

The new European university

Andrea Bonaccorsi
University of Pisa

The Atlanta Conference on S&T Policy
Atlanta, May 18-20, 2006

Outline

Part 1

The debate on European university model.

Insights from a new platform of data developed under the PRIME Network of Excellence

Part 2

The long term impact of the European model on scientific competition in fast moving fields.

The case of careers of top 1,000 scientists in computer science

The debate on the European university model

- Rise of policy debate about universities in Europe.
Question about the scientific performance
- European Commission “new instruments”:
 - newly created mechanisms (European Research Council, European Institute of Technology)
 - a new policy to address universities directly, i.e. without the mediation of national governments

Two underlying broad issues:

- bundling of teaching and research (Humboldtian model)
- differentiation of the higher education system

The debate on Humboldtian model

It has sometimes been proposed the notion that European universities should move beyond the model of bundling teaching and research together creating separate institutions.

On the other hand, economic analysis of universities as multi-tasking units shows that **research and teaching may complement positively to each other.**

Humboldtian universities may be appropriate but only if there are **separate contracts between universities and the State regarding teaching and research** (Gautier and Wauthy, 2004; Dewatripont, Thys-Clemens and Wilkin, 2002; Walckiers, 2004).

This will inevitably produce **institutional differentiation** and the **emergence of research universities** (De Fraja and Iossa, 2002) without government paternalism.

Mass higher education and the differentiation of the university system

- Literature on mass higher education
 - participation rates beyond 15% (mass HE) or 50% (universal) in the relevant age cohort (Trow, 1974)
 - waves of massification: mid-'60s, early '80s, mid-'90s
 - last wave massive and rapid; Bologna process
 - assumption that differentiation of the university system will follow spontaneously from the need to cope with the pressure of demand against restrictions in public budget
 - national pathways to differentiation
- In reality, **the institutional inertia may well inhibit or constrain differentiation**, producing highly inefficient outcomes

Some empirical evidence

Bonaccorsi and Daraio (eds.) *Universities as strategic knowledge creators. Differentiation and performance in Europe*, Edward Elgar, forthcoming

PRIME project

Data on 217 individual universities from UK, Spain, Italy, Portugal, Switzerland, Norway

Extension to France, Netherlands, Hungary (2006)

Time series 1995-2004

Data on inputs (academic staff, nonacademic staff, funding by type) and outputs (undergraduate students, postgraduate students, publications, patents)

Country reports on the evolution of HE system and policy

Main preliminary results

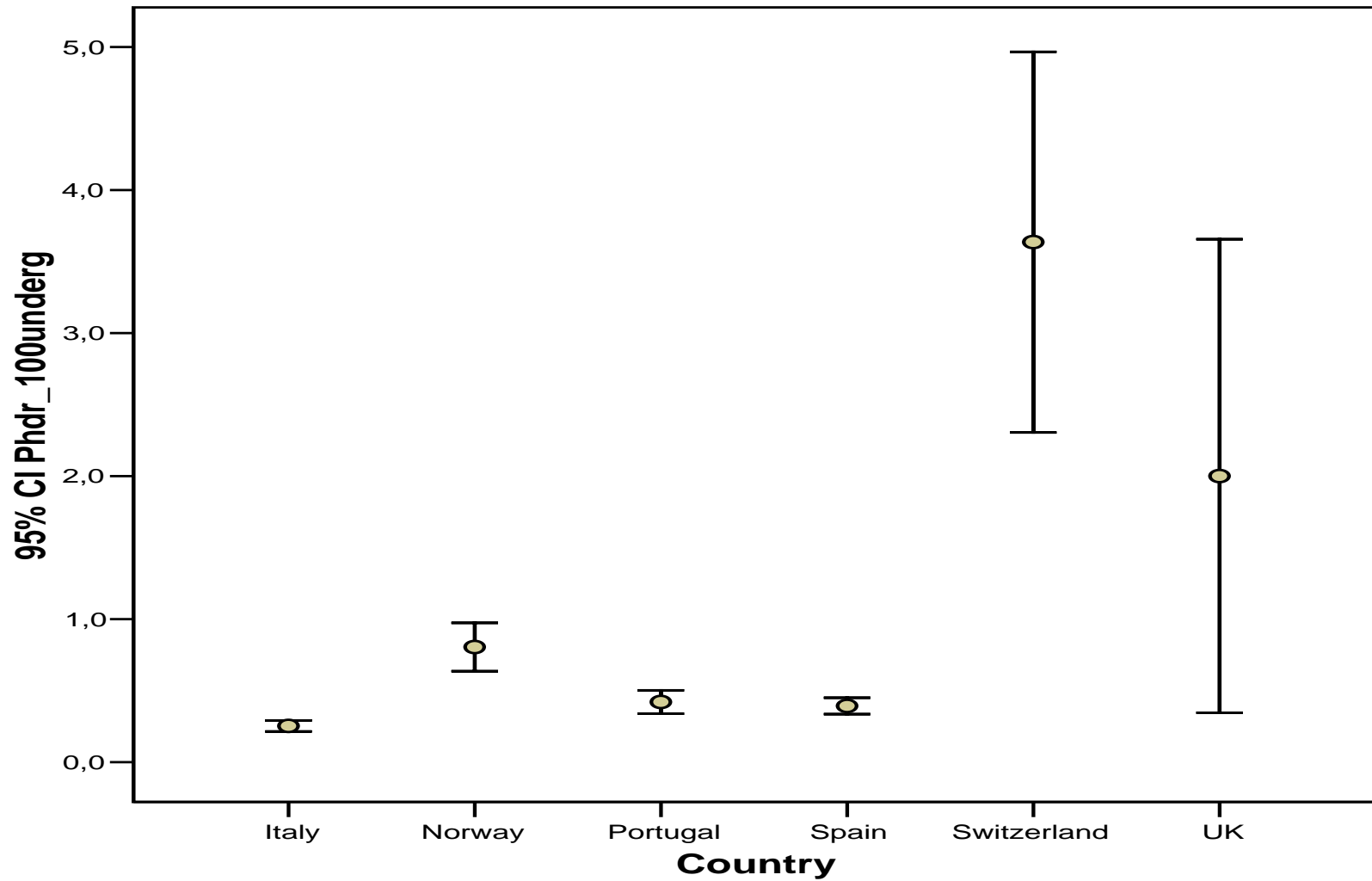
Lack of differentiation with respect to research:

- research intensity (PhD students)
- research activity (scientific production per capita)

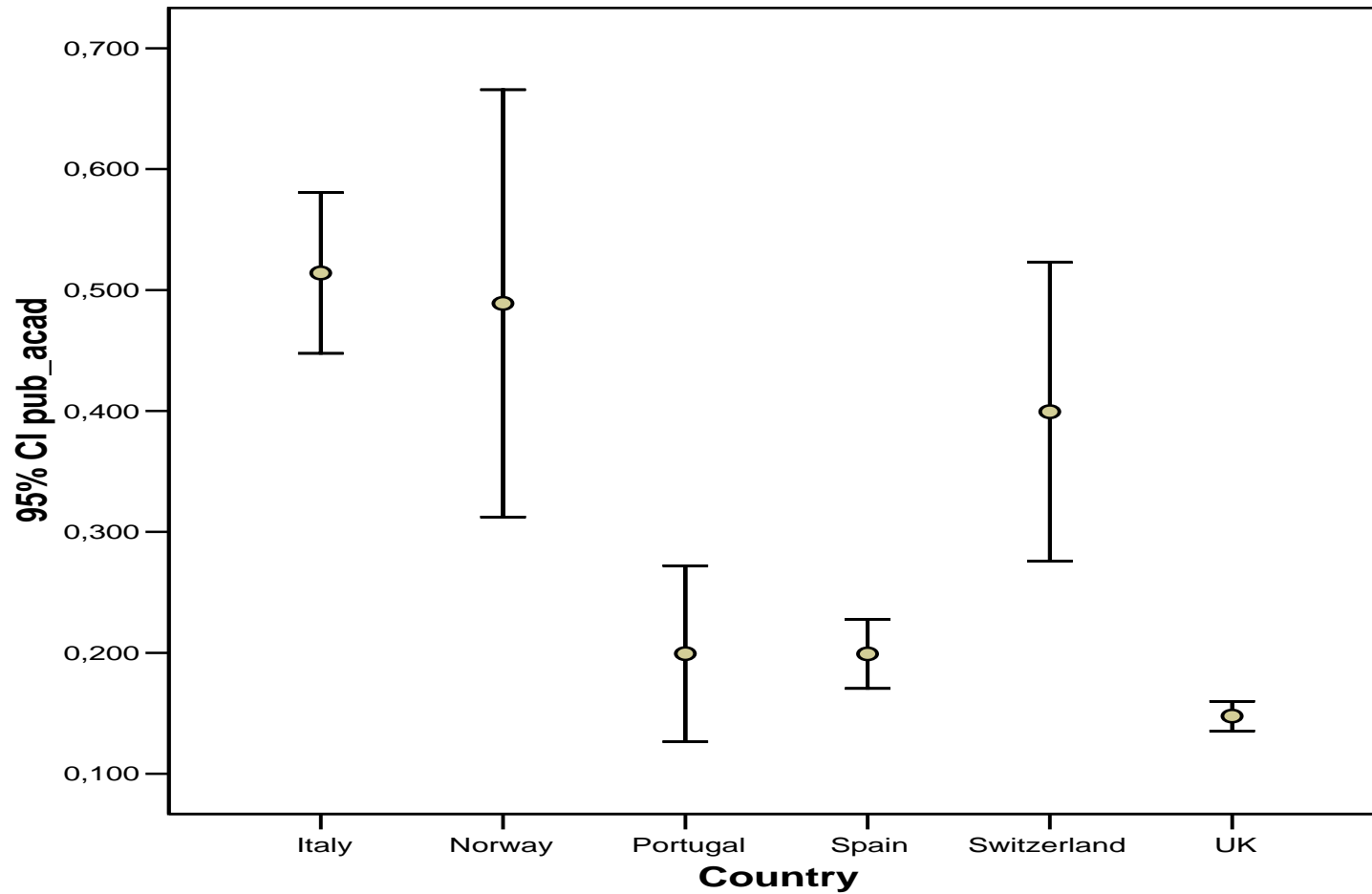
Lack of differentiation with respect to the relative weight of teaching and research

