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UNIVERSITY CHOICE, PEER GROUP AND DISTANCE

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University choice, peer group and distance *

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Abstract

We analyze how authorizing a new university affects welfare when the students' education depends on the peer group effect. Students are horizontally differentiated according to their ability and the distance from the university. Comparing a monopolistic university with a two-universities model we find that allowing a "new" university is welfare improving when the monopolistic university is only attended by able students with less mobility constraints. This occurs when mobility costs are sufficiently high. When mobility costs are low, a negative externality arises and welfare decreases. The negative externality comes through the peer group effect: high ability students that would have gone to the monopolistic university go to the university with the lower average ability. These students end up in a university with students whose ability was not high enough to go to the monopolist. On the other hand, students remaining in the good university benefit from a lower average ability. Thus, a new university is welfare improving only for those with low ability that in the monopolistic scenario would remain unskilled. When, instead, the mobility cost is high, the monopolist leaves out a significative mass of individuals. In this case, no negative externality arises because no student swaps university therefore a "new" university is welfare improving. However, this welfare improvement makes the opportunities for a higher education less equal (according to Romer, 1998) because an "external circumstance" like mobility cost, rather than own ability, becomes the main determinant of the students' human capital.

Keywords: peer group quality, mobility costs, universities.
Jel Classification: I21, I23.

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1 Introduction

Empirical evidence confirms a proliferation of universities in Europe.[1] Widening higher education participation, for instance, is one of the main points of the UK government's agenda. The recent publication of "A Challenge to University" highlights the development of local higher education as a strategy to increase higher education participation to those who would be usually excluded. This official document explains that the UK government's strategy aims to create up to 20 new centers of higher education (HE) by 2014. Such a policy is based on the empirical evidence that geographical distance and peer group quality are relevant in determining higher education participation. If distance is one of the main barriers to participation, on the other hand the peer group quality strengths participation in higher education. As largely shown for compulsory education, also university students achieve a higher human capital when attending an institution with a high average quality.

We study the implications of introducing a "new" university in a model in which students are uniformly distributed according to their ability and mobility costs. We compare a monopolistic university scenario with a two-university model (free for all) in which a student's human capital positively depends on own ability and the average ability, that is endogenously determined by students' sorting. We find that the monopolistic university is characterized by a higher average ability (but a lower participation). When a new university is introduced, and the mobility costs are low, a negative externality arises through the peer group effect: high ability students, that would have gone to the monopolistic university, go to the "new" university with a lower average ability. These students end up at the university with those whose ability was not high enough to go to the monopolist. On the other hand, students remaining in the good university now receive a lower average ability. In this scenario, the new university is welfare improving only for the low ability students that otherwise would have remained unskilled whereas now can afford the "new" institution in a two-university model.

This externality does not arise when the mobility cost is sufficiently high. In this second scenario, only able students go to the good monopolistic institution and none prefer to switch to a new bad university, therefore no negative externality arises. The effect of a new university is simply that of allowing students close to the bad university to be skilled. Thus, introducing a university does not affect the peer group quality within the good university (monopolistic or not) that, in turn, appears as an "elite" institution attended only by able students with lower mobility costs. These "elite" students are unaffected, while the welfare improvement comes from less able students with more mobility constraints who are strictly better off. A new university also affects the equality of opportunities that, according to Romer (1998), should occur when the future income

[1] In a recent empirical study Daraio et al. (2010) find that the number of universities shows an acceleration after 1970 in Finland, France, Germany, Hungary, Italy, Netherlands, Norway, Portugal, Spain, Switzerland and the UK. This phenomenon is strong in Italy where 27 universities have been created between 1982 and 2004.

only depends on student's ability and not on other "external" factors. In our simple framework, the future income is the student's education while the external factor is the mobility cost. Interestingly, we find that, when transportation cost are high, introducing a university, thought welfare improving, makes the mobility cost the main determinant of the students' sorting and therefore of their future income.

Our paper is in line with Del Rey (2001), Gautier and Wauthy (2007) and De Fraja and Iossa (2002). The first three papers consider universities competing in teaching and research activities. Our is however closer to De Fraja and Iossa (2002), who, focusing on distance and students' ability, find that high mobility costs lead to the arise of an "elite" institution.[2]

Our paper is clearly based on two main empirical results: i) the existence of the peer group effect in higher education, and ii) the effect of geographic distance on the higher education participation. Empirical evidence confirms that peer quality affects the student's performance at the higher education level in the US (Sacerdote (2001), Zimmerman (2003), Arcidiacono and Nicholson (2005), Hoxby and Weingarth (2005), Aricidiacono et al. (2010)), in Italy (De Giorgi, Pellizzari and Redaelli (2006) and Brunello, De Paola and Scoppa (2010)), in China (Ding and Lehrer (2007)) and in South Korea (Kang (2007)).

