



## Competition among universities: The role of preferences for research and government finance \*

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### Abstract

We build on previous results to explore the effect of student mobility on university behaviour. Our results suggest that, if universities do not care for research, they do not react to increased competition when students are able to choose where to study. Further, neither do they react to the incentives provided by the government through the financing scheme. Preferences for research thus turn out to be the key element for success of policies which aim at (i) enhancing competition in the higher education sector and (ii) affecting resulting levels of education quality and research through incentives provided by the financing scheme.

*Keywords:* university competition, higher education finance.

*JEL Classification:* L3, I22.

### 1. Introduction

Much is expected from the introduction of competitive forces in the domain of publicly provided higher education. Even those who do not challenge the principle that higher education must be publicly financed, advocate student mobility as a means to enhance competition among universities. If students can choose which university to attend, universities will behave strategically in order to attract students, thus raising education quality.

Or will they? Our analysis suggests that only if universities care sufficiently for research will student mobility have an effect on their behaviour. Moreover, competition may allow the government to induce the desired levels of teaching, education quality and research by means of a very simple tool: the relative weight of per-student allocations in the funding scheme. Information about number of enrolments is easier to obtain than information about research output or education quality. For this reason, per-student allocations, actually widely used in Europe as a way to finance schools and universities, can be an invaluable tool.

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This work builds on previous results. In Del Rey (2001) we analyzed a game between two publicly financed universities competing for students in the same jurisdiction. In doing so, this work put together three elements of higher education provision that appear separately in previous literature about university behaviour: the trade-off between teaching and research (Garvin, 1980; Boroah, 1994), the competition among universities (Gary-Bobo and Trannoy, 1998b; Debande and Demeulemeester, 1998) and the role of the incentives provided by the government (Gary-Bobo and Trannoy, 1998a,b). The model considers two identical universities that care for research as well as the increase in productivity of students through education. The education production function is assumed to depend on student's average ability as well as resources devoted to teaching. Finally, universities are funded by the government by means of a lump-sum amount and a per-student allocation.

The resulting equilibrium is unique and symmetric but can take four different shapes depending on preferences for research, the technology of the education production function and the relative weight between the two components of the finance scheme. The four equilibrium types are:

1. Full-time teaching.
2. Selective teaching and research.
3. Mass teaching and research.
4. Full-time research.

The aim of this note is to compare our previous results with the outcome of university behaviour in absence of student mobility. By doing this, we shall be able to isolate the role of competition on university behaviour as well as the conditions for it to take place.

We obtain the following result: in absence of student mobility, universities devote all their time/resources to either teaching or research. Therefore, equilibrium types 2 and 3 will only result in presence of student mobility. Further, neither of these mixed equilibrium types results if preferences for research are not strong. As a result, we may conclude that, *for student mobility to have an effect on higher education, we need universities to have strong preferences for research*. On the other hand, we will show that both student mobility and strong preferences for research are necessary conditions for universities to react to changes in the funding scheme.

This note is organized as follows. In Section 2, we briefly introduce the model and solve it, comparing the outcome to our previous results. In Section 3, we conclude.

## 2. The model

We consider the model specified in Del Rey (2001) and assume that, now, students are assigned by law to their closest university. This way, demand is given by the student population within each jurisdiction. As a result, no interaction among the universities takes place. The aim of this note is precisely to compare the outcome of university behaviour in a com-

petitive environment (Del Rey, 2001) with the outcome of university behaviour in absence of strategic interaction.

The model is then as follows: there are two identical universities  $i = 1, 2$ . Students differ in ability  $a$  and in location  $x$ , which are uniformly and independently distributed on  $[0, 1] \times [0, 1]$ . Since students do not choose university, demand for university  $i = 1, 2$  is exogenous and equals one half. The universities behave as local monopolies.

