Good research and bad teaching? A business school tale

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Résumé : Cet article propose l’étude d’un jeu différentiel opposant deux écoles de commerce. A l’état stationnaire, le jeu présente un équilibre dans lequel une des écoles présente un enseignement de mauvaise qualité alors que la recherche effectuée est de bonne qualité. Une des sources de ce déséquilibre provient de l’accumulation du capital humain qui, une fois atteint une masse critique, permet l’accroissement rapide de la recherche et incite les responsables de l’école à sous utiliser le capital humain à fin pédagogique.

Abstract: The paper presents a simultaneous differential game between rich and poor Business Schools [BS] that yields equilibrium in which either type of BS may end up with bad teaching and good research, without resorting on informational problems. The necessary condition for this is that the BS’s impatience is smaller than the growth rate of research, which may arise as a result of school’s lack of vision and ambition in becoming a leading school, or due to the fact that after a given critical mass of human capital is achieved in a BS, research grows fast, making BS managers to underuse the available human capital for teaching. Policy implications are discussed.

Key words: Education and teaching; Research policy; Business schools.

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1. Introduction

The market for managers is growing fast with globalization. The demand for good managerial skills is reflected in the growth and importance of Business Schools [BS thereafter]. Traditional BS have received huge amounts of resources, becoming richer, more powerful and influential. The high demand for professionals has created an immense international market allowing new BS to appear. The creation of new BS is increasing competition. The competition between BS has generated rankings that aim at informing prospective students and employers how good they are. Most of the BS rankings are based on research output, measured through publications in academic journals. The rankings have made the BS to put emphasis on research and to invest in new personnel, and resources for research. However, this relatively new trend has attracted criticism. For the critics the emphasis on research has damaged teaching, and the research output of BS is being regarded in some circles as narrow, irrelevant and impractical.

One of the main issues raised by the critics is whether BS can create a research environment and reputation without affecting negatively teaching quality. Some authors have tried to explain why schools would engage in a race for publications that brings only a

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1 One of the sources of resources is the Business school’s naming, see Burch and Nanda (2005).
2 A signal of the internationalization of BS is the emergence of new BS in Europe; see Bowden and Mulinix (2005) on differences between American and European BS, and Kraft and Vodopovig (2003) on the creation of new BS in transition economies.
4 Others such as Binks et al. (2006) stress that links need to be created between teaching and research with increasing focus on the general utility of entrepreneurial skills and aptitudes.
limited value to students and managers. Recently Besancenot et al. (2008) addressed the possible trade-off between research and teaching in BS. Their approach depends on informational problems. They show that if students have imperfect information about the BS, the least productive BS have an incentive to do as much research as the top-tier ones in order to manipulate student’s expectations and attract them. This makes the most productive schools to do excess research to signal their types, sacrificing teaching.

This paper examines how bad teaching and good research can arise as equilibrium without resorting on informational problems. The paper examines a simultaneous differential game between rich and poor BS that yields, among the possible steady state solutions, an equilibrium in which either type of schools may end up with bad teaching and good research. In the model all BS try to be successful in publishing research in order to gain reputation in the market as a leading business school. They invest in human capital to do research and teaching. They do not aim at doing only research or teaching. However, whenever one of the BS’s impatience is smaller than the growth rate of research, it may end up with good research and bad teaching. There are a number of possible explanations. One explanation may be due to school’s lack of ambition in becoming a leading school, and it is just joining the wagon of research making. Another explanation is related to the fact that after a given critical mass of human capital is achieved in a BS, research takes off, growing fast, and it makes BS managers wondering what they can achieve with the human capital at their disposal, leading them to underuse it for teaching.

Bad teaching, seen as a suboptimal allocation of personnel in teaching, can be a policy issue, and one wonders how to fix it. We consider some policies
regarding public funding, and curriculum changes and human capital formation, that may improve teaching without damaging research.

The paper is organized as follows. The next section presents the general model and a tractable, stylized, model, which admits an explicit solution. The outcome of bad teaching and good research is analyzed in section three. Section four discusses the policy implications, and section five brings the concluding remarks.