The relevant effect of the geographical distance has been recently confirmed by Frenette (2004, 2006 and 2009), Sà et al. (2006), Gibbons and Vignoles (2009), Speiss and Wrohlich (2010) and Kenyon (2010). Kenyon (2010) analyzes the UK government's strategy in "A challenge to University" and confirms that a strategy targeted to the transport cost may be significant in increasing the participation of the under-represented groups in the higher education. Frenette (2009) shows that the creation of a local university in Canada, is associated with a large increase in university attendance among local youth in each affected city. Speiss and Wrohlich (2010) find that in Germany an increase in the distance between home and university is associated with a lower participation in higher education. Gibbons and Vignoles (2009) show that in Britain distance is the strongest factor influencing university choice among those who participate.

The paper is organized as follows. Section 2 develops the model. Sections 3 analyzes the case with a monopolistic university while in Section 4 we introduce another university. Section 5 caracterizes the equilibria and studies the welfare implications. Section 6 concludes.

2 The model

We consider two universities $j = A, B$ operating in the same jurisdiction. Each of them "produces" graduates. We assume a horizontally differentiated model over a line $[0, 1]$. Let university A be placed at $x = 0$ and university B at $x = 1$.[3]

[2] See also Grazzini et al. (2010) for a recent analysis.

[3] Locating the firm A at $x = 0$ is an innocuous assumption because, as it will be clear in what follows, locating the monopolistic firm at $x = 1$ will give the same qualitative results.

2.1 The students

We use a spatial competition model to describe the students' behavior. Students are distributed in a two-dimensional space: each student, i, is characterized by her address, x, along the line $[0,1]$ that separates the two universities, and by her initial ability θ_i. We assume for simplicity that θ_i and x_i are uniformly and independently distributed on $[0,1] \times [0,1]$. A student located at x faces a mobility cost tx if attending University A and $t(1-x)$ if attending University B. Total population of students is normalized to one.

Each student enrolled at university j achieves a level of human capital equal to:

$$e_i = \theta_i \left(1 + \overline{\theta}_j\right) \tag{1}$$

where $\overline{\theta}_j$ measures the peer group effect, the average ability at the university j. This human capital function is in line with the common assumptions in literature such as $e_{i\theta_i} > 0$, $e_{i\overline{\theta}_j} > 0$ and $e_{i\overline{\theta}_j\theta_i} > 0$. The first is largely accepted. The second confirms the presence of the peer group effect: human capital increases in the average ability of the university. The positive cross derivative in the last term implies that the peer effect becomes more effective in the production of human capital as the level of innate ability increases, or in other words a higher peer-group effect benefits more high ability students. This assumption follows Epple and Romano (2008) and is in line with the empirical evidence in Hoxby and Weingarth (2005), Ding and Lehrer (2007), Kang (2007) and Brunello, De Paola and Scoppa (2010) finding that the peer effect of good peers rises along the ability distribution.[4]

The labour market is over simplified. We assume that wage is equal to the human capital. We denote $\alpha(\theta_i)$ as the probability of completing the university. With probability $1 - \alpha(\theta_i)$ the student drops out. In case of drop out he does not benefit from the peer group effect therefore his wage is equal to the unskilled student's wage. The utility for each student i enrolled at university j is:

$$U_i^j = \alpha(\theta_i)\left(\theta_i\left(1 + \overline{\theta}_j\right)\right) + \left(1 - \alpha(\theta_i)\right)\theta_i \tag{2}$$

The human capital production function (1) implies that the utility function satisfies the following properties: *i)* $U_{\overline{\theta}} > 0$, *ii)* $U_\theta > 0$ and *iii)* $U_{\overline{\theta}\theta} > 0$.

Since each student faces the same per-unit transportation cost equal to t, the net utility for the student i enrolled at the university j is:

$$U_i - t\widehat{x}_j \tag{3}$$

with $\widehat{x}_j = \{x, 1-x\}$ according to which university he is enrolled at.

[4] Hoxby and Weingarth (2005) in particular find a positive cross derivative when having higher ability peers, whereas a weak effect is found with peers of similar abilities. For the Italian case, Brunello, De Paola and Scoppa (2010) prove that peer effects are positive and statistically significant for students enrolled in engineering, math and natural science and close to zero in the humanities. Less recent evidence is also provided by Sacerdote (2001) and Zimmerman (2003).

Trasportation costs are one of the main economic constraints for student attending university. Some universities, in fact, include these costs for the purpose of determining the full cost of attendance and eligibility for financial aid.

The student i not attending the university is denoted by u (unskilled) and he receives a wage equal to his human capital, his utility is simply:

$$U_{i,u} = \theta_i \tag{4}$$

We keep the labour market as simple as possible because we aim at focusing on the effect of the transportation cost and the peer group effect. In our model the net utility for the skilled workers is higher, but it does not imply, ex ante, that the gross utility (included the transportation cost) is higher than the utility of being unskilled. Students, in fact, can go to the university (paying the transportation cost) but then drop out. In this easy interpretation higher education is a risky investment. To ease the computational tractability of the model we simplify the probability of getting the degree as follows.