Universities can control for the average ability of their students by limiting admissions. They can for example hold an exam and offer admission only to the students with the best results. Since individual ability varies between zero and one, individuals with ability 1 will be offered admission first. Let  $a_i \in [0, 1]$  be the ability (or the grade obtained in the entrance exam) of the last student to whom university  $i$  will offer admission. Given the number of applications ( $1/2$ ) the limiting grade  $a_i$  determines the number of admissions  $N_i \in [0, 1/2]$ :

$$N_i = (1 - a_i) \frac{1}{2} \quad [1]$$

Each of the universities devotes some funds to research ( $R_i$ ), and “produces”  $N_i$  graduates of equal labour productivity (or quality)  $q_i$  according to a production function of the form:

$$q_i \leq \alpha \bar{a}_i + \beta t_i \quad [2]$$

where  $\bar{a}_i$  is the average ability of admitted students and  $t_i = T_i/N_i$  are the funds the university devotes to teaching ( $T_i$ ) per enrolled student ( $N_i$ ). From [1], we have  $\bar{a}_i = 1 - N_i$ . Although we are aware of existing synergies between teaching and research at the graduate level, these are much less obvious within the framework of undergraduate education, where teaching and research are to a large extent mutually exclusive activities. We then concentrate on undergraduate education.

The parameters  $\alpha, \beta \geq 0$  represent, respectively, the peer effect and the productivity of teaching per student. Universities care for the increase in total productivity of their students  $N_i q_i$  (which provides reputation or prestige) and also derive some utility  $\gamma R_i$  from time/funds devoted to research activities  $R_i \cdot \gamma \geq 0$  is thus the marginal utility of research. The payoff of the university is

$$U_i = N_i q_i + \gamma R_i$$

Finally, funds available to universities are provided by the government in the form of a fixed amount  $F$  and a positive per-student allocation  $s$ . Per student allocations are widely used in Europe as a simple way to adjust funding for the relative size of a university. Funds obtained from the government are entirely devoted to paying the teachers a salary  $w$  in exchange of which they teach (thus increasing the productivity of the students) and/or research (providing the institution with higher utility levels). We can normalize the exogenous wage  $w$  to 1 to obtain the simple budget constraint for each university  $i$ :

$$F + sN_i \geq T_i + R_i \quad [3]$$

It is worth noting that separability and linearity in the education production function are bound to lead to extreme solutions. Hence, we must be ready to interpret our results as magnified tendencies.

The following table summarizes the results corresponding to the existence of student mobility according to Del Rey (2001). Demand depends on quality and limits feasible enrolments at each university. Different equilibrium types result depending on the parameter configuration. The third column collects the effect of marginal increases in the per-student allocation  $s$  paired with the necessary reduction in  $F$  required to keep the budget balanced. When preferences for research are strong and either  $\alpha$  the peer group effect, or  $s$  the per student allocation, are large enough, the government can control resulting levels of research, teaching and hence education quality by means of the relative weight given to per student allocations in the finance scheme.

Table 1

Equilibrium type	Conditions	Role of Financing Scheme
Full-time $T$	$\beta > \gamma$	none
Selective $T$ and $R$	$\gamma > \beta$ , $\alpha$ large	$\Delta s \rightarrow$ less $R$ , more $T$ and $q$
Mass $T$ and $R$	$\gamma > \beta$ , $\alpha$ small, $s$ large	$\Delta s \rightarrow$ less $R$ , more $T$ and $q$
Full-time $R$	$\gamma > \beta$ , $\alpha$ and $s$ small	$\Delta s$ can change equilibrium type

In absence of student mobility, demand is given. As a result, no interaction takes place among the institutions. Our problem has then two possible corner solutions. In order to see this, note that the constraints [2] and [3] are always binding. If they were not, we could always increase the allocation to research and thus raise the payoff. Hence, we can substitute  $q_i = \alpha \bar{a}_i + \beta (T_i / N_i)$  and  $R_i = F + sN_i - T_i$  into the utility function, which yields:

$$U_i = \alpha N_i (1 - N_i) + (\beta - \gamma) T_i + \gamma (F + sN_i) \quad [4]$$

This function is increasing in the relevant range of  $N$  so that all applications are always accepted. If  $\beta > \gamma$ , [4] is also increasing in  $T$ : *all funds are devoted to teaching*. If  $\gamma > \beta$ , the payoff of the university is always decreasing in  $T$  so that *all funds are devoted to research*. Since demand does not depend on quality, universities still manage to enrol  $N = 1/2$  students. This, together with the fact that no funds are devoted to teaching, yields minimal (though positive) quality. The following table represents equilibrium types in absence of student mobility.

