Evaluating Impact OF Mexican Higher Education Policy on State Universities Using Direct and Indirect Technologies.

Efficiency in Education Workshop

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Agenda

- Motivation
- The Mexican Higher Education context and aim.
- Previous work, litterature review and inputs and outputs discussion.
- The data
- Methodology
- Results and Discusion
- Conclusions and Future Research

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Why Higher Education is important

- It supports economic growth trough human capital accumulation (Barro & Sala-i-Martín, 1995).
- Enables social mobility (Haveman & Smeeding, 2006)
- Contributes to well-being: quality of life, self-confidence and personal happiness. (Cuñado & Pérez de Gracia, 2012), (Yakovlev & Leguizamon, 2012)
- Egalitarian perspective: public good, universal right, social good. (UNESCO, 2009)

But not everybody agrees…

- Chronic shortage of public funds for higher education (public taxpayers pressure)

- More private spending (OECD, 2012)

- Increasing costs: intensive in highly skilled personnel. (Ginés-Mora,2003)

- The widespread introduction of neo-liberal economic policies (leave it to the market) and globalization of world trade

- More actors seeking to legitimize the sale and purchase of higher education, as if it is a normal commodity

- **Suspicious about higher education managers spending efficiently…**

- **More performance-based funding formulas** (Sexton, Comunale, & Gara, 2012)

- Actually happening: More market oriented systems worldwide

- Meritocratic perspective.

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The modern Mexican Higher Education System

Our work

Post-Revolution Modernization

Crisis and deacceleration

Continuity

1930

1940-1960

1970-1980

1990

2000

Expansion

Evaluation
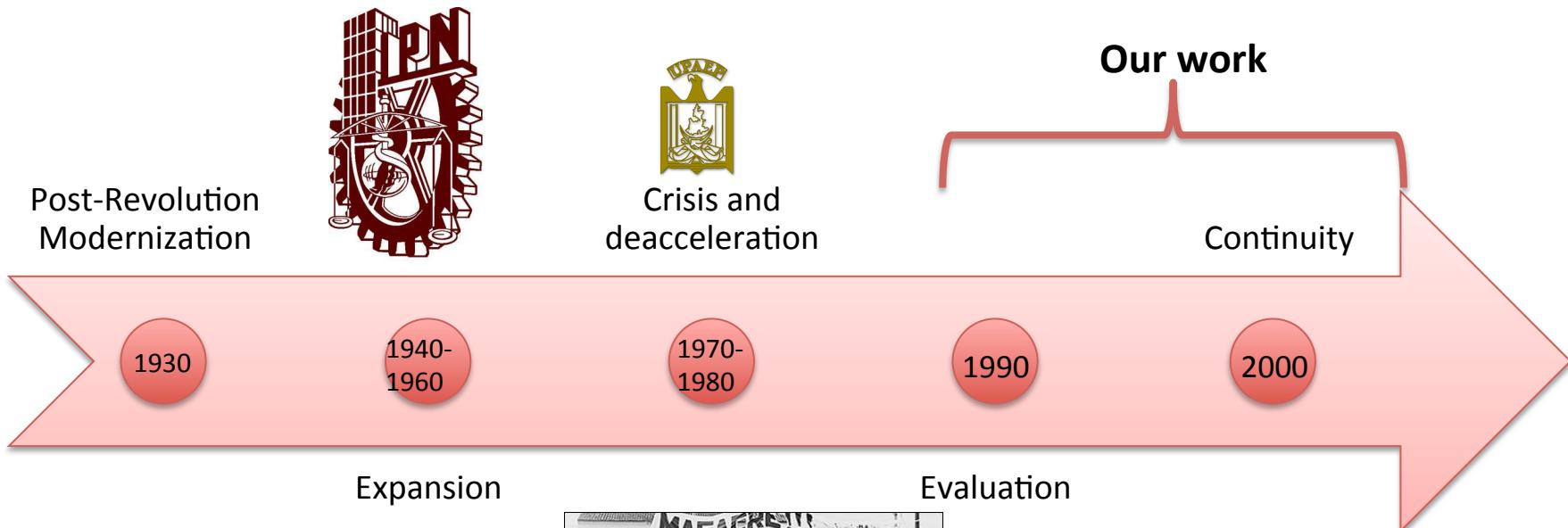
Demographic Pressure.