Assumption 1 $\alpha(\theta_i) = \theta_i$, *for every* $\theta_i \in [0,1]$, *with* $\alpha(0) = 0$ and $\alpha(1) = 1$.

The probability of getting the degree (a higher wage) increasing in the innate ability is largerly used in literature.

3 Monopolistic University

In this section we study the scenario with only one university, A, called here monopolistic university. Let's assume that it is located at $x = 0$. In this scenario each student can only choose between going to the monopolistic university or being unskilled. Hence, a student i located in x_i will go to the monopolistic university A if:

$$U_i^A \geq U_{i,u} \tag{5}$$

or:

$$\alpha(\theta_i)\left(\theta_i\left(1+\overline{\theta}_M\right)\right) + (1-\alpha(\theta_i))\,\theta_i - tx \geq \theta_i \tag{6}$$

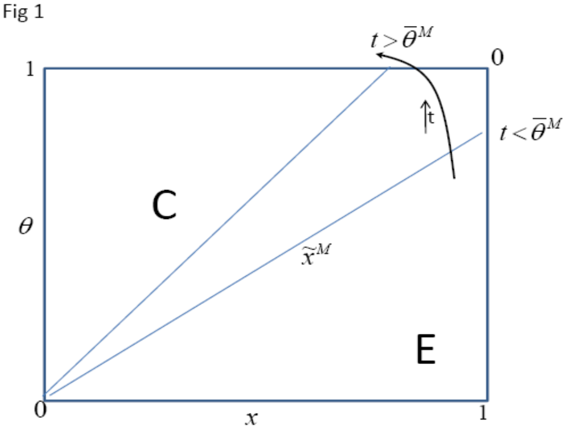
where $\overline{\theta}_M$ is the peer group effect (average ability) at this university. It is possible to show that there exist infinite pairs x, θ such that a student is indifferent between going to the monopolistic university and being unskilled. This indifference locus is denoted by $x^M(\theta)$. Since $\alpha(\theta_i) = \theta_i$, $x^M(\theta)$ is defined as follows:

$$\theta\left(\theta\left(1+\overline{\theta}_M\right)\right) + (1-\theta)\,\theta - tx^M(\theta) - \theta = 0 \tag{7}$$

or:

$$x^M(\theta) = \frac{\theta^2\overline{\theta}_M}{t} \tag{8}$$

Fig 1



the slope is clearly positive.[5]

Given $e_{i\overline{\theta}_j\theta_i} > 0$ and the consequent single crossing property of the utility ($\frac{\partial U_i^j}{\partial\overline{\theta}_j\partial\theta} > 0$) then we have that students with higher ability go to the monopolistic university. The single crossing property says that the marginal increase in human capital due to a higher ability is higher in the presence of the peer group.

To simplify the notation we denote the indifference locus simply by x^M and for further purposes we graphically represent it in Fig 1. We have that the intercepts have the following coordinates: *1)* $\theta = 0, x^M = 0$, and *2)* $\theta = 1$, $x^M = \frac{\overline{\theta}_M}{t}$ with $x^M \gtreqless 1$ if $\overline{\theta}_M \gtreqless t$. The area C, above the locus, is the mass of individuals going to the university, whereas the area E, below the locus, is the mass of those preferring to be unskilled. Fig. 1 explains that the higher the transportation cost the smaller the mass of university students. In other words, when the effect of the transportation cost dominates the benefit from the peer group effect, then mass of students deciding to remain unskilled gets bigger.[6]

4 Two University model

We now introduce the university (B), located at $x = 1$. We define the *marginal* student as the student indifferent between the University A or B. The marginal

[5] The condition for $\frac{d(x^M(\theta))}{d\theta} = \frac{2\theta\overline{\theta}_M + \frac{d\overline{\theta}_M}{d\theta}\theta^2}{t} > 0$ is $\frac{d\overline{\theta}_M}{d\theta} > 0$, that holds given the endogeneity of the peer group that is clearly increasing in the ability.

[6] If the monopolistic university was located in $x = 1$, the indifference focus would be $\widetilde{x}^M = 1 - \frac{\theta^2\overline{\theta}_M + \theta}{t}$ that, by symmetry, is downward sloping in θ, with the intercept $x^M(\theta = 1) \lesseqgtr 0$ if $t \lesseqgtr \overline{\theta}_M + 1$. All higher ability students keep going to the monopolist.

student, denoted by $\widetilde{x_i}(\theta)$, is defined by the following identity:

$$U^A \equiv U^B \tag{9}$$

$$\theta\left(\theta\left(1+\overline{\theta}_A\right)\right)+(1-\theta)\,\theta-t\widetilde{x}(\theta)=\theta\left(\theta\left(1+\overline{\theta}_B\right)\right)+(1-\theta)\,\theta-t\left(1-\widetilde{x}\right) \tag{10}$$