Constraints to financial autonomy of universities

Constraints to university growth



Confidence interval of the distribution of share of PhD recipients over the total population of undergraduate students



Confidence interval for the number of publications per unit of academic staff

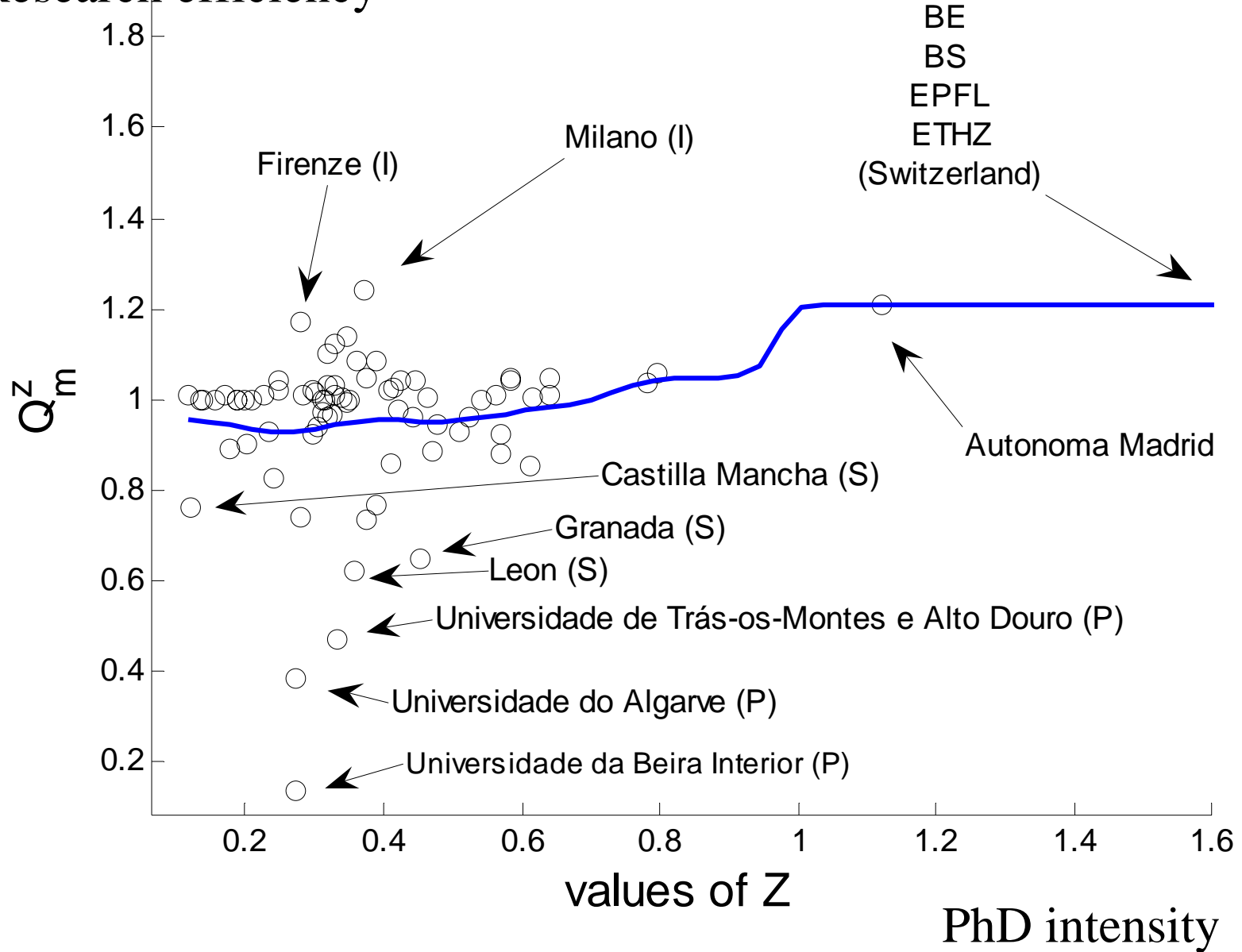
Which is the likely effect of lack of differentiation on research productivity?

- intensity of PhD at university level greatly enhances research productivity
- integration of graduate education in the university environment and in international networks
- lack of focus and underinvestment into PhD education

Use of newly developed robust nonparametric techniques to explore external effects

Effect of PhD intensity on the research productivity - Generalist sample

Research efficiency



Indicators of trade-offs

Teaching and research may be rival or complementary

Develop a new methodology to estimate the relative weight of substitution and complementarity effects