Important Growth: demographics favored the trend

Population and Higher Education Growth in Mexico: Past, present and future

Legend:
- Population in the 18-23 range
- Enrollment
- Participation Rate

Y-axis (left): Millions of people
Y-axis (right): Participation Rate
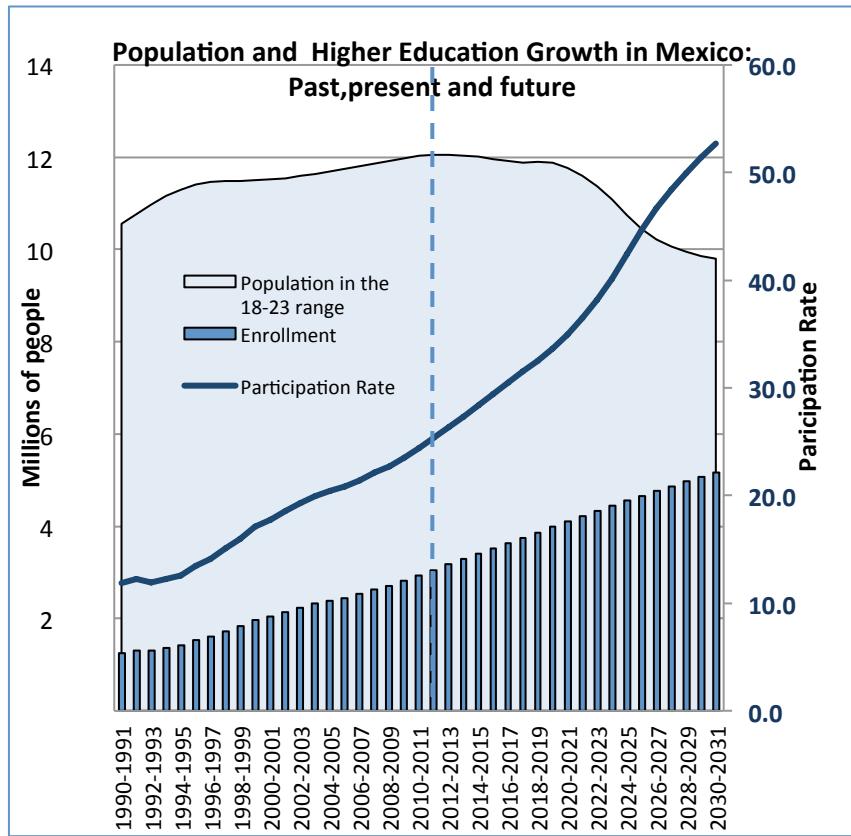
Source: ANUIES

Increased Competition: The Private sector is winning territory

Total enrollment in Mexican Higher Education System (Graduate included)

CAGR
Public   3.4%
Private 7.8%
Total   4.5%

32%

Y-axis: Millions of students

Legend: Total Public   Total Private
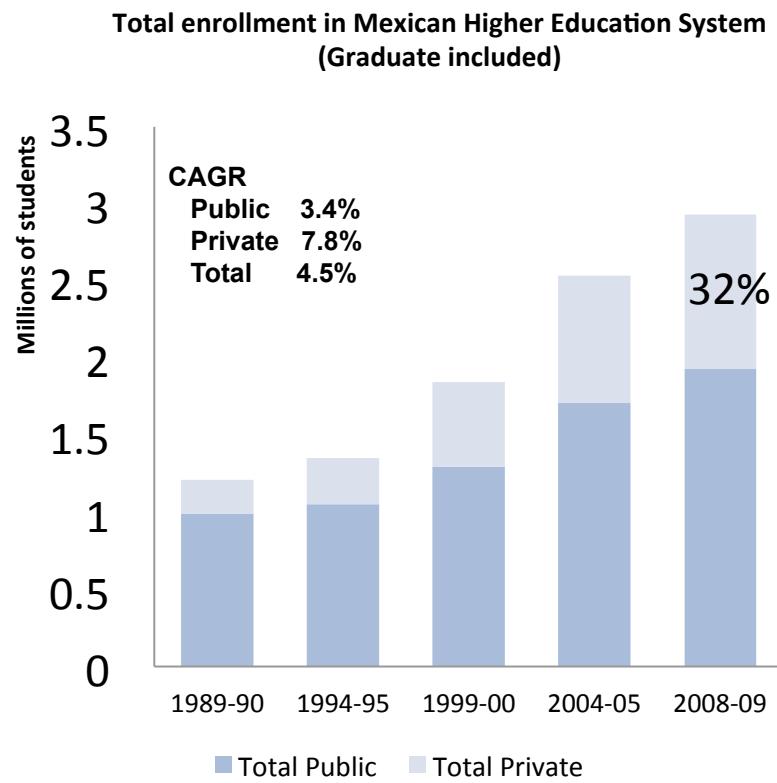
Source: SEP