That, after same simplifications, gives:

$$\widetilde{x}(\theta)=\frac{\widetilde{\theta}^2\left(\overline{\theta}_A-\overline{\theta}_B\right)}{2t}+\frac{1}{2} \tag{11}$$

Consider the case $\overline{\theta}_A-\overline{\theta}_B>0$. Our assumption $\frac{\partial e}{\partial\overline{\theta}_j\partial\theta}>0$ (equivalent to $\frac{\partial U_i^j}{\partial\overline{\theta}_j\partial\theta}>0$) implies that high ability students are better off at the university with the higher peer group effect, thus $\overline{\theta}_A-\overline{\theta}_B>0$ (given the endogeneity of the average ability) clearly implies that the high ability students go to the university A. In fact, given $\overline{\theta}_A-\overline{\theta}_B>0$ the slope of the locus, in θ, is positive with the following intercepts: 1) $\theta=1, \widetilde{x}>\frac{1}{2}$ and 2) $\theta=0, \widetilde{x}=\frac{1}{2}$. In particular, $\widetilde{x}\gtreqless 1$ when $t\lesseqgtr\left(\overline{\theta}_A-\overline{\theta}_B\right)$. [7] See Fig 2 for the cases $t<\overline{\theta}_A-\overline{\theta}_B$ and $t>\overline{\theta}_A-\overline{\theta}_B$. The transportation cost t is the "marginal" cost faced when moving toward the good university (or the monopolistic university) while $\overline{\theta}_A-\overline{\theta}_B$ is the "marginal" benefit the individual with ability θ obtains from a higher peer group effect. The area C above the locus is the mass of students preferring the university A whereas the the area E below the locus is the mass of student preferring B. When the transportation cost dominates the benefit from switching university B with A (leading to a higher peer group effect) the mass of student preferring the worse university (B) gets bigger. A student living close to the new university (B) prefers the better university (A) only if his ability is sufficiently high.[8]

So far we have simply specified which university the student would prefer if he had the option to choose between A and B. Nevertheless, we need to introduce the mass of student who prefer remaining unskilled rather than going to any university. We found then the loci such that students are indifferent between going to university (whatever it is) or being unskilled. Let us to denote $\widetilde{x}_{B,u}$ and $\widetilde{x}_{A,u}$ the indifference loci between the university (B or A) and being unskilled. The locus $\widetilde{x}_{B,u}$ is defined as follows:

$$\theta^2\left(1+\overline{\theta}_B\right)+(1-\theta)\,\theta-t\left(1-\widetilde{x}_{B,u}\right)\equiv\theta \tag{12}$$

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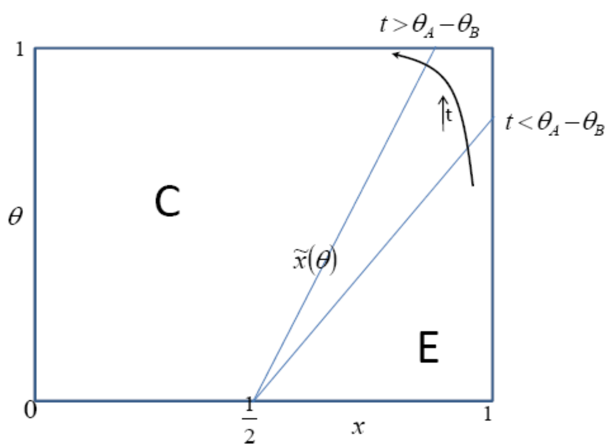
[7] That is: $\frac{d\widetilde{x}(\theta)}{d\theta}=-\frac{\frac{\partial\left(\overline{\theta}_A-\overline{\theta}_B\right)}{\partial x}-2t}{2\theta\left(\overline{\theta}_A-\overline{\theta}_B\right)+\frac{\partial\left(\overline{\theta}_A-\overline{\theta}_B\right)}{\partial\theta}\theta^2}$

[8] If university A was located at $x=1$, by symmetry the indifference locus would be $\widetilde{x}(\theta)=\frac{1}{2}-\frac{\widetilde{\theta}^2\left(\overline{\theta}_A-\overline{\theta}_B\right)}{2t}$ that, under $\overline{\theta}_A-\overline{\theta}_B>0$, is downward sloping as the locus for the monopolistic scenario. High ability students keep going to the university A and we obtain the same qualitative results of the case in which university A is located at $x=0$.

Fig 2



that gives:

$$\widetilde{x}_{B,u} \equiv 1 - \frac{\theta^2 \overline{\theta}_B}{t} \tag{13}$$

The Fig. 3 illustrates this locus.