2. The Model

2.1 General formulation

There are two types of business school [BS], rich and poor. Both schools try to be successful in publishing research \( R \) in order to gain reputation in the market as a leading business school. Market leadership in research may attract more and better students, allowing the BS to become a market leader. As publications depend on external peer evaluation of the work done in any given school, it should be considered as a variable that is not under BS control. The production and evolution of research depend on previous research, the BS human capital and teaching, and the opportunity costs of academic personnel.

The rich BS recruits its academic personnel from top schools; these personnel human capital is denoted by \( H \). The poor BS recruits people from any school, their academic personnel have human capital denoted by \( h \).

The time evolution of research is:

\[
\dot{R} = F(R, H, h, T, \tau) - cT - \delta \tau \tag{1}
\]

Where \( \dot{R} \) denotes the time derivative of \( R \), \( \dot{R} = \frac{dR}{dt} \); \( T \) and \( \tau \) are the teaching at the rich and poor BS respectively; and \( F(\bullet) \) is the production function of research.
We assume that the production function of research $F(\bullet)$ depends on previous research, on the efforts of the human capital of both BS [since research is a social product it depends on efforts of all researchers, no matter their affiliation or human capital], and on the positive spillovers of teaching on research. In eq. (1) the term $\delta \tau + cT$ accounts for the total opportunity costs of research. It is important to stress that $T$ and $\tau$ are teaching indexes, they combine the amount of time dedicated to teaching with quality.

The preferences of both BS over time are represented by the following utility integrals:

Rich business school:
\[
\int_{0}^{\infty} U(Y) e^{-rt} dt
\]

Poor business school:
\[
\int_{0}^{\infty} V(y) e^{-\rho t} dt
\]

Where $r$ and $\rho$ are the rate of time preference of the rich and poor BS, respectively.

Note that the argument in each BS utility function is income $Y$, and $y$. As BS income depends on the product and services they sell, education, it depends on teaching and research. Therefore, we have: $Y = Y(T, R)$, and $y = y(\tau, R)$.

The general problem of our interest is that each BS maximizes its respective utility integrals taking as given the dynamic constraint (1). They consider eq.(1) as a constraint because the schools cannot control published research since it depends on external peer review and, consequently, is outside their reach. What each BS controls is teaching. Therefore the general problem to be studied here is how each BS allocates teaching so as to maximize their respective utility integral,
which is equivalent to maximize their discounted flow of income, taking into account how research evolves\textsuperscript{5}.

This general formulation does not provide us with clear cut results, so we must specify the functions paying special attention to their mathematical tractability so as to obtain a set of explicit solutions for the problem. This is done in the next subsection.

2.2 Explicit model

Table 1 below summarizes all parameters and variables for each specific BS in the explicit functions considered in this section to solve the general model.

<table>
<thead>
<tr>
<th>Variables and Parameters</th>
<th>Rich BS</th>
<th>Poor BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human capital research productivity</td>
<td>$b$</td>
<td>$\beta$</td>
</tr>
<tr>
<td>Rate of time preference</td>
<td>$r$</td>
<td>$\rho$</td>
</tr>
<tr>
<td>Teaching index</td>
<td>$T$</td>
<td>$\tau$</td>
</tr>
<tr>
<td>Teaching time</td>
<td>$\xi$</td>
<td>$\eta$</td>
</tr>
<tr>
<td>Marginal product of past research</td>
<td>$\theta$</td>
<td>$\theta$</td>
</tr>
<tr>
<td>Teaching externality on research</td>
<td>$m$</td>
<td>$\psi$</td>
</tr>
<tr>
<td>Opportunity cost of research</td>
<td>$c$</td>
<td>$\delta$</td>
</tr>
</tbody>
</table>

Let us start with the production function of research, $F(\bullet)$. Assuming the marginal productivity of $H$ and $h$ doing research are, respectively, $\beta$ and $b$, one can think of these parameters also being impacted by the capital made available for research by the BS, such as better libraries, computers, databases, etc. The