Effect on teaching efficiency of the variability in PhD intensity

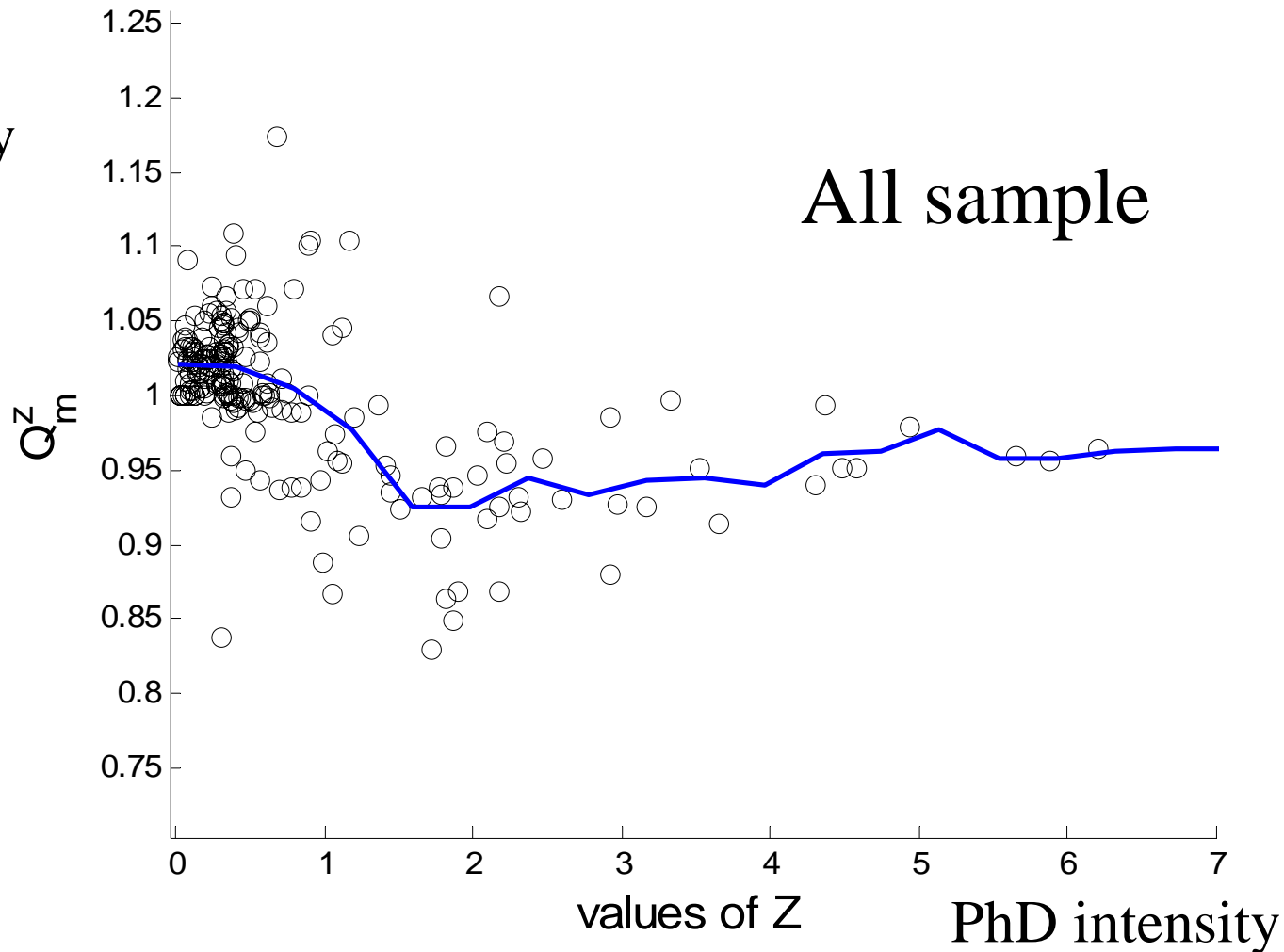
- robust nonparametric techniques allow to estimate the ratio between conditional and unconditional efficiency

Trade off teaching vs intensity in research activities

MOD TEACH (X1 =AC_TOT, X2=TECHADM, Y=GRADUATE,
Z=PHDr_100und).