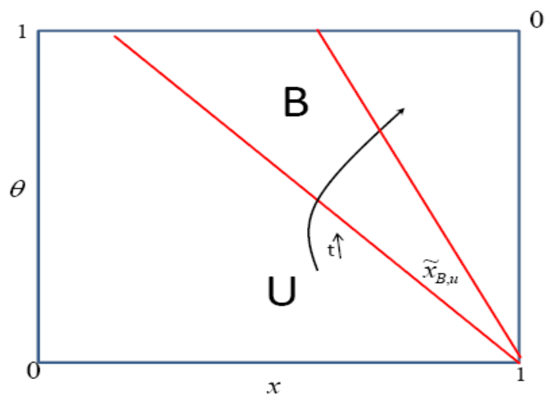
Given the intercepts, 1) $\theta = 0, \widetilde{x}_{B,u} = 1$, and 2) $\theta = 1$, $\widetilde{x}_{B,u} = 1 - \frac{\overline{\theta}_B}{t} < 1$, the slope is negative $\frac{d\widetilde{\theta}_{B,u}}{dx} < 0$. This still means (for the same reasoning above) that the high ability student prefers B (area B) rather than being unskilled (area U). Also, the slope is increasing in t with the locus getting steeper the lower is t. In particular, when $\theta = 1$ and $t = \overline{\theta}_B$ then $\widetilde{x}_{B,u} = 0$; in other words the locus is orthogonal to the horizontal axis and the slope is zero. This implies that when the transportation cost exactly overcomes the benefit from attending the university B, nobody goes to the university. Only students living in the same location as the university (along the locus) are indifferent between going and staying put. When instead $t = 0$, the slope is infinite and the locus coincides with the horizontal axis, this implies that all students go to the university.

The locus $\widetilde{x}_{A,u}$ is obtained from the locus x^M, by construction they coincide up to the point in which x^M crosses the locus $\widetilde{x}(\theta)$. This leads to the following Corollary, that will be useful in the rest of the paper.

Corollary 1 $\overline{\theta}_A < \overline{\theta}_M$.

Proof. The monopolistic firm is located at $x = 0$, then the locus $\widetilde{x}_{A,u}$ is a function $\widetilde{x}_{A,u} \equiv x^M$ up to the crossing point with $\widetilde{x}$. Since $\widetilde{x}$ is stepper than x^M

Fig 3



and the lowest ability necessary to go to the monopolistic university increases in the distance x, there exists a part of high ability students relatively closer to $x = 1$ that leaves the monopolist when the university B is introduced. The monopolistic university faces a drop in the high ability students, this implies that $\overline{\theta}_A < \overline{\theta}_M$. ■

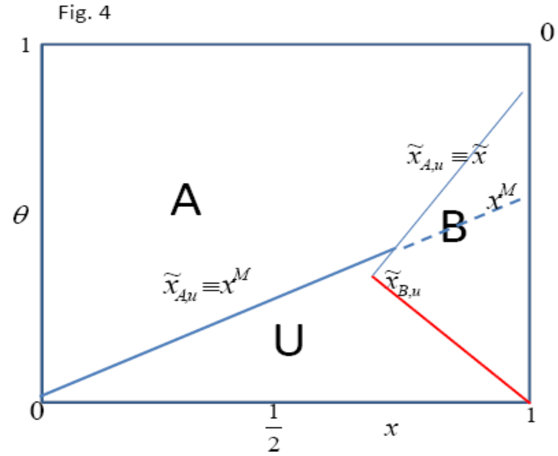
The Corollary 1 says that, in our scenario, the monopolistic university guarantees a higher average ability because it enrolls also the mass of high ability students that in a two university model are below $\widetilde{x}$ and prefers university B to A. Fig. 4 illustrates this point. The U area is the mass of student below both $\widetilde{x}_{A,u}$ and $\widetilde{x}_{B,u}$ that prefers remaining unskilled basically for two reasons: they are too far from both universities and their ability is not high enough to offset the transportation cost. Area B is the mass of students that goes to the worse university (B), while A is the mass attending the (better) university A. Students close to the university B go to the university A only if sufficiently able. The triangular area below $\widetilde{x}_{A,u} \equiv x^M$ but above x^M is the mass of student with a relative high ability that in a monopolistic scenario would go to the monopolistic university, whereas, in a two-university scenario, go to the university B (the bad one) because it is closer.

5 Characterizing equilibria and welfare analysis

The possible equilibria depend on t, $\overline{\theta}_A - \overline{\theta}_B$ and $\overline{\theta}$.[9] In this section we study the welfare effect of introducing a new university and find the equilibria in which a new university is unambiguously welfare decreasing or enhancing.

[9] We remind that $\overline{\theta}_A > \overline{\theta}_B$. The model is perfectly symmetric and the opposite results hold when $\overline{\theta}_A < \overline{\theta}_B$.