Table 2

Equilibrium type	Conditions	Role of Financing Scheme
Full-time $T$	$\beta > \gamma$	none
Full-time $R$	$\gamma > \beta$	none

We can conclude that, in absence of student mobility, each university will teach full time at equilibrium if the productivity of teaching is larger than the marginal utility of research

and research full-time otherwise. In both cases, all applications are accepted. Moreover, this result is independent from the relative weight given to per-student allocations in the proposed funding scheme. Although this may seem trivial, note that, in principle, there is a trade-off between the costs and benefits of limiting admissions. We could expect universities to be more or less selective according to the size of per-student allocations even at the monopolistic case. For example, if per-student allocations were low, the university could reduce admissions if the associated loss of funds was smaller than the gain in quality obtained through student selection. We have shown that, in absence of student mobility, she will not have an interest in doing this.

Indeed, when students are not mobile, the higher quality derived from selection has no positive effect on demand. For this reason, selection of students will not take place.

### 3. Concluding remarks

Competition is understood here as strategic interaction between the institutions. Whenever the model allowing for student mobility (Del Rey, 2001) yields identical results as those obtained at the local monopoly case, we conclude that competition has no effect at equilibrium.

This is the case in equilibrium types number 1 and 4 in the introduction (full-time teaching and full-time research), which yield the exact same outcome as that of the local monopolies case analyzed next. Student mobility, certainly a necessary condition for competition to take place, is however not *enough* for it to affect university behaviour. In particular, we also need that the marginal utility of research is larger than the productivity of teaching ( $\gamma > \beta$ ). Of course, very large preferences for research eliminate teaching and, hence, competition for students.

In absence of student mobility all students attend their assigned university independently of the quality provided. When students are mobile, they choose the university that offers the highest quality. The question is whether universities will try to attract those mobile students or not. The answer is that they may, provided that they care for research.

The intuition underlying this result is the following. If universities do not care for research, all funds are simply devoted to teaching and all applications are accepted. Caring for research implies that, if they teach, universities want to make the best out of teaching (minimize costs/maximize benefits). That way, remaining funds will be transferred to research. Each additional admission then implies a novel trade-off between the additional funds obtained through the per-student allocation and the fall in average ability of students, which raises the cost of teaching. If peer effects are strong relative to per-student allocations, universities caring for research are selective. Clearly, as the relative size of per-student allocations grows, admissions increase.

Hence, when student mobility affects the outcome of university behaviour, the financing scheme is the ultimate determinant of education quality and research levels (see Propositions

3 and 5 in Del Rey (2001)). We are thus able to conclude that, desirable or not per se, competition may allow the government to control resulting levels of teaching, education quality and research by means of a very simple tool: the relative weight of per-student allocations in the funding scheme. In the context of a simple model we have shown that high preferences for research are a necessary condition for this to be the case. Empirical work should provide the evidence required to assess the relevance of this result.

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## Resumen

Este trabajo explora, basándose en resultados previos, los efectos de la movilidad de estudiantes sobre el comportamiento de las universidades. Los resultados sugieren que, si a las universidades no les preocupa la investigación, no reaccionarán ante el aumento de competencia cuando los estudiantes pueden elegir dónde estudiar. Además, tampoco reaccionarán ante los incentivos proporcionados por el gobierno a través del esquema de financiación. Las preferencias por la investigación se convierten en un elemento clave del éxito o fracaso de políticas diseñadas para (i) potenciar la competencia en el sector de la educación superior, y (ii) modificar los niveles de investigación y calidad educativa mediante los incentivos que puede proporcionar el esquema de financiación.

*Palabras claves:* competencia entre universidades, financiación de la educación superior.

*Clasificación JEL:* L3, I22.