Most relevant policies implemented during the 90s Kent-Serna et al. (2009)

1. The establishment of an evaluation system as a normal practice

2. The promotion of competition among the institutions, either public or private

3. The endorsement of enrolment growth and education quality

4. The support of scientific research and technological development

5. The promotion of better management practices

6. **The partial modification of the funding allocation rules**

Subject to performance budget increasing as % of total.

Total Budget
(1993 prices)

23%

0%

ordbdgt_miles   fedextbdgt_miles
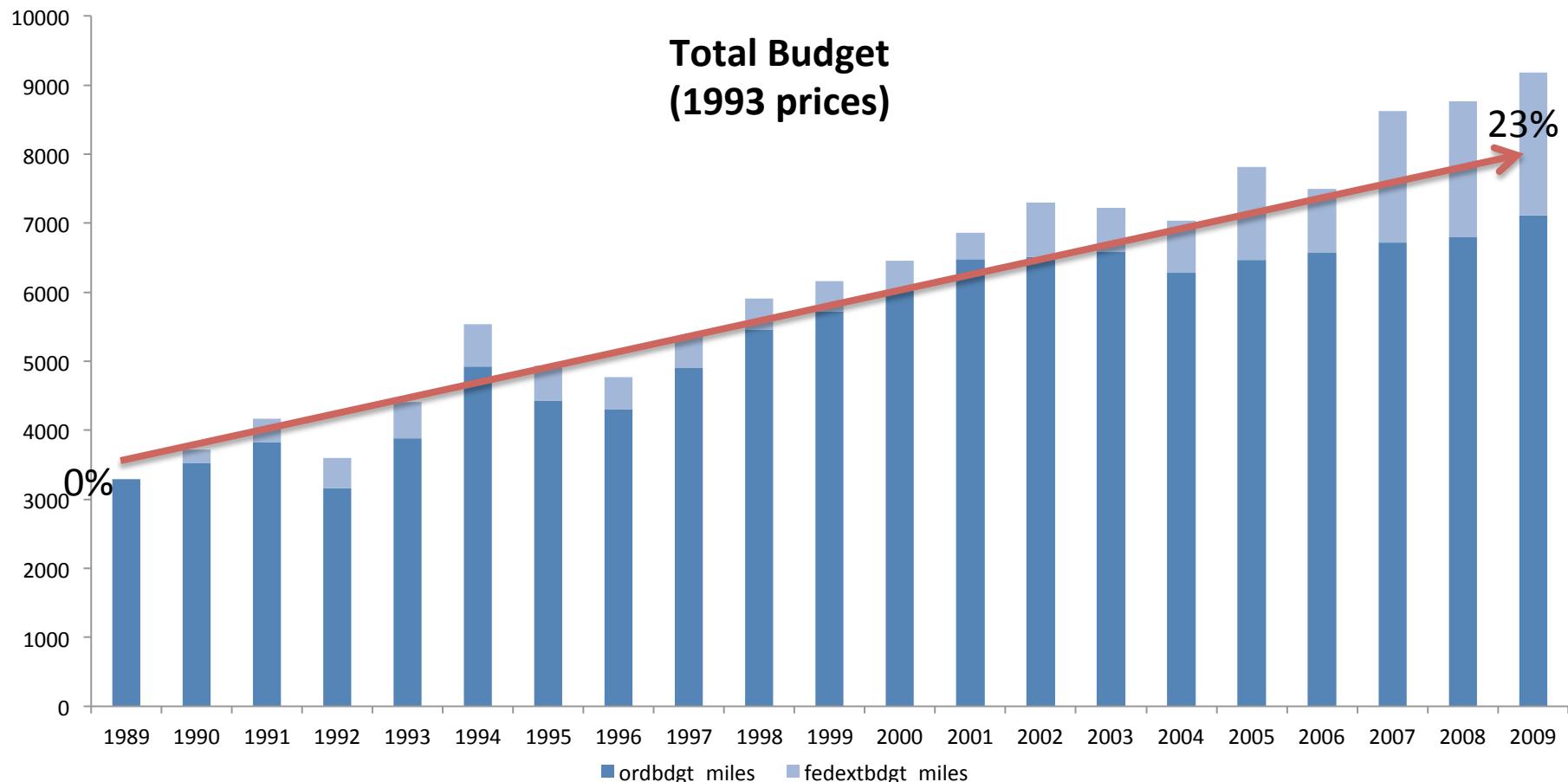
More carrots than sticks…

