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# Academic Productivity: Major Issues

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## Higher Education

Major developments

Why did HE grow?

How does growth affect the recruitment of talent?

What are the implications of the growth of HE?

Diversification issues

## Research Universities

Research universities versus teaching institutions

Internal organization

comparing MIT with ETHZ

## Research Effectiveness

Within research groups

Within departments

Between Departments

**Thank you!**

# Higher Education: Major Developments

- ▶ Birth of the modern university (Berlin 1809, William von Humboldt)
- ▶ Enrollment rates:
  - ▶ beginning 19th century: circa 1-2 %
  - ▶ after World War II: roughly 6 %
  - ▶ Martin Trow (1970) coined the term “mass higher education”
  - ▶ today: 30-60 % (depending on country and HE definition)
- ▶ Number of separate academic fields:
  - ▶ beginning 19th century: circa  $2^3$  to  $2^4$
  - ▶ today: roughly  $2^8$  to  $2^9$  (Institute of Scientific Information)

# Higher Education: Why Growth?

- ▶ Jean Fourastié (1949) had predicted that the pyramid composed of the three industrial sectors (primary, secondary and tertiary) will turn on its head
- ▶ In today's (Western) economies the tertiary sector dominates (this applies, with a time lag, to other economies as well):
  - ▶ manual labor is being replaced by equipment
  - ▶ labor intensive activities are outsourced (to corresponding regions)
  - ▶ professions and employment prospects change (with implications for educational programs and research)
- ▶ HE has become an “engine of economic development”:
  - ▶ modern economies (societies) depend on education
  - ▶ HE is characterized, in comparison to other economic sectors, by a very high economic multiplier (around 3)

# Higher Education: Talent Distribution

- ▶ Talent (natural ability) has (roughly) a normal distribution
- ▶ Implications of (increased) enrollment rates:
  - ▶ beginning 19th century: cognitively talented participated (as a rule), but many talented did not enroll
  - ▶ after World War II: similar picture still
  - ▶ today: many participate in HE now, and average proficiencies diminished as a consequence
- ▶ Implications of diminished average proficiencies (issues):
  - ▶ matching students to academic programs and institutions
  - ▶ fourth academic freedom to recruit students? (Felix Frankfurter)
  - ▶ recruiting faculty and staff

# Higher Education: Growth Implications

- ▶ Higher participation rates (by factors of 5 to 10 since WWII) imply:
  - ▶ more institutions
  - ▶ more faculty and staff
  - ▶ higher spendings (% of GDP) on HE
- ▶ Higher spendings (% of GDP) on HE imply:
  - ▶ retrenchment (i.e. competition with other social causes like old age provisions, health insurance measures)
  - ▶ search for new funding sources as part of the entrepreneurial institution (e.g. philanthropy, increased tuition and fees)
  - ▶ search for new efficiency measures (e.g. massive open source courses)
  - ▶ diversifying HE (i.e. matching students to programs and institutions, separating research universities from teaching institutions)

# Higher Education: Diversification Issues

- ▶ Research universities versus teaching institutions
  - ▶ respective shares for students, faculty and staff
  - ▶ institutional autonomy
- ▶ Research universities:
  - ▶ mission, self-assessment and peer review
  - ▶ research: theory focused vs. technology focused
  - ▶ research funding (institution versus individuals)
  - ▶ recruitment of students, faculty and staff
  - ▶ faculty-student ratios, faculty-staff ratios
  - ▶ university-industry-relations (incl. spin-off-companies)
- ▶ Teaching institutions
  - ▶ mission, self-assessment and peer review
  - ▶ faculty-student ratios
  - ▶ alliances with universities
  - ▶ university-industry-relations

# Research universities versus teaching institutions

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# Research Universities: Internal Organization

- ▶ Focus on departments (US) versus focus on chairs (Europe)
- ▶ Leadership issues
- ▶ Research effectiveness: size issues
  - ▶ within research groups (economies or diseconomies of scale)
  - ▶ within departments (agglomeration economies I)
  - ▶ between departments (agglomeration economies II)

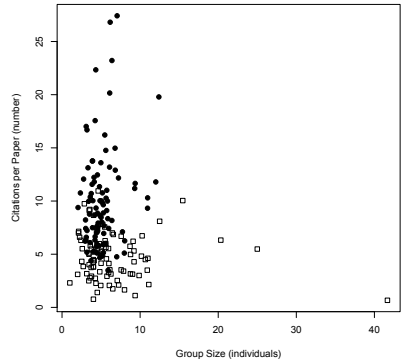
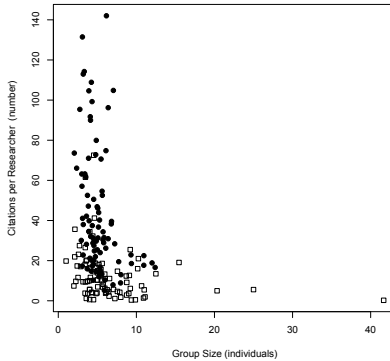
# Research Universities: comparing MIT with ETHZ

- ▶ Both institutions were founded around 1850
- ▶ Intention: to serve their communities in engineering and technology
- ▶ Around 2002, both institutions had roughly the same size and the same teaching & research orientation:
  - ▶ students: 10,220 (MIT); 11,689 (ETHZ)
  - ▶ staff: 7,644 (MIT); 6,660 (ETHZ)
  - ▶ however: research productivity at MIT was 2 to 4 times higher than at ETHZ (with the exception of the field of chemistry)
  - ▶ Why?
- ▶ See: "MIT and ETH Zürich: Structures and Cultures Juxtaposed", CEST 2009/9 ([http://www.swir.ch/images/stories/archiv/CEST\\_2002\\_MIT\\_ETH\\_Zurich.pdf](http://www.swir.ch/images/stories/archiv/CEST_2002_MIT_ETH_Zurich.pdf))

# Research effectiveness: Within Research Groups

- ▶ Focus: Economies or diseconomies of scale
- ▶ Effectiveness defined (e.g.):
  - ▶ papers per researcher
  - ▶ citations per paper
  - ▶ citations per researcher
- ▶ Effectiveness peaks in (relatively) small groups
  - ▶ groups too small cannot exploit economies of scale
  - ▶ groups too large suffer from diseconomies of scale (need to be restructured hierarchically, with negative effects)

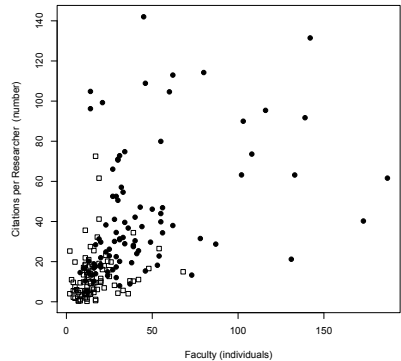
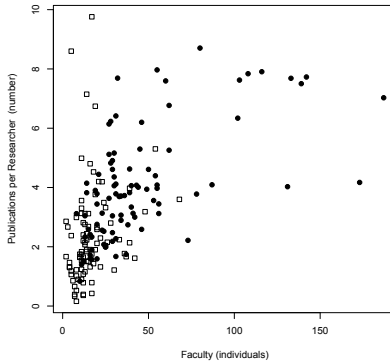
# Research effectiveness: Scale economies



## Research effectiveness: Within Departments

- ▶ Focus: Agglomeration Economies I
- ▶ Effectiveness defined as before
- ▶ Departmental effectiveness requires a size of some 2 dozen faculty members
  - ▶ departments too small cannot really exploit agglomeration economies
  - ▶ departments that are far larger do not benefit from their excessive size (they could be subdivided to exploit agglomeration economies II)

# Research effectiveness: Agglomeration economies I



# Research effectiveness: Between Departments

- ▶ Focus: Agglomeration economies II
- ▶ Effectiveness defined as before
- ▶ Departments profit from each other:
  - ▶ interdepartmental curricula
  - ▶ interdepartmental institutes
  - ▶ informal contacts

# Thank you!

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