

Teaching quality in a technical university: trade-offs and complementarities with research productivity and consulting activities

Stefano Bianchini ^{a,b} Francesco Lissoni ^{c,d}
Michele Pezzoni ^{d,e} Lorenzo Zirulia ^{d,f}

^aBETA, University of Strasbourg, France

^bLEM, Scuola Superiore Sant'Anna, Pisa, Italy

^cGREThA, Universisty Bordeaux IV, France

^dKITeS, Bocconi University, Milan, Italy

^eCEMI, Ecole Polytechnique Federale De Lausanne

^fUniversity of Bologna, Italy

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Motivation and background

- As it is widely recognized, universities play three roles in modern societies (Molas-Gallart et al., 2002): (i) human capital creation, (ii) knowledge production, and (iii) knowledge transfer
- Much of the public debate and most policy proposals have focused on the evaluation of research activities, both at the individual and at the departmental level (Rebora and Turri, 2013)
- Academics face huge trade-offs and some complementarities in allocating time and effort among their “missions” (and the current incentive scheme does not help)

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- A long standing debate on the teaching-research nexus, although with quite controversial and mixed result (Ramsden and Moses, 1992; Hattie and Marsh, 1996; Jenkins, 2004); it seems that good research positively influences teaching, but not the vice-versa
- A lot of empirical work on university-industry relations, academic patenting, academic entrepreneurship has explored the link between research and various “third mission” initiatives (among the many see: Thursby and Thursby, 2002; Lissoni et al., 2008; Crespi et al., 2011; Perkmann et al., 2013)

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- Many channels bind universities to the society: technology commercialisation, entrepreneurial activities, commercialisation of facilities, advisory work or consultancy
- Informal knowledge transfer (consultancy) has received little attention compared to the other mechanisms (Link et al, 2007)

No evidence (for the best of our knowledge) on the teaching-consulting nexus, not to say the influence of research on this relationship. More precisely, our core focus is on teaching activity and on the effects that research and consulting might play on its quality

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The contributions of our study

- On the **theoretical** side, we propose a formal model in which academics allocate their effort (time) between three activities:
 - ✓ Teaching, which provides “intrinsic” satisfaction
 - ✓ Research, which provides “intrinsic” satisfaction, increases teaching quality and works as signal for consulting activities
 - ✓ External consulting, which provides additional income
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The model: Initial setting

- A university professor is active in two periods, period 1 (when she is “junior”) and period 2 (when she is “senior”)
- In each period, the professor has an effort (time) endowment τ to allocate among teaching (e_T), research (e_R) and consultancy (e_C). Professor utility function is given by:

$$u(e_T, e_R, m) = u_R(e_R) + u_T(e_T) + m$$

- u_R and u_T are the benefits (strictly increasing and concave functions) of efforts in research and teaching, while m stands for income.

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- (Extra-) income comes from consultancy, under the form of fees per time unit ϕ :
 - ✓ ϕ is influenced by exogenous factors (in particular the discipline of research), which are captured by a parameter x , with $\frac{\partial \phi}{\partial x} > 0$;
 - ✓ ϕ is time-variant, with ϕ_2 increasing in e_{R1} (signaling effect of research).
- We assume that teaching quality T depends positively on current teaching effort and past research effort, i.e. $T_1 = T(e_{T1}, 0)$ and $T_2 = T(e_{T2}, e_{R1})$
- The model is solved "backwards":
 - ✓ Optimal efforts in the second period;
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Model assumptions: A discussion

- The model aims to capture the specificities of the Italian (more in general European) university system so far:
 - ✓ Few institutional constraints in the allocation of efforts among activities
 - ✓ Teaching quality does not influence rank advancement (at least not as research does)
 - ✓ Wages are more depending on “outside opportunities” than rank advancement (strongly depending on first-period effort in research)
- Consulting opportunities depend on the discipline (Lee and Rhoads, 2004), with faculty in applied fields facing higher possibilities for extra-academic activities

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Testable implications

- We derive three sets of propositions on teaching quality as a function of: (i) academic seniority (or rank), (ii) past research activity, and (iii) external consulting opportunities
 - ✓ By assumption research commitment is an input of teaching quality but it builds the “signal” for external consulting → decreasing marginal effect
 - ✓ Senior professors operating in applied disciplines devote less effort in teaching because of external consulting opportunities; however they have exerted more research effort when junior (to build the “signal” and for career advancement) → rank effect is a-priori ambiguous
 - ✓ The larger are the consulting opportunities the lower is teaching effort always

Empirical investigation: Data

- Source: Teaching evaluation questionnaires from the Faculty of Engineering, University of Brescia; all courses in the academic year 2005/06 to 2007/08.
- Unit of observation: course (1546 obs) - to which a single professor is associated (175 professors in total)
- Available information:
 - ✓ Mean values of the answers for each item of the questionnaire concerning diverse aspect of teaching quality
 - ✓ Professor characteristics: age, gender, rank, discipline, stock of publications/citations/patents, teaching workload
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Empirical investigation: Data

- We do not have direct information on consulting
- We interpret **discipline dummies** as capturing the effect of outside opportunities (consistent with the structure of the local economy).
- Four disciplinary fields (which correspond to four different departments):
 - ✓ Basic science (chemistry, math, physics): low opportunities
 - ✓ Mechanical engineering: high opportunities (mostly local)
 - ✓ Electronic engineering: high opportunities (more global)
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Empirical investigation: Methodology

- Exploratory factor analysis (EFA) to extract a synthetic indicator of teaching quality
- Inclusion of a large set of controls (several specifications)
- Econometric technique:
 - ✓ Pooled OLS [alternatives have been tested]
 - ✓ Time dummies for the second and third year of observation
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	(1)	(2)	(3)	(4)	(5)
RANK_ASSISTANT	ref	ref	ref	ref	ref
RANK_ASSOCIATE	-0.0897	-0.0828	-0.2088*	-0.1219	-0.1600
RANK_FULL	-0.3380***				-0.4508***
BASIC_RANK_FULL		0.0176	-0.1578	-0.0086	
CIVIL_RANK_FULL		-0.3107*	-0.4401***	-0.3287**	
ELECT_RANK_FULL		-0.3856*	-0.6734***	-0.4363**	
MECH_RANK_FULL		-0.4265***	-0.4689***	-0.4257***	
STOCK_PUB			0.0388***		0.0328***
STOCK_PUB_SQ			-0.0005***		-0.0004***
STOCK_CIT				0.0005***	
STOCK_PAT					0.0192
BASIC_SCIENCE					ref
CIVIL					-0.4250***
ELECT					-0.4477***
MECH					-0.4060***
CONTROLS	yes	yes	yes	yes	yes
R ²	0.4460	0.4532	0.4780	0.4866	0.4769
Observations	1,546	1,546	1,546	1,546	1,546

Notes: ***, ** and * indicate significance on a 1%, 5% and 10% level, respectively.

Conclusions and limitations

- We have built a benchmark model that links teaching, research, and consulting with the aim of analysing the influence of research and consulting on teaching quality
- Our empirical results are consistent with the theoretical framework
 - ✓ senior professors display the lowest level of teaching quality in consulting-oriented disciplines
 - ✓ past research effort plays a positive role on future teaching quality (at least up to a plateau)
 - ✓ past research effort does not compensate the negative effect of external attractiveness
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 - ✓ new incentive structure toward a better teaching quality
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