Current Budget

?

Input prices available!

Inputs

STP Budget

To produce

Outputs
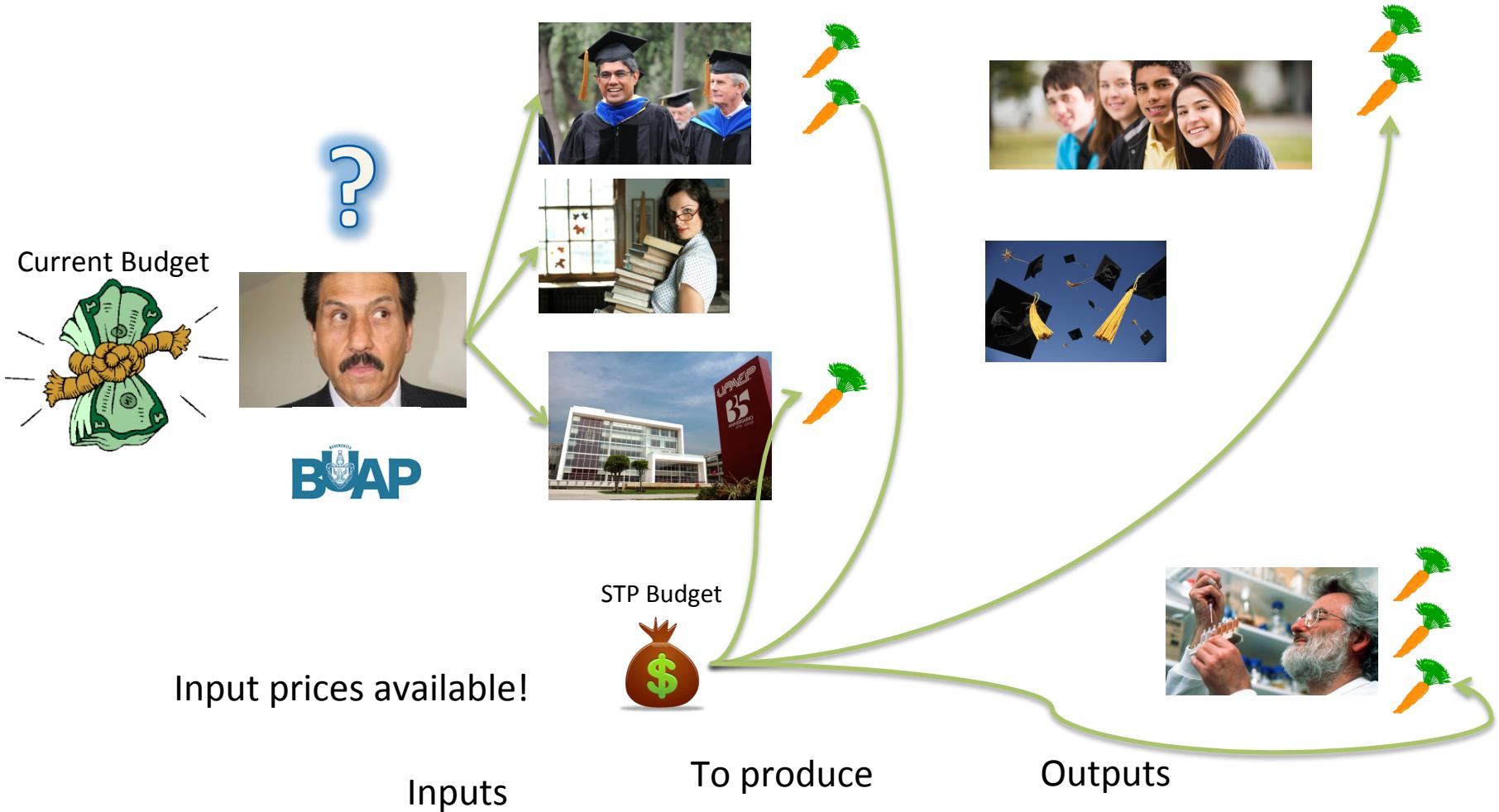
The aim of our work

- To understand impact of higher mexican education reforms in 34 State Universities
- To seek for HEIs response to incentives, particulary the adoption of some performance based funding.
- To provide an innovative way to measure input mix efficiency chage.
- To enlight policy makers and administrators.
- To create useful information for strategy purposes.

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Several studies worldwide to assess efficiency of higher education: DEA is helping.

Higher Education Efficiency

Author(s)	Year	Methodology	Unit of Analysis
Ahn, Charnes and Copper	1998	DEA	Public and private HEIs in the US
Breu and Raab	1994	DEA	Top 25 US Universities
Colber, Levay and Shaner	2000	DEA	MBA Programs in the US
Avkiran	2001	DEA	
Abbott and Doucouliagos	2003	DEA	Australian Universities
Worthington and Lee	2008	DEA	
Johnes and Johnes	1996 2006	DEA	United Kingdom
García-Aracil and Palomares-Montero	2008	DEA	Spain

The Mexican Case

Author(s)	Year	Methodology	Unit of Analysis
Barraza and Martínez-Romero	2004	General Indexes	6 mexican HEIs
Güemes-Castorena	2008	DEA	34 Mexican HEIs
López, Quijano & Bernal	2011	DEA	34 Mexican HEIs

Other Methodologies include:
- **Ordinary OLS**
- **Stochastic Frontier Analysis**

Indirect Technology (Budget constrained)

- **Anticipating the consequences of school reform: A new use of DEA, Grosskopf et al. (1999)**
  - 35 times cited.
  - GAIN functions.
- Fukuyama, H., & Weber, W. (2009).
 - Indirect Farrell output allocative efficiency change index IFAC(.)

Our previous work

1. **"Efficiency and Productivity Analysis of Mexican Public Higher Education Institutions using a DEA Output Oriented Approach and Malmquist Indexes"** Rodríguez-Regordosa, Grifell-Tatjé & Arocena (Palma, 2010)

2. **"A Cost Constrained Approach to Assess Efficiency and Productivity Growth for the Mexican State Universities"** Rodríguez-Regordosa, Grifell-Tatjé & Arocena (Verona, 2011)

3. **"Evaluating the success of educational policy in Mexican Higher Education"** (Sagarra,Mar-Molinero &Rodríguez-Regordosa, Higher Education, 2014, DOI 10.1007/s10734-014-9785-2)