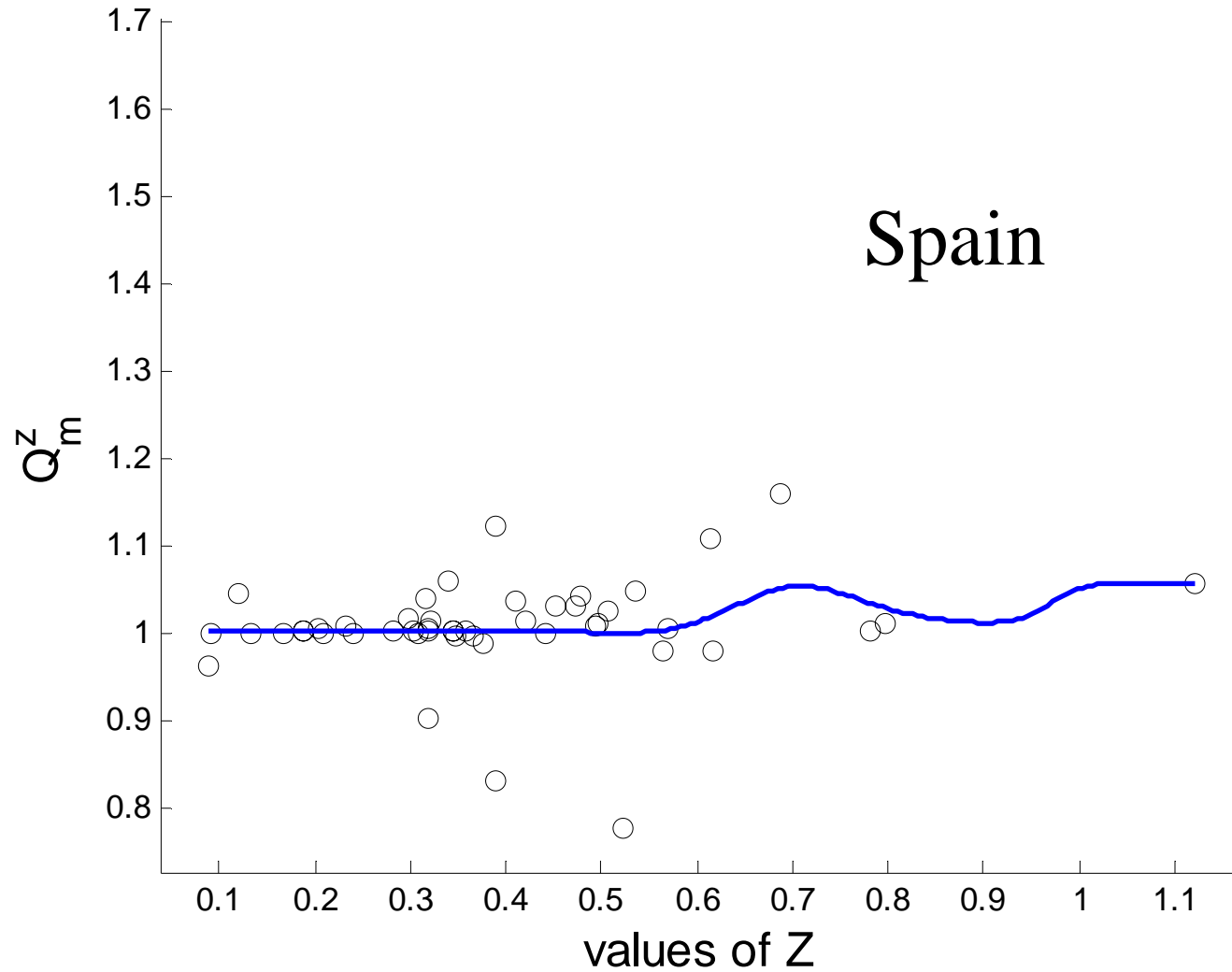
Effect of Z on Order-m frontier

Teaching
efficiency

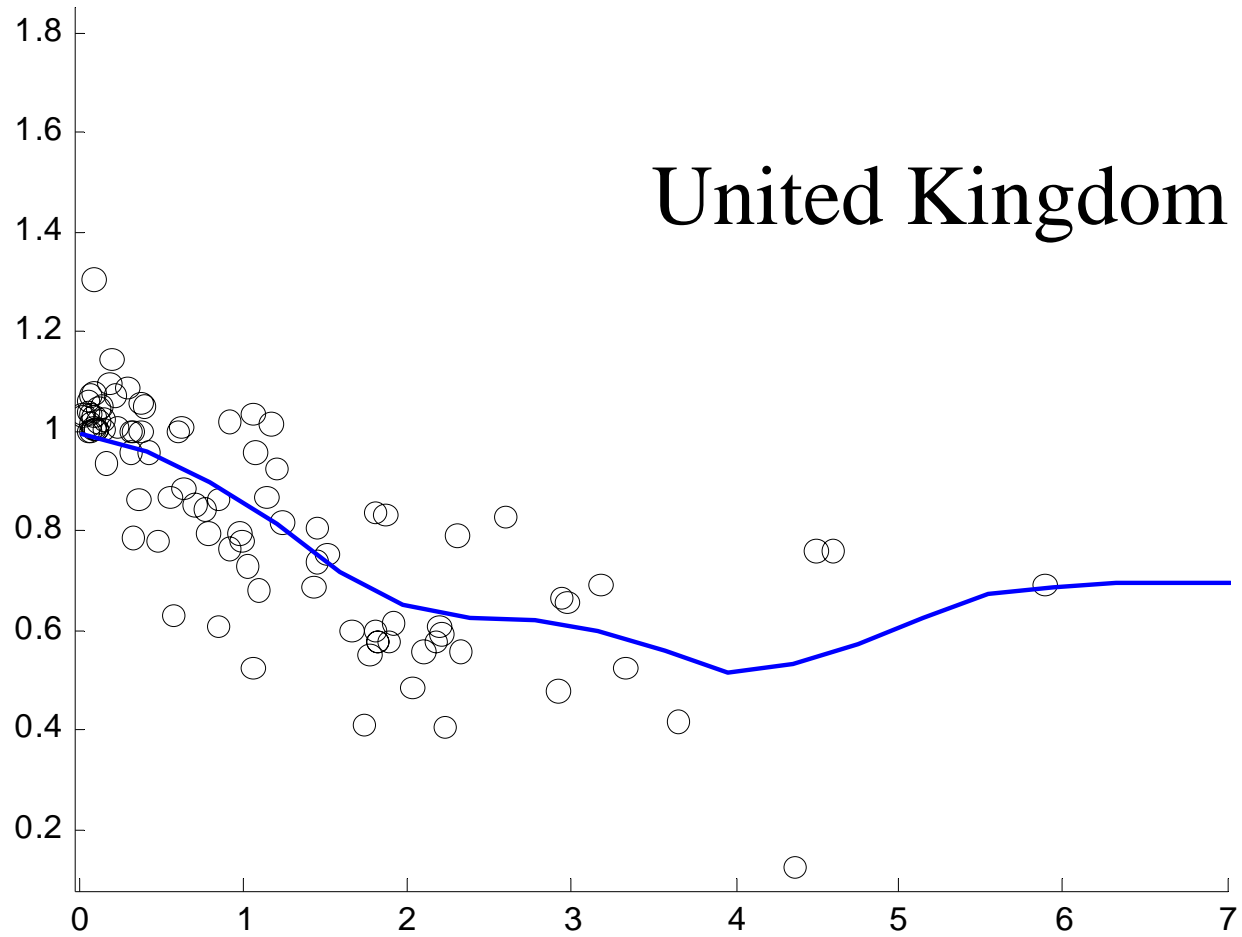


Trade off teaching vs intensity in research activities

Effect of Z on Order-m frontier

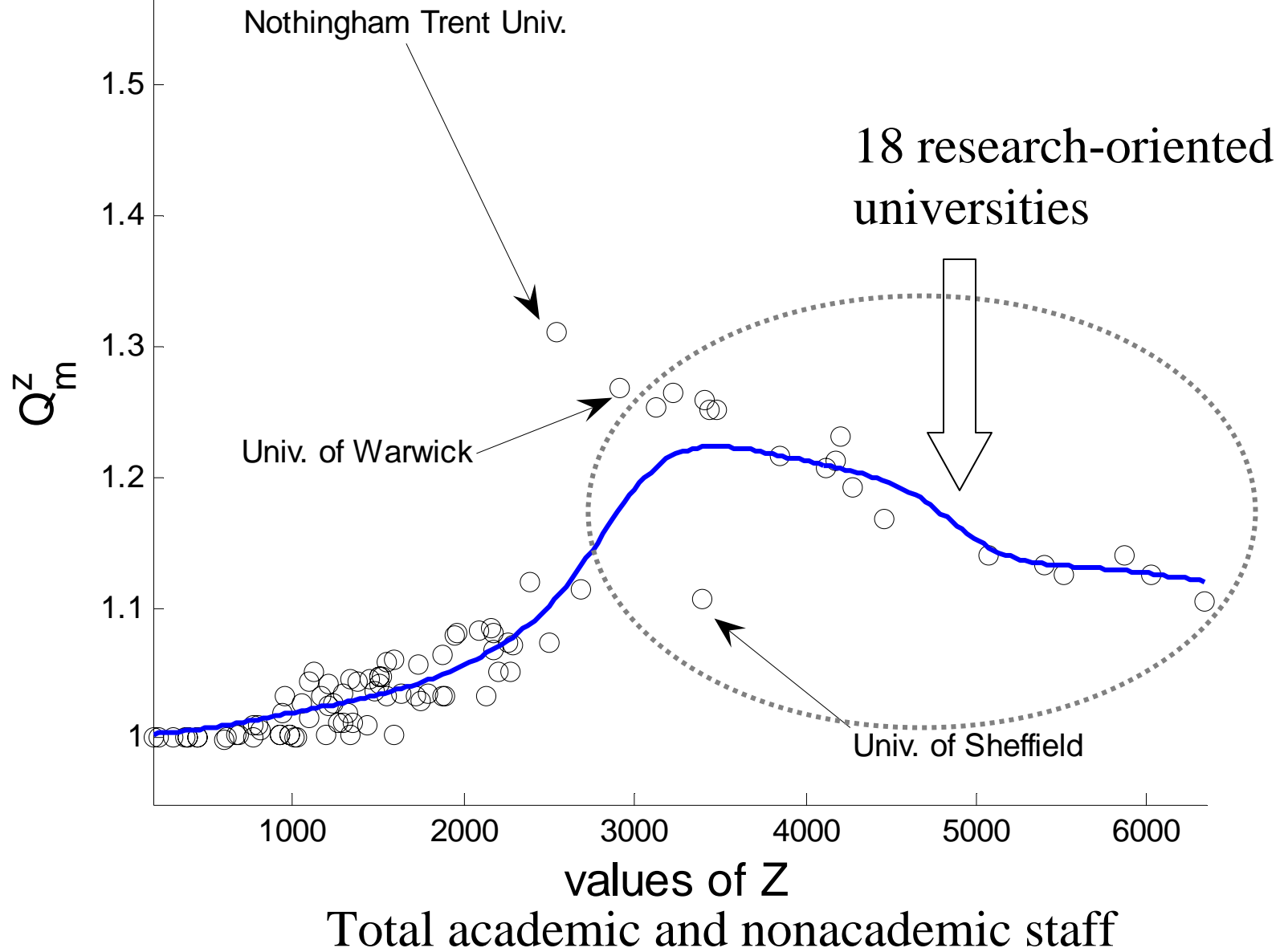


Trade off teaching vs intensity in research activities



Teaching efficiency

Economies of scale in Teaching - UK

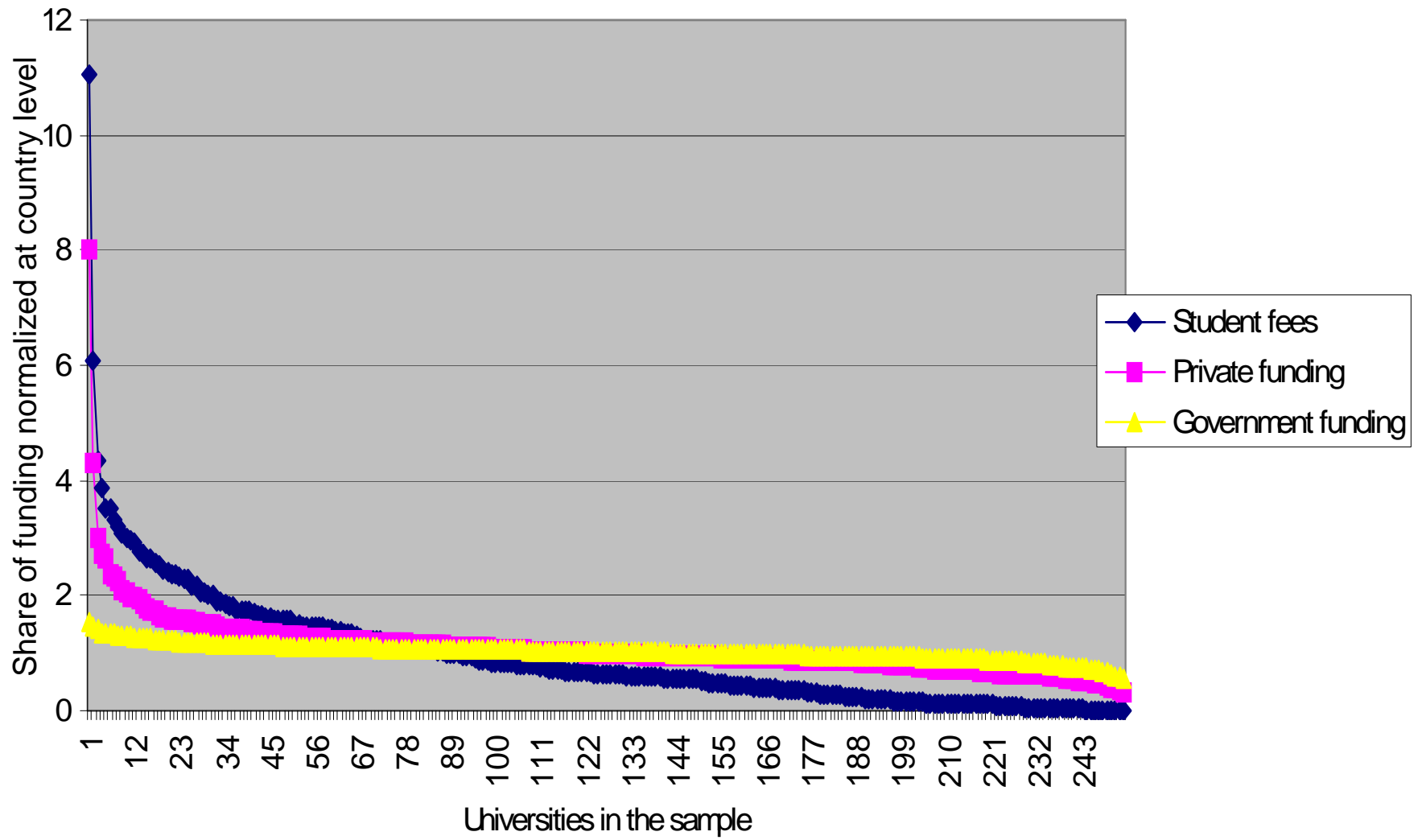


Indicators of strategic autonomy

Share of funding of university budget, normalised against the national average value as an indicator of:

- degree of autonomy of universities in changing the funding mix
- characterisation of particular strategic groups (e.g. high growth universities, entrepreneurial universities)

Variability of sources of funding across universities



Indicators of post-entry growth

Characterization of high growth universities

- Small specialised (e.g. Medical Schools)
- Private
- Strongly supported by the local community
- Former Polytechnics (UK)