Fig. 4



Proposition 2 *When i)* $t \leq \overline{\theta}_A - \overline{\theta}_B, t < \overline{\theta}_M$*, and ii)* $t > \overline{\theta}_A - \overline{\theta}_B$*,* $t \leq \overline{\theta}_M$ *a new university is unambiguously welfare reducing. For any* t *satisfying* $t > \overline{\theta}_A - \overline{\theta}_B$ *and* $t > \overline{\theta}_M$*, a new university is welfare increasing when* $t > \overline{\theta}_A + \overline{\theta}_B$*.*

Proof. See Appendix. ■

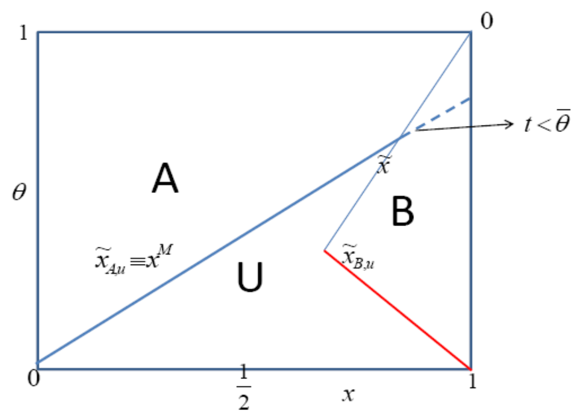
The result in Proposition 2 shows that when the mobility cost is sufficiently low, there exists a negative externality due to some high ability students preferring the bad institution in a two-university scenario (See Fig 5), although they would have chosen the good monopolistic university. All students above the monopolistic locus (the dashed line partially overlapping with $\widetilde{x}_{A,u}$) would go to the monopolistic university.

The red line is the mass of individuals who are indifferent between B and being unskilled, while the upward sloping line ($\widetilde{x}$), crossing the red line, is the indifference locus between A and B. Once a new university (B in our case) is introduced, high ability students relatively closer to the location $x = 0$ go to the university A (students in the top left area A) whereas students in the right area (area B) will choose university B because it is relatively closer.

The area B below the monopolistic locus (excluded the triangle below x^M but above the dashed line) represents those students who with only one university would have remained unskilled, but in a two-university model can afford the university B. The bottom irregular triangle U includes students that remain unskilled as under monopoly as well as in a two-university scenario.

Students going to A (and previously going to the monopolistic university) are worse off because the average ability (peer group effect) they receive is now lower. This reduction is due to the fact that some high ability students now prefer B. These students are located in the top part of the area B (triangle

Fig 5



below $\widetilde{x}$ but above the dashed line) and are worse off because they now share the university with the low ability students that, absent the second university, would have remained unskilled. Students in the remaining part of the area B are better off because now they can be skilled. Students in the bottom triangle U are indifferent because they don't go to the university at all.

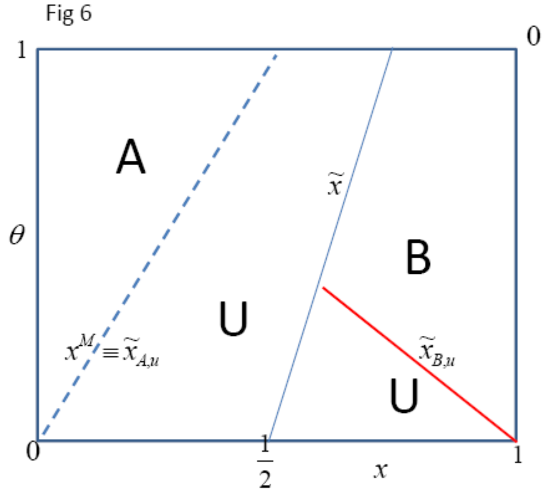
Under $t \leq \overline{\theta}_A - \overline{\theta}_B$ and $t < \overline{\theta}_M$ the mass of worse off students is higher than the mass of better off students[10]. Furthermore, by condition $U_{\overline{\theta}\theta} > 0$ we know that the impact of a higher peer group effect is stronger (in negative or positive sense) for the students with the higher ability. This equivalently implies that a reduction in the utility due to a lower peer group is stronger for the student with the higher ability (in the area A) or, in other words, the aggregate marginal benefit (for the students that are better off) is lower than the aggregate marginal loss (for the students that are worse off). This, together with transportation cost incurred by students in B, implies that a new university is welfare reducing.

The negative externality disappears when the transportation costs are sufficiently high, therefore a welfare improvement occurs. See the Figure 6.

Areas A, B, U are the mass of students going respectively to university A, B and being unskilled. The dashed line represents the overlapping loci for the monopolistic university and the university A in a two-university model. When the mobility cost is sufficiently high, a significant mass of students remain unskilled under a monopoly because the mobility cost overcomes the benefit from attending the university. When the new university is introduced, all the students that would have gone to the monopolist now go to the good university A, while the new (bad university) is only a way for low ability students (living far from the monopolist) to afford education (even though of a lower quality). In this scenario, no students previously choosing the monopolistic university

[10] See the proof of the Proposition 2 for the details.

Fig 6



chooses the new one, therefore the negative externality disappears.

