpha - 1)\left[p\left(A - L - c_u\right) + kp'(p - 1)\left(B - c_u - c_s - L\right)\right]$$

And,

$$V_1^s = p'(L + \alpha(B - c_s - L)) + (1 - p')(L - c_s)$$

Their slope with respect to p' are

$$\frac{\partial V_1^u}{\partial p'} = k(1 - p)[\alpha(B - L) + (1 - \alpha)(c_u + c_s)] \tag{14}$$

And,

$$\frac{\partial V_1^s}{\partial p'} = \alpha(B - L) + (1 - \alpha)c_s \qquad (15)$$

Then, under risk aversion, we have $\frac{dp}{dp'} \gtreqqless 0$ if $k \lesseqqgtr \overline{k}^A = \frac{1}{1-p}\frac{\alpha(B-L)+(1-\alpha)c_s}{\alpha(B-L)+(1-\alpha)(c_u+c_s)}$. It is then immediate to check that $\overline{k}^A < \overline{k}^N$ whenever $\alpha > 1$. Besides, we have $\frac{\partial \overline{k}^A}{\partial \alpha} > 0$. ∎

According to Proposition 4 a policy aimed at increasing enrolment in superior programs by increasing pass rates in this curriculum might actually have the opposite effect of increasing the attractivness of university curricula.

5   Conclusion

In this paper, we addressed the impact of risk aversion on students' decision regarding higher education choices. We showed that, while it is in general not possible to establish a link between students' decisions and their degree of risk aversion, it is clear that when costs differentials accross curricula are negligible, a would-be student is more likely to opt for university if his risk aversion is small. We also considered the possibility for students to attend superior programs after failing at University . Associated to a "*learning to learn effect*", we show that the possibility to opt for Superior after having failed at University creates a kind of complementarity between University and Superior because University attendance can be viewed as a way to increase the probability of success in Superior. This possibility is preferred by students characterized by low risk aversion levels according to the fact that even though it creates a positive value from an expected wealth point of view it also implies an additional lottery. The comparative statics result with respect to risk aversion has a significant economic policy implication: as it is often mentioned, this possibility generates high expenditure, most of the time financed by public transfers, but is more probably taken by students characterized by low risk aversion, the risk aversion distribution being negatively correlated with the wealth distribution (Brunello, 2003).

The present results could be useful for the analysis of the redistributive implications of education policy in an optimal taxation framework.[11] Indeed, in this family of models, most of the time, students differ in wealth

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[11]The utility function used in this paper has already be used in an optimal taxation topic by Eeckhoudt and Hansen (1982).

and in ability. According to the role played by uncertainty and the correlation between wealth and risk aversion, it should be interesting to revise previous analysis by substituting the wealth distribution by the risk aversion one. By adapting the techniques provided in Jullien, Salanié B., and Salanié F. (1999), it would be possible in an optimal taxation framework to build a mechanism which allows to screen agents with respect to their risk aversion.

Last, this very simple analysis should also motivate some empirical studies. The different parameters capturing expected incomes as well as the probability of success associated to the different options could be easily found. Then, it would be interesting to estimate the expenditure generated by the learning to learn effect and if there is a bias selection with respect to risk aversion as our present analysis suggests.

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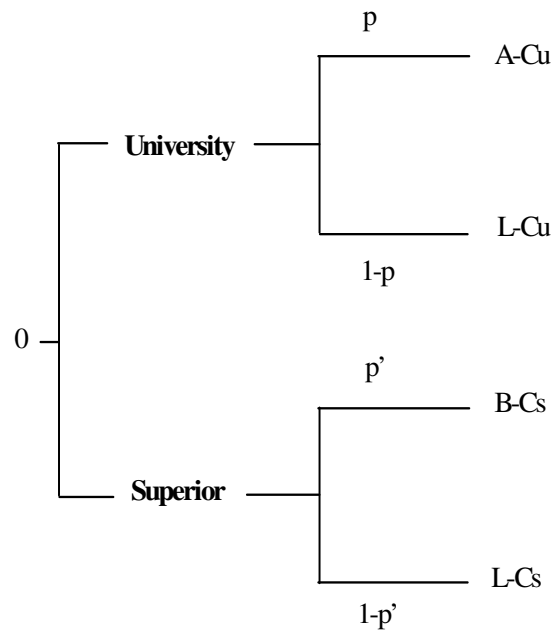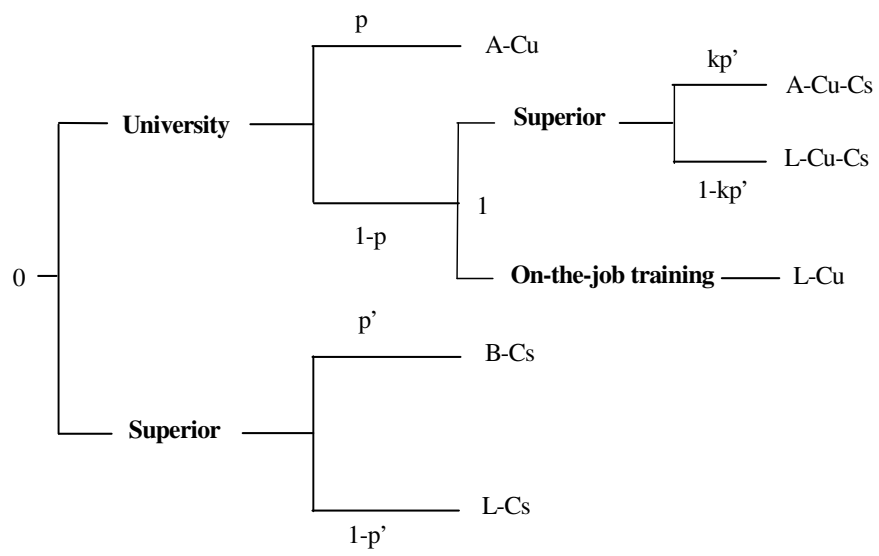
Figure 1:

Figure 2: