The Elite University
Are we too selective?

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Motivation

- Gaping inequality, poor development outcomes.
- Robust institutions but poor governance.
- Poor capacity and an allocation problem?
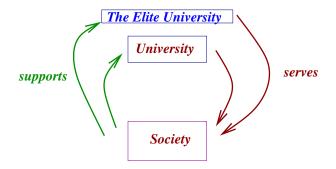- *Question*: Are poor knowledge mechanisms and incentives a culprit? [2]

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[2]Also see Stiglitz on knowledge formation and development.

The Outline

- Elite Indian University: its role and importance.
- The Placement Data: methodology, analysis and conclusions.
- Ability and Wages: Wage curves for IIT Bombay.
- Meritocracy and globalization. The problems.
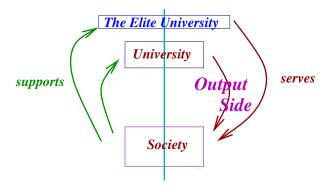- The way ahead.

Society and the University-*a virtuous loop*

- The University
  - ▶ repository of knowledge and practices
  - ▶ training agents who deliver value
- The Elite University
  - ▶ thought leadership, the arts, long-term research, *destiny*
  - ▶ *symbolic of what a society values!*

This talk-*the output side*

- The University
  - repository of knowledge and practices
  - training agents who deliver value
- The Elite University
  - thought leadership, the arts, long-term research, *destiny*
  - *symbolic of what a society values!*

The Indian Elite University

- Long history-right after independence
- The IITs, IISc, ISIs, IIMs, TIFR, JNU, Delhi School of Economics
  - the new *IISERs*, new IITs
- *Key areas*: Science, Technology, Engineering, Economics, Mathematics

Typical features:

- Centrally funded, autonomous
- Research orientation, international faculty
- transparent and highly selective admissions
- focus on excellence and global standing

Just how elite are these?-*IITs*

Why only the IITs

- because we are here.
- Engineering and Technology key to development outcomes.

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Rough numbers (in Rs. crores)

Total	Central	CFI	IITs
200K	60K	3K	2K

- i.e., about Rs. 10-15 lakhs per student.
- Besides this, roughly equivalent funding from DST, DBT and other agencies.
- Mangalyaan: about Rs. 400 crores. ISRO: Rs. 5000 crores.
- Maharashtra Water Supply and Sanitation : Rs. 1000 crores. Mumbai University: 400 crores.
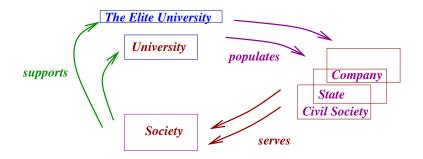
More than money-*intellectual space*

- JEE and GATE: define engineering in the country.
- TEQIP II: Project document, Chapter 1, page 1: . . . gap between other colleges and IIT which needs to be bridged. . . IITs to act as a catalyst . . .
- Domination in research agenda and allocation.
- Curriculum: NCERT, Andhra Pradesh. What is science for schools.

- Bragging rights in a poor developing society.

The Input side

At the UG level:

- Two layer process-JEE and advanced JEE.
- In 2013, 12 lakh students sat for JEE of which 1.5 lakh were allowed to write advance JEE.
- JEE admits to NITs (roughly 7000 seats)
- advanced JEE admits into IIT (another 7000 seats) JEE and GATE data
- odds of roughly 1 in 200. Selectivity varies dramatically with discipline.

At the PG level:

- Disciplinary GATE exams. Separate admissions.
- Roughly 10 lakh sat for about 5000 seats. Selectivity roughly *more* constant.

The Output side-*the intermediaries*

Analysis.

- Placements: The allocation of graduating students to jobs.
- Sectors: Which sectors of the economy.
- Companies: Who owns these companies and which society do they serve.

Research Objective-who joins where?

- This is done by looking at placement data of IIT Bombay for 2013 (upto April 90% of placements over)

Aeronautical & Aerospace (A)
Chemical (CHE)
Civil (C)
Computer Science and Engg.
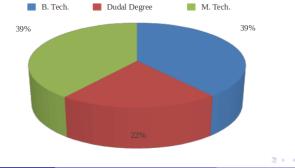(CSE)
Electrical (EE)
Mechanical (Mech.)
Metallurgical (Met.)

3 Programs
B.Tech
DD
M.Tech

- Excluded - 5 yr & 2 yr M.Sc., M.Des & Phd
- Energy Science, Environmental Science, etc.

Data-Sample

Sample:
833 out of 1066 done (81% approx)
TOTAL APPLIED - 1421

- 324 B.Tech Students
- 180 Dual Deegree Students
- 329 M.Tech Students

Detailed number-wise break-up and average annual salary in Rs. lakhs.

Program	Aero	Chem	Civil	CSE	EE	Mech	Meta
B.Tech.	9(8.6)	45(9.5)	57(7.6)	65(33.4)	48(15.5)	65(10.2)	35(7.4)
DD	21(11.6)	32(11.0)	11(8.4)	-	44(16.4)	46(11.2)	26(8.3)
M.Tech	11(5.9)	17(6.7)	28(4.8)	93(14.8)	98(9.7)	50(8.0)	32(7.3)

Av. Salary highest for CSE be it B.Tech or M.Tech (100 and 50% more than next category).
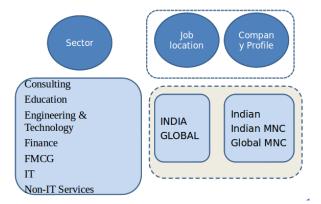For DD, it is EE (>33% higher then next category - Aero)

Table 2: % of students in different Sectors for 3 programs and Av. Annual Salary (Rs. Lakhs)

Sectors: Engineering and Technology, Finance, IT, FMCG, Consulting, R&D, Education and others.

Sector	ET	Fin	Consulting	IT	FMCG	non-IT	Edun
B.Tech	22(10.2)	24(13.0)	21(13.2)	24(23.2)	6(10.0)	2(15.0)	1(6.7)
DD	24(10.0)	24(13.2)	26(11.6)	14(12.9)	9(12.1)	3(16.4)	1(6.2)
M.Tech.	51(8.6)	4(9.4)	10(5.6)	29(15.0)	2(6.2)	1(11.0)	5(4.5)

2 Attribute Label for job profile

Table 3: Job and Company Profile Label

Name	Description	Location	Example
Super-GG	Globally owned, Global revenues	Abroad	Sony, Japan
GG	Globally owned, Global revenues	India	Goldman Sachs
IG	Indian owned, Global revenues	India	Infosys
GI	Globally owned, Indian revenues	India	Proctor-Gamble
II	Indian owned, Indian revenues	India	Tata Motors

Table 4: Profile-wise allocations (in %) for the 3 programs and Av. Annual Salary (Rs. Lakhs)

Profile	Super-GG	GG	IG	GI	II
B. Tech	15(46.8)	41(10.8)	14(7.1)	9(10.6)	21(7.3)
DD	8(34.7)	57(10.4)	7(6.8)	9(11.0)	19(8.7)
M.Tech.	7(38.7)	56(8.8)	16(6.4)	7(8.2)	15(6.1)

Table 5: Number by Sector and Profile and Av. Annual Salary (Rs. Lakhs)

Sector	ET	Finance	Consulting	IT	FMCG	non-IT	Edun
Super-GG	25(27.7)	10(35.0)	8(49.6)	41(52.1)	-	-	-
GG	116(7.9)	82(11.7)	110(9.6)	102(10.0)	-	6(22.0)	2(7.0)
IG	52(6.5)	19(7.2)	11(5.8)	28(7.2)	2(6.7)	-	-
GI	24(9.3)	10(14.2)	10(5.2)	5(9.3)	20(11.0)	-	-
II	64(6.5)	13(9.5)	8(5.8)	22(7.9)	19(9.8)	6(8.5)	18(4.7)
TOTAL	281	134	147	198	41	12	20

CPI as measure of Training

Profile	Sector	slope(vs. CPI)	p-value	Gini
Super-GG	finance	0.013	0.311	0.209
Super-GG	IT	0.056	0	0.116
II	consulting	1.187	0	0.169
II	finance	0.768	0.11	0.086
II	FMCG	2.189	0	0.198
IG	consulting	1.053	0.08	0.213
GG	finance	4.287	0	0.311
GG	IT	1.566	0	0.18
Super-GG	ET	0.006	0.805	0.23
GG	ET	0.135	0.402	0.109
IG	ET	0.55	0.011	0.165
GI	ET	0.006	0.991	0.119
II	ET	0.051	0.826	0.108

IIT Placements -Key findings

- Global companies serving global consumers is the biggest winner. Super-GG, an increasing trend.
- Engineering is least paying among all major sectors. Service sector most paying. *This is a glaring exception.*
- Indian engineering is poorly represented and least paying. M.Tech. program largely serves ET(GG). UG programs serve high-end finance, consulting.
- Most profiles do not need the engineering training that we claim to give.

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- Most profiles do not need the engineering training that we claim to give.

- mis-allocation. Away from engineering and away from the Indian economy.
- irrelevance of training. Our course seem to (i) not help Indian engineering, and (ii) not matter in better salaries.
- Essential to understand cause!

How does production happen?

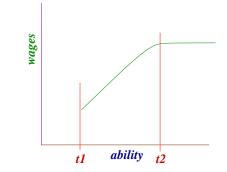# How does production happen?

Biscuits

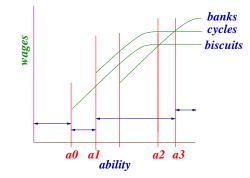| Machine (Facility)	Production tons/day	Operator Ability	Other costs
M1	10	0.3	low maintenance
M2	50	0.4	good overall support
M3	200	0.6	imported

- 0.6 is that the person should be in the top 40%.
- similar analysis for service sectors as well.
- may be aggregated for a segment, e.g., cycles.
- wages: depend on taxes, rents, training costs etc.

The Wages curves

- t_1: minimum ability needed.
- t_2 saturation ability, beyond which wages dont improve.
- In our example, $t_1 = 0.3$ and $t_2 = 0.6$.

Multiple Segments

- a_0, a_1, a_2, a_3: critical ability values.
- identification of ability decide allocation.

Table 6: Sectors and Salaries (Summary of Table 5)

Sector	Number	Salary (Rs. lakh)
Super-GG	84	>40
Finance (GG)	82	11.7
IT (GG)	102	10.0
Consulting (GG)	110	9.6
ET (GG)	116	7.9
ET (IG)	52	6.5
ET (II)	64	6.5

Table 7: Ranking in Selectivity

Rank	Code	Program	Rank	Code	Program
6	B(CSE)	B.Tech.(CSE)	3	M(CSE)	M.Tech.(CSE)
5	B(EE)	B.Tech.(EE)	2	M(EE)	M.Tech.(EE)
4	D(EE)	DD(EE)	1	M(O)	M.Tech.(Others)
3	B(ME)	B.Tech.(Mech.)			
2	DD(O)	DD(Others)			
1	B(O)	B.Tech.(Others)			

Table 10: Sector-wise salaries (Sectors 1-9)