It is straightforward to see that this scenario in which a new university is welfare increasing, it also reduces the *equality of the opportunities* (EO) that, according to Romer (1998), occurs when the expected income (that in our simple case is the education) depends only on the ability and not on the transportation cost (the so called "external circumstances" by Romer). Under perfect equal opportunity students should sort across universities only according to their ability. In our model, a perfect equality of opportunities would imply horizontal indifference loci. Since, under high transportation cost, the indifference locus between the university A and B is steeper than the indifference locus for the monopolistic university, we can conclude that a new university makes the opportunities more unequal. In other words, when transportation costs are high a new university is welfare improving but the transportation costs, rather than ability, becomes the main driver for the students' sorting.

6 Main conclusions

This paper starts from two recent empirical evidences: *i)* peer group effect in the higher education, and *ii)* the proliferation of universities. We link these two results and theoretically investigate the effect of a new university when the peer group effect influences the educational achievement and students choose universities according to their ability and mobility costs. Comparing a monopolistic system with a two-university scenario in which universities differ in their average (endogenous) ability we found that introducing one more university decreases the welfare when the mobility costs are low whereas it is welfare enanching in the presence of high mobility costs.

When the mobility cost is suffciently low, a new university widens partecipation to higher education also to those students that would have remained unskilled in a single-university scenario. Nevertheless, some able students living far from the good university (that would have gone to the monopolist) prefer the new closer university (thought with a lower average ability). This sorting induces a negative externality working through the peer group effect: high ability students remaining in the good university receive a lower average ability. Also, high ability students leaving the monopolist for the new university benefit from a lower average ability because they share the same university with less able students that, without the new university, would have remained unskilled. When the transportation cost is high, this externality disappears and a new university is welfare enanching. When the monopolistic university has also the higher average ability in the two-university system, then such university appears as an *elite institution* because it is attended only by able students without mobility constraints. A new university (though with a lower peer group quality) does not induce *elite* students to switch, but it simply allows less able students with more mobility constraints to be skilled. *Elite* students are unaffected while, on the other hand, a mass of less able students with more mobility constraints are strictly better off. However, we find that a welfare improvement induces more unequal opportunities because an "external circumstamce" (see Romer ,1998) like the mobility cost, rather than the own ability, becomes the main determinant of the students' human capital.