\textsuperscript{5} Faria (2002) discusses in detail a model for a representative scholar that has some similarities with the current approach.
positive externality of teaching on research is given by \( \psi \) and \( m \), for the poor and rich BS, respectively. We can write the production function of research as:

\[
F(R,H,h,T,\tau) = R^\theta + bh + \beta H + mT + \psi \tau; \quad 0 \leq \theta \leq 1
\]  
(2)

Academic personnel are allocated in teaching and research according to:

\[
h = \eta \tau + (1 - \eta)R
\]  
(3)

\[
H = \xi T + (1 - \xi)R
\]  
(4)

Where \( \eta \) and \( \xi \) are positive constants defined in the unitary interval.

Substituting equations (2), (3) and (4) into (1) yields:

\[
\dot{R} = \theta R + b(1 - \eta)R + \beta(1 - \xi)R + (b \eta + \psi - \delta) \tau + (\beta \xi + m - c)T
\]  
(5)

Each BS controls teaching so as to maximize their respective welfare:

\[
\text{Max} \int_0^\tau A(T, R) e^{-rt} \, dt
\]  
(6)

\[
\text{Max} \int_0^\tau B(\tau, R) e^{-\rho t} \, dt
\]  
(7)

Where \( A(T, R) = U(Y) = U(Y(T, R)) \), and \( B(\tau, R) = V(y) = V(y(\tau, R)) \).

Let us assume the following Cobb-Douglas instantaneous utility functions [which can be thought as income generation functions for the schools]:

\[
A(T, R) = T^a R^{1-a}
\]

\[
B(\tau, R) = \tau^\alpha R^{1-\alpha}
\]

Where \( a \) and \( \alpha \) are defined in the unitary interval.

Equations (5)-(7) describe a differential game. This paper focuses only on open-loop strategies [e.g., Dockner et al., 2000]. An open-loop Nash equilibrium is the pair of strategies \( \tau \) and \( T \), such that the poor and rich BS maximize their
objective. The necessary optimality conditions of the control problems of both schools hold simultaneously, and are presented below.

The rich BS Hamiltonian function is:

$$J^R = T^a R^{1-a} + \lambda[R^\theta + b(1-\eta)R + \beta(1-\xi)R + (b\eta + \psi - \delta)\tau + (\beta \xi + m - c)T]$$  \hspace{1cm} (8)

The first order conditions are:

$$J^R_T = 0 \Rightarrow aT^{a-1}R^{1-a} + \lambda(\beta \xi + m - c) = 0$$ \hspace{1cm} (9)

$$\dot{\lambda} - \dot{\lambda} = -J^R_r \Rightarrow \dot{\lambda} - \dot{\lambda} = -\{(1-a)T^a R^{-a} + \lambda[\theta R^{\theta-1} + b(1-\eta) + \beta(1-\xi)]\}$$ \hspace{1cm} (10)

The poor BS Hamiltonian function is:

$$J^P = \tau^a R^{1-a} + \mu[R^\theta + b(1-\eta)R + \beta(1-\xi)R + (b\eta + \psi - \delta)\tau + (\beta \xi + m - c)T]$$ \hspace{1cm} (11)

The first order conditions are:

$$J^P_T = 0 \Rightarrow \alpha T^{\alpha-1}R^{1-a} + \mu(b\eta + \psi - \delta) = 0$$ \hspace{1cm} (12)

$$\mu - \rho \mu = -J^P_r \Rightarrow \mu - \rho \mu = -\{(1-\alpha)\tau^a R^{-a} + \mu[\theta R^{\theta-1} + b(1-\eta) + \beta(1-\xi)]\}$$ \hspace{1cm} (13)

In order to find the steady state equilibrium, we set $\dot{R} = \dot{\lambda} = \dot{\mu} = 0$ in eqs. (5), (10) and (13), and use eqs. (9) and (12). The optimal research level is given by:

$$R^* = \left\{ \frac{a(1-\alpha)\tau + \alpha(1-a)\rho - (1-a\alpha)[b(1-\eta) + \beta(1-\xi)]}{(1-\alpha)(1-\alpha) + (a(1-\alpha) + \alpha(1-a))\theta} \right\}^{1/(\alpha-1)}$$ \hspace{1cm} (14)