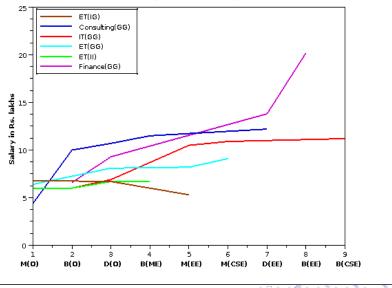| Programs Index	M(O) 1	B(O) 2	D(O) 3	B(ME) 4	M(EE) 5	M(CSE) 6	D(EE) 7	B(EE) 8	B(CSE) 9
SuperGG	-	8(20.9)	8(29.2)	-	-	9(55.3)	-	-	31(54.7)
Finance(GG)	-	22(6.6)	16(9.3)	-	-	-	9(13.8)	11(20.2)	-
Consult.(GG)	18(4.4)	32(10.0)	30(10.7)	10 (11.5)	-	-	11(12.2)	-	-
IT(GG)	-	9(6.0)	10(6.9)	-	15(10.5)	48(10.9)	-	-	9(11.2)
ET(GG)	21(6.4)	-	15(8.1)	-	49(8.2)	12(9.1)	-	-	-
ET(IG)	34(6.8)	-	6(6.7)	-	5(5.3)	-	-	-	-
ET(II)	14(6.0)	13(6.0)	10(6.7)	18(6.7)	-	-	-	-	-

The X-axis

Salary vs. Selectivity

- The order of disciplines by *JEE*. (except one flip)
- The same order for *PG students*.
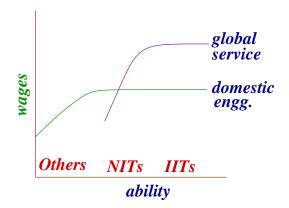- *Insertion* of the PG order into the UG order.
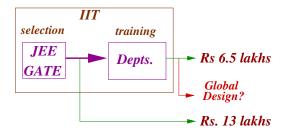
Salary vs. Selectivity

So whats happening?

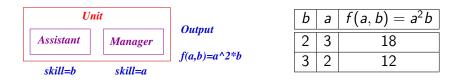
- Excessive selectivity causing severe mis-allocation.

A conundrum-Why isnt the training valued?

- Why are the global design companies *not* hiring our UGs/PGs?
- To some extent, they are.
- More likely. Our training just isnt good enough.
  - ▶ *Engineering is all about relevance.*
  - ▶ *Engineering is an inter-disciplinary skill.*

High salaries and net social wealth

- Do not the high salaries of GG companies benefit the Indian economy?
- Are not remittances by Super-GGs important? Are not \$'s important?
- YES, if you believe in trickle-down economics.
- NOT always, as shown by Maskin and Kremer.

Unit

Assistant   **Manager**

skill=b   skill=a

Output

f(a,b)=a^2*b

b	a	$f(a, b) = a^2 b$
2	3	18
3	2	12

Society and companies

One option:

Society	2,2,3,3
Companies	(2,2), (3,3)
Produce	8+27=35
Wages	2.7,5.3,4,9,18

- $f(a, b) = a^2 b$ is the output.
- Wages: ratio $2b : a$.
- Society is a collection of individuals with abilities, say $\{2, 2, 3, 3\}$.
- Forms companies to maximize social value.

Better Option:

Society	2,2,3,3
Companies	(3,2), (3,2)
Produce	18+18=36
Wages	7.7,7.7,10.3,10.3

Another case

One option:

Society	2,2,4,4
Companies	(2,2), (4,4)
Produce	8+64=72
Wages	2.7,5.3,22,42

In general:

- Mixed companies when abilities comparable.
- Separate companies when abilities disparate.

Worse Option:

Society	2,2,4,4
Companies	(4,2), (4,2)
Produce	32+32=64
Wages	11,11,21,21

Another case

One option:

Society	2,2,4,4
Companies	(2,2), (4,4)
Produce	8+64=72
Wages	2.7,5.3,22,42

In general:

- Mixed companies when abilities comparable.
- Separate companies when abilities disparate.

Worse Option:

Society	2,2,4,4
Companies	(4,2), (4,2)
Produce	32+32=64
Wages	11,11,21,21

Consider Globalization!

Society	2,2,3,3	6,6
Companies	(3,2), (3,2)	(6,6)
Produce	18+18=36	216
Wages	7.7, 7.7 10.3, 10.3	72,114

Suppose now we test and train the 3 and find them to be 4.