- New universities in densely populated areas with overcrowded universities
- (in a few cases) Strongly supported by the central government

NOT research universities

Mass higher education and the differentiation of the university system

The institutional texture of European universities **place heavy constraints to the process of differentiation**, particularly in research

- **governance** (weak role of President; tradition of shared governance in the Academic Senate)
- **structure of funding** (large share of government funding on a per capita basis and with political criteria; low student fees; inequality in the access/capabilities for private funding)
- **vertical differentiation** (absence of institutionalized mechanisms for comparison; shared political culture in favour of the principle “all universities are equal”; legal value)
- **mobility of positions** (mainly internal careers and limited mobility; disciplinary and/or clanistic academic control over admissions and career progression)

Lack of horizontal and vertical differentiation alongside the research dimension and mechanisms for growth

Preliminary conclusions

The ability of European universities to develop a strategic profile and to compete in the (accelerating) world competition is severely limited by the institutional context:

- lack of institutional differentiation
- constraints to financial autonomy
- impossibility to differentiate job descriptions for academic staff
- uniform contracts between universities and the State regarding teaching and research
- poor institutional flexibility

An examination of the professional career of top 1000 scientists in computer science

- Excellence measured by total number of citations received in all published articles in the field (source: www.citeseer.com)
- Well recognized source in the scientific community
- Identify top 1,010 scientists by number of citations
- Download CVs from individual websites, or search CVs on the web
- Codify CV data and build the dataset
- Analysis: (a) overall career pattern (b) by cohort of age.