Optimal research is non-negative, thus the following inequality holds:

$$a(1-\alpha)\tau + \alpha(1-a)\rho \geq (1-a\alpha)[b(1-\eta) + \beta(1-\xi)]$$ \hspace{1cm} (15)

The comparative statics of (14) yields interesting results:

$$\frac{dR^*}{dc} = \frac{dR^*}{d\delta} = 0; \frac{dR^*}{dm} = \frac{dR^*}{d\psi} = 0; \frac{dR^*}{db} > 0; \frac{dR^*}{d\beta} > 0; \frac{dR^*}{d\rho} < 0; \frac{dR^*}{d\tau} < 0$$ \hspace{1cm} (16)

Notice that optimal research is not influenced by $c$ and $\delta$, the opportunity costs of research. It also should be noted that whether or not research and teaching may
be complementary in the research production function, it does not affect the equilibrium value of research, since $m$ and $\psi$ do not appear in eq.(14). As expected, optimal research is positively affected by the marginal productivity of human capital in research production ($b$ and $\beta$). In addition, equilibrium research is negatively impacted by the BS impatience ($r$ and $\rho$), and by the time allocated into teaching ($\xi$ and $\eta$). Finally, optimal research is negatively affected by the marginal product of past research, $\theta$.

The steady state value of teaching in the rich BS [expressed as a function of optimal research, $R^*$] is:

$$T^* = \frac{aR^*}{(1-a)(c-\beta\xi)}[r - \theta R^* x \theta - b(1-\eta) - \beta(1-\xi)] \quad (17)$$

It is worth noticing that there are two cases for a positive $T^*$:

1) $c - \beta\xi > 0$, and $r > \theta R^* x \theta - b(1-\eta) + \beta(1-\xi)$

2) $c - \beta\xi < 0$, and $r < \theta R^* x \theta - b(1-\eta) + \beta(1-\xi)$

When case 1) holds, it is easy to see that an increase in optimal research increases teaching quality in the rich BS, since $\theta > \theta^2$, therefore:

$$\frac{dT^*}{dR^*} = \frac{a}{(1-a)(c-\beta\xi)}[r - \theta^2 R^* x \theta - b(1-\eta) - \beta(1-\xi)] > 0 \quad (18)$$

According to Eq. (17) good research leads to good teaching in the rich BS if case 1) holds.

In case 2) optimal research leads to better teaching in the rich BS, $\frac{dT^*}{dR^*} > 0$, if the following inequality holds: $r < \theta^2 R^* x \theta - b(1-\eta) + \beta(1-\xi)$.

However, we may have a special result steaming from case 2), in which an increase in research may lead to a fall in teaching quality at the rich BS, $\frac{dT^*}{dR^*} < 0$. 
This happens when the rich BS rate of time preference, \( r \), assumes values in the following range:

\[
\theta^2 R^{*\theta-1} + b(1-\eta) + \beta(1-\xi) < r < \theta R^{*\theta-1} + b(1-\eta) + \beta(1-\xi) \quad (19)
\]

This particular result deserves some attention because it yields an undesirable outcome, i.e., when the rich BS puts too much emphasis in quality research, it may lead to a fall in teaching quality.

In the same vein, the analysis for the poor BS is analogous.

The steady state value of teaching in the poor BS [expressed as a function of optimal research \( R^* \)] is:

\[
\tau^* = \frac{\alpha R^*}{(1-\alpha)(\delta - b\eta)} [\rho - \theta R^{*\theta-1} - b(1-\eta) - \beta(1-\xi)] \quad (20)
\]

There are two cases for a positive \( \tau^* \):

I) \( \delta - b\eta > 0, \text{and } \rho > \theta R^{*\theta-1} + b(1-\eta) + \beta(1-\xi) \)

II) \( \delta - b\eta < 0, \text{and } \rho < \theta R^{*\theta-1} + b(1-\eta) + \beta(1-\xi) \)

In case I) an increase in optimal research \( R^* \) increases teaching quality in the poor BS, \( \tau^* \), since \( \theta > \theta^2 \), therefore:

\[
\frac{d\tau^*}{dR^*} = \frac{\alpha}{(1-\alpha)(\delta - b\eta)} [\rho - \theta^2 R^{*\theta-1} - b(1-\eta) - \beta(1-\xi)] > 0 \quad (21)
\]

According to eq.(20) good research is conducive to good teaching in the poor BS if case I) holds.

In case II) optimal research leads to better teaching, \( \frac{d\tau^*}{dR^*} > 0 \), if the following inequality holds: \( \rho < \theta^2 R^{*\theta-1} + b(1-\eta) + \beta(1-\xi) \).

The poor BS can also suffer of too much research leading to bad teaching. The special case in which teaching quality suffers as a result of greater emphasis in
quality research is related to case II), in which an increase in research may lead to a fall in teaching quality at the poor BS, \( \frac{d\tau^*}{dR^*} < 0 \). This happens when the poor BS rate of time preference, \( \rho \), assumes values in the following interval:

\[
\theta^2 R^* \theta^{-1} + b(1-\eta) + \beta(1-\xi) < \rho < \theta R^* \theta^{-1} + b(1-\eta) + \beta(1-\xi) \quad (22)
\]

The analysis above is interesting and important because it suggests that either school can end up with good research and bad teaching. The next section describes all possible scenarios associated with good research and bad teaching.

3. **Good Research, Bad Teaching**

There are two special cases in which bad teaching and good research can arise as an optimal equilibrium for a business school, and they depend on the BS impatience:

i) The poor BS is more impatient than the rich BS: \( \rho > r \)

ii) The rich BS is more impatient than the poor BS: \( \rho < r \)

It is important to stress that conditions 2) and II) cannot hold simultaneously. Therefore the bad teaching scenarios are associated with the following combinations of non-negativity conditions: a) when conditions 2) and I) hold simultaneously, or b) when conditions 1) and II) hold simultaneously.

In the first case, the poor BS is more impatient than the rich BS: i) \( \rho > r \). In this case bad teaching happens when conditions 2) and I) hold simultaneously:

\[
\theta^2 R^{\theta^{-1}} + b(1-\eta) + \beta(1-\xi) < r < \theta R^{\theta^{-1}} + b(1-\eta) + \beta(1-\xi) < \rho \quad (23)
\]

According to inequality (23), the rich BS has good research and bad teaching, while the poor BS has good research and good teaching.
In the second case, the rich BS is more impatient than the poor BS: ii) $\rho<r$. In this case bad teaching happen when condition 1) and II) hold simultaneously:

$$
\theta^2 R^{\theta-1} + b(1-\eta) + \beta(1-\xi) < \rho < \theta R^{\theta-1} + b(1-\eta) + \beta(1-\xi) < r \quad (24)
$$

According to inequality (24), the poor BS has good research and bad teaching, while the rich BS has good research and good teaching.

From (23) and (24), one may conclude that the likelihood of either type of BS schools to end up with bad teaching is the same. However, there is no reason for that. Recalling that the marginal productivity of $H$ and $h$ doing research are, respectively, $\beta$ and $b$. Assuming that a graduate from a top school has greater human capital than other graduates, $H>h$, which may translate into greater research productivity, $\beta>b$. If this is true, case 2) is more likely to happen than case II), which leads one to conclude that the rich BS has greater probability to end up with bad teaching than the poor BS.

However, if one assume that teaching time is the same in both BS, $\eta=\xi$, and $H>h$, then it follows that teaching at the rich BS is better than teaching at the poor BS: $T>\tau$. It is important to stress that this inequality does not necessarily imply that the poor BS is characterized by bad teaching, since bad teaching is associated with a negative impact of research on teaching, $\frac{d\tau^*}{dR^*} < 0$.

The above bad teaching scenarios given by inequalities (23) and (24) suggest that the rate of growth of research given by:

$$
\frac{d R^*}{dR} = \theta R^{\theta-1} + b(1-\eta) + \beta(1-\xi) \quad (25)
$$

is of utmost importance.
Basically, whenever one of the BS’s impatience is smaller than the growth rate of research, it may end up with good research and bad teaching. This is a necessary although not sufficient condition for bad teaching.

A noticeable characteristic of these bad teaching scenarios is that bad teaching can be an optimal outcome for both types of schools. Bad teaching can happen in the rich or in the poor BS. However, bad teaching cannot happen in both schools at the same time.

There are a number of possible explanations consistent with BS’s impatience being smaller than the growth rate of research. One possible explanation may be due to school’s lack of ambition or vision in becoming a leading school. It invests in research following the market trend. In this scenario the BS dean does not realize that good teaching can be achieved with the available BS’s resources, and he thinks in research and teaching in terms of an inexistent trade-off. Alternatively, when human capital accumulation in a BS reaches a critical point, the growth rate of research accelerates, and research grows too fast. As a result, BS managers may wonder how to allocate the human capital at their disposal, leading some of them to underuse it for teaching.

In the next section we discuss some possible policy recommendations to correct the bad teaching good research scenario.

4. Policy implications

It is somewhat ironical and paradoxical that business schools, in a competitive environment, may end up with the bad teaching and good research outcome. If one understands bad teaching as a suboptimal employment of human capital, a
market failure, one wonders what can be done to fix it. Particularly, one wonders whether public policies can be enacted so as to correct this problem.

As we noted before, bad teaching and good research can occur when the BS is patient relatively to the growth rate of research. A patient BS is the one that invests heavily in research and knows that it takes time to benefit from the research output in terms of recognition. A BS can afford to be patient when it has no financial problem and is not under financial stress. For instance, if the BS is public funded, it has no direct pressure to make money through tuition fees from its students. If, however, the BS has to face increasing and tougher competition, and has no major source of finance other than tuition fees, its impatience can increase. In this scenario the BS has to perform in the short run to attract more students, which can only be done by improving its teaching standards, since research takes longer time to be effective. A public policy that subsidises the students rather than the public BS can work to improve teaching standards, since the students can shop around for schools with better teaching and the public BS will have to compete for students, having lost the luxury of financial security.

Curriculum changes demanding greater number of hours of teaching, can affect the allocation of resources inside the BS so as that more teaching is devoted for each unit of human capital. However this policy can lead to a fall in the growth rate of research, leading to a trade-off between teaching and research: better teaching comes with a price, worse research.

Incentives for capital accumulation, such as scholarships for PhDs, can increase human capital research productivity, leading to an acceleration of the growth rate of research making scenarios II) and 2) more likely to happen, avoiding the trap described by the inequalities in eqs. 23) and 24).
5. **Concluding Remarks**

The paper examines a simultaneous differential game between rich and poor Business Schools [BS] that yields an open-loop Nash equilibrium in which either type of BS may end up with bad teaching and good research. In stark contrast with the literature that emphasizes informational issues, this result arises without resorting on informational problems.

In the model all BS try to be successful in publishing research to gain reputation in the market to become a leading business school. They invest in human capital to do research and teaching. They do not aim at doing only research or teaching. However, whenever one of the BS’s impatience is smaller than the growth rate of research, it may end up with good research and bad teaching. There are a number of possible explanations consistent with this condition. One explanation may be due to school’s lack of vision and ambition in becoming a leading school. The schools are just joining the wagon of research making. Another explanation is related to a threshold level of human capital accumulation, which after a BS reaches it, research takes off, growing fast. In this situation BS managers wonder how to allocate the human capital at their disposal, leading some of them to underuse it for teaching.

Because bad teaching can be seen as a suboptimal outcome, a market failure, we consider policies regarding public funding, curriculum changes and human capital formation that may improve teaching without damaging research. Among our proposals, shifting subsidies from public BS to students, and emphasis in human capital formation may work to correct the problem.
References