Society	2,2,4,4	6,6
Companies	(2,2), (4,4)	(6,6)
Produce	8+64=72	216
Wages	3,5,21,42	72,144

Suppose next, that we globalize

Society	2,2,4,4,6,6
Companies	(2,2), (6,4) (6,4)
Produce	8+144+144=296
Wages	3,5,62,62,82,82

Suppose now we test and train the 3 and find them to be 4.

Society	2,2,4,4	6,6
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Produce	8+64=72	216
Wages	3,5,21,42	72,144

Suppose next, that we globalize

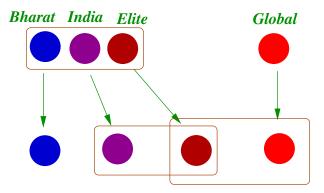| Society	2,2,4,4,6,6
Companies	(2,2), (6,4) (6,4)
Produce	8+144+144=296
Wages	3,5,62,62,82,82

Effects on Society 1.

After identifying *merit*

- Increasing production and wages.
- Increasing inequality.

After globalization.

- Even more inequality.
- Fewer managers-*less research on local problems? Fewer companies?*
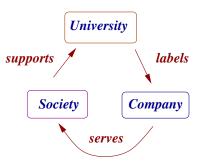- Less produce and more wage earning - *inflationary?*

Conclusion

- Excessive identification of talent may be downright harmful!
- "Merit" systems must be designed with GREAT care.

Meritocracy

- Sorting: The university *correctly* sorts and labels.
- Production: The state and the company utilizes these labels to improve outputs for the society.
- Taxation: Wages are redistributed so that everyone is better off.
- Popular Support: People make an informed judgement to support the university. **Closing the loop!**

Our Meritocracy-an open loop!

The INPUT side

- at best, a *fair* lottery. Negative sum game.
- aspirational dysfunction. loss of scientific temper.

CONTENTS

- upward compatibility: IISER, Delhi School of Economics, NCERT. doubtful use for current society.
- less than 50% of IITians know how to measure land, or have visited a well or a factory.
- mysterious faith on agents to stick by and become change agents.

Outcomes

- *terrible*, esp. for the bottom 80%.
- collapse of civil society.
- collapse of knowledge formation.

What to do?

A realization!

- Our destiny (and the road to MIT) goes through Gawandwadi!
- The source of new problems, and new *engineering* jobs at the highest end!

The new jobs-working in the field!

- Saving drinking water supply schemes from failing.
- Getting sanitation systems to work.
- Developing public transport systems.
- Influencing policy.
- Delivering efficiency and making it pay.

How to do it?

Redefine Engineering:

- Inter-disciplinary and focus on Society and outcomes. *sadak, bijli, paani*.

- Engage with society, state and industry-*both formal and informal*.

- Regional stake-holders and partnerships with other colleges.

Broad-base engineering : *and confuse the GGs*.

- Modify curriculum which many can implement.
  - ▶ Remember *Workshop Practice!!*, sanitation, etc.
  - ▶ Water supply problem was solved in Europe before Navier-Stokes.

- Case studies and good practices.

MHRD and DST

- Maintain data on placements.
- Re-think TEQIP, GATE and Accreditation.
- Reserve substantial part of research funding for regional outcomes.
- Case-studies and stake-holder reports as valid research outputs.
- Joint programs with MoRD, MoUD, Railways etc.

Most important

- a shared vision of knowledge and practice
- and the elite institution as a pillar of civil society

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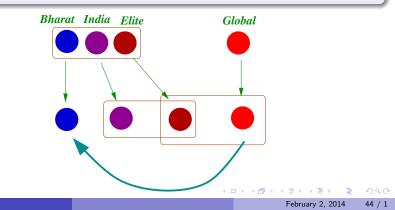
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Closing the loop!

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Some References

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Thanks