This presentation

- Small sample of descriptive analysis
- Modeling effort on research productivity (by age, cohort, country, affiliation) under way
- Build arguments about the relation between institutional features of higher education systems in Europe, USA and Asia, and long term technological performance
 - educational paths
 - professional mobility
 - Industry-academia mobility

Top current affiliation of scientists

Institution	Count
Stanford University	45
Carnegie-Mellon University	42
Massachusetts Institute of Technology	42
University of California at Berkeley	36
University of Washington	23
Microsoft Research	20
Cornell University	18
University of Maryland	18
University of Wisconsin	16
University of Illinois	16
University of California at San Diego	16
University of Texas	14
Princeton University	14
Brown University	14
Bell Laboratories	14
University of Pennsylvania	13
University of Massachusetts	12
University of Toronto	12
Yale University	11
Columbia University	11
University of Southern California	10
Rice University	10
AT&T Labs Research	10
University of California at Los Angeles	10
University of Michigan	9

Ranking of Top 15 Affiliation per PhD

<i>University</i>	<i>Count</i>	<i>%</i>
Massachusetts Institute of Technology	82	9.6%
Stanford University	78	9.1%
University of California at Berkeley	69	8.1%
Carnegie Mellon University	43	5.0%
Harvard University	35	4.1%
Cornell University	27	3.2%
Princeton University	26	3.0%
University of Illinois	22	2.6%
University of Michigan	20	2.3%
University of Cambridge	16	1.9%
Yale University	15	1.8%
University of Wisconsin	14	1.6%
University of Toronto	13	1.5%
University of Edinburgh	13	1.5%
University of Pennsylvania	13	1.5%

USA

Asia

Europe

Other

Tot: 855

Ranking of Top 15 Affiliation per Master

<i>University</i>	<i>Count</i>	<i>%</i>
Massachusetts Institute of Technology	47	10.3%
Stanford University	29	6.3%
University of California at Berkeley	27	5.9%
Harvard University	14	3.1%
Carnegie Mellon University	13	2.8%
University of Illinois	12	2.6%
Cornell University	12	2.6%
University of Wisconsin	10	2.2%
University of Michigan	9	2.0%
University of Massachusetts	8	1.8%
University of Toronto	7	1.5%
University of Washington	7	1.5%
University of California at Los Angeles	7	1.5%
Yale University	7	1.5%
Indian Institute of Science	7	1.5%

USA

Asia

Europe

Other

Tot: 457

Ranking of Top 15 Affiliation per Bachelor

<i>University</i>	<i>Count</i>	<i>%</i>
Massachusetts Institute of Technology	45	7.0%
Indian Institute of Technology	34	5.3%
Harvard University	25	3.9%
University of California at Berkeley	20	3.1%
University of Michigan	18	2.8%
University of Cambridge	18	2.8%
Princeton University	15	2.3%
Yale University	14	2.2%
National Taiwan University	13	2.0%
California Institute of Technology	12	1.9%
Technion Israel Institute of Technology	11	1.7%
Cornell University	11	1.7%
Brown University	10	1.6%
Stanford University	10	1.6%
University of Toronto	9	1.4%

USA

Asia

Europe

Other

Tot: 641

Professional positions over the career of top scientists

Number of scientists: 1010.

Number of different positions: 4418.

Mean 4,36

Prof career	Count position
University	2620
University-director	497
Industry	463
Consulting	332
Industry-director	323
Government	183

Ranking of top 15 affiliations in the total number of positions over the career. Academic positions

Institution	Count
Massachusetts Institute of Technology	174
Stanford University	166
University of California at Berkeley	102
Carnegie-Mellon University	102
University of Illinois	59
University of Maryland	58
Cornell University	52
University of Washington	45
University of Pennsylvania	44
Harvard University	44
Princeton University	44
University of Texas	44
University of Massachusetts	42
Brown University	41
University of Toronto	34

Distribution of industry positions in the career per country of PhD

		Country_PhD_Area				Total
			Europe	Other	USA	
empl_ind	0	1	2	0	2	5
	1	15	20	7	127	169
	2	3	8	3	44	58
	3	1	1	0	25	27
	4	1	0	1	9	11
	5	0	0	0	5	5
	6	0	0	0	1	1
	7	0	0	0	2	2
Total		21	31	11	215	278

Conclusions

Why do we (Europeans) failed in fast moving scientific fields?

- new and divergent research directions are generated within established scientific paradigms
- the reputation of the university is a powerful **signaling** mechanism, due to the difficulty to evaluate the merits of competing claims centrally
- there is a need to **rapidly** mobilize resources and to build up the required institutional and human capital complementarity
- **opportunity costs** for young and brilliant scientists are extremely high
- high **mobility** is the rule of the game
- **poor industrial competitiveness may be rooted in the weaknesses of the institutional science and HE system**