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7 Appendix

Proof of the Proposition 2

We start by excluding the following four cases: **1)** $t > \overline{\theta}_M$, $t = \overline{\theta}_A - \overline{\theta}_B$, and **2)** $t < \overline{\theta}_A - \overline{\theta}_B, t = \overline{\theta}_M$, **3)** $t = \overline{\theta}_M$, $t = \overline{\theta}_A - \overline{\theta}_B$, **4)** $t < \overline{\theta}_A - \overline{\theta}_B, t > \overline{\theta}_M$. In cases **1)-2)-4)** x^M and $\widetilde{x}$ do not cross, then we have $x^M \equiv \widetilde{x}_{A,u}$ that implies $\overline{\theta}_A = \overline{\theta}_M$. This equality is in contradiction with the range of t in 1), 2) and 4). See Fig. 5 for the intuition. Case **3)** is excluded for a similar argument in the previous points. In fact, x^M and $\widetilde{x}$ cross only at $\theta = x = 1$, then we still have $x^M \equiv \widetilde{x}_{A,u}$, still implying $\overline{\theta}_A = \overline{\theta}_M$, that is again a contradiction. The reasonable equilibria are only three: **5)** $t < \overline{\theta}_M$, $t \leq \overline{\theta}_A - \overline{\theta}_B$, **6)** $t \leq \overline{\theta}_M$, $t > \overline{\theta}_A - \overline{\theta}_B$, and **7)** $t > \overline{\theta}_M$, $t > \overline{\theta}_A - \overline{\theta}_B$. **Equilibrium 5)**. ***a)*** Consider $t < \overline{\theta}_M$, $t = \overline{\theta}_A - \overline{\theta}_B$. In this case x^M and $\widetilde{x}$ cross ($\widetilde{x}$ crosses the vertical axis at $\theta = 1$ and $x = 1$) then $x^M \neq \widetilde{x}_{A,u}$ and $\overline{\theta}_A \neq \overline{\theta}_M$. See Fig 6. The area A above x^M and above the upper right part of $\widetilde{x}$ is the mass of student going to A in a two university model (the mass going to the monopolist is all the area above x^M). The area B is the mass of student going to B, this area also includes the right upper part just below $\widetilde{x}$ and above the dashed line. The irregular bottom triangular area U is the mass of unskilled. In this equilibrium the new university is welfare reducing because more than half population is worse off when switching to a two-university model. There exists, in fact, a mass of high ability students (the upper right triangle below $\widetilde{x}$ and above the dashed line) previously going to the monopolist, that in a two university model goes to the bad university. This moving induces a negative externality for the students still going to the good university (via a lower average ability). On the other hand, the mass of students better off is only the area B (excluded the upper right part above the dashed line) that however is clearly smaller than the sum between the area A and the upper right triangular area. This point together with assumption $U_{\overline{\theta}\theta} > 0$ is a sufficient condition for having a welfare reduction after the introduction of the university B. **b)** Consider $t < \overline{\theta}_M$, $t < \overline{\theta}_A - \overline{\theta}_B$. In this case it is possible to show that x^M and $\widetilde{x}$ cross at a pair $\theta < 1$, $x < 1$, with the exact distance given by $x^M = \widetilde{x} < 1$, where in particular, $x^M = \widetilde{x}$ if $\theta_n = \pm\sqrt{\frac{t}{2\overline{\theta}_M - (\overline{\theta}_A - \overline{\theta}_B)}}$. By plugging the positive value of θ_n into x^M we have $x^M = \frac{\frac{t}{2\overline{\theta}_M - (\overline{\theta}_A - \overline{\theta}_B)}\overline{\theta}_M}{t} = \frac{\overline{\theta}_M}{2\overline{\theta}_M - (\overline{\theta}_A - \overline{\theta}_B)}$. Now by Corollary 1 (saying that $\overline{\theta}_A \leq \overline{\theta}_M$) the denominator is positive and we obtain that $\frac{\overline{\theta}_M}{2\overline{\theta}_M - (\overline{\theta}_A - \overline{\theta}_B)} < 1$ if $\overline{\theta}_M - \overline{\theta}_A + \overline{\theta}_B > 0$, that holds. This ensures that a crossing point in this equilibria is at a pair $\theta < 1$, $x < 1$, therefore the argument in the point a) (according to which most of the individuals are worse off in a two university model) holds also here. Hence, under $t < \overline{\theta}_M$, $t < \overline{\theta}_A - \overline{\theta}_B$ a new university cannot be welfare improving. Clearly the possible values of the mobility cost with respect to $\overline{\theta}_B$ could be $t \gtreqless \overline{\theta}_B$. It is possible to see that the way of this inequality does not affect the conclusion in terms of welfare. Hence equilibrium 5) is welfare reducing. **Equilibrium 6).** Case **a)** $t < \overline{\theta}_M$, $t > \overline{\theta}_A - \overline{\theta}_B$. Even in this case x^M and $\widetilde{x}$ cross at a pair $\theta < 1$, $x < 1$ and all the arguments in the previous points hold, then most of the individuals are worse off. The same in case **b)** $t = \overline{\theta}_M$, $t > \overline{\theta}_A - \overline{\theta}_B$. In point b) the intercept of the monopolistic locus at $\theta = 1$ is $x^M(1) = 1$; this means that the locus is a 45° line. However the same arguments above about the higher utility loss for high ability students in A and B due to $U_{\overline{\theta}\theta} > 0$ still hold. Hence, under equilibrium 6) a new university is welfare reducing. **Equilibrium 7).** Given the range $t > \overline{\theta}_A - \overline{\theta}_B$ and $t > \overline{\theta}_M$, it is possible to show that a new university is welfare increasing when $t > \overline{\theta}_A + \overline{\theta}_B$. This proof essentially follows the arguments in the previous points. See the Fig. 7. The sufficient condition to eliminate the negative externality is that x^M and $\widetilde{x}$ do not cross in the range in which $\theta, x \in [0, 1]$, or equivalently they cross at a positive level of ability $\theta_n > 1$. If this holds, then the previous arguments in the proof and the assumption $U_{\overline{\theta}\theta} > 0$ hold also here and are enough to show the result. x^M and $\widetilde{x}$ cross at a positive level of ability $\theta_n > 1$ if and only if $2\overline{\theta}_M - (\overline{\theta}_A - \overline{\theta}_B) < t$ (as before we obtained that $x^M = \widetilde{x}$ when $\theta_n = \pm\sqrt{\frac{t}{2\overline{\theta}_M - (\overline{\theta}_A - \overline{\theta}_B)}}$). However, if the two loci cross at an ability higher than 1, then the indifference locus for the monopolist overlaps with the indifference locus between going to A and being unskilled ($\widetilde{x}_{A,u} \equiv x^M$), therefore this still implies $\overline{\theta}_M = \overline{\theta}_A$. Since $\theta_n = \pm\sqrt{\frac{t}{2\overline{\theta}_M - (\overline{\theta}_A - \overline{\theta}_B)}} > 1$ if $\overline{\theta}_A + \overline{\theta}_B < t$ we conclude that a welfare increase is possible if $\overline{\theta}_A + \overline{\theta}_B < t$ (or in other words, x^M and $\widetilde{x}$ cross at a $\theta > 1$). Clearly $\overline{\theta}_A + \overline{\theta}_B < t$ is respected when $t > \overline{\theta}_A - \overline{\theta}_B$ and $t > \overline{\theta}_M$. Furthermore $t > \overline{\theta}_B$ implies that $\widetilde{x}_{B,u} > 0$ at $\theta = 1$.

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