Some previous findings: clear families among mexican HEIs
(Sagarra, Mar-Molinero /Rodríguez-Regordosa, 2014)
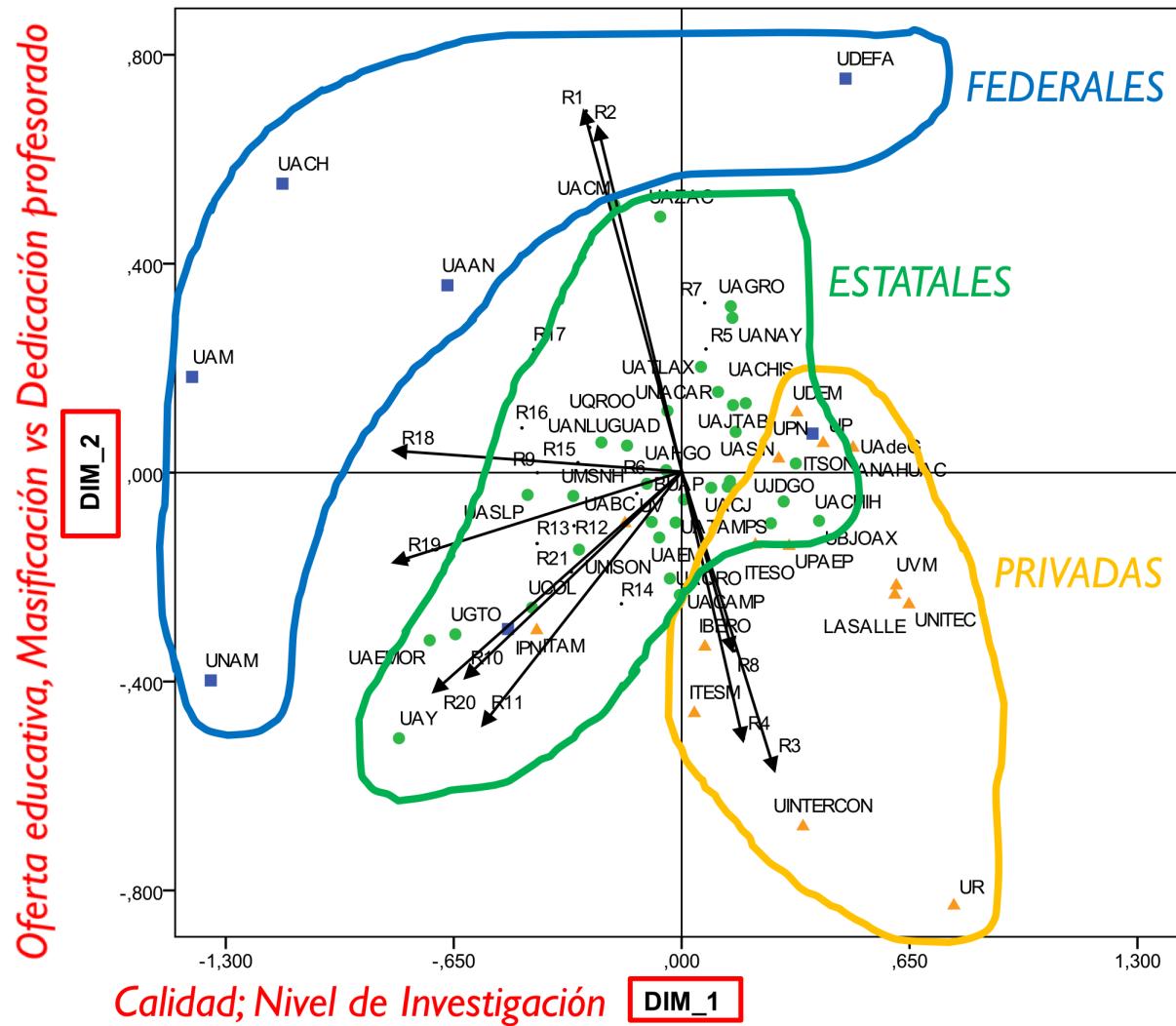
World Class Universities: inputs and outputs.

Concentration of talent

Students
Teaching staff
Researchers
Internationalization

Graduates

Research output

WCU

Supportive regulatory framework

Abundant resources

Public budget resources
Endowment revenues
Tuition fees
Research grants

Autonomy
Academic freedom

Favorable governance

Technology transfer
Service

Leadership team
Strategic vision
Culture of excellence

Source: Created by Jamil Salmi.

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The Dataset

21 years of consistent data

- 34 State Universities that account for 30% of the total enrolment and 46% of the public enrolment.

- 21 Years (1989-2009)

Inputs, Outputs, Budget and Input Prices!

- *3 Variable Inputs*
  - **FTEFACULTY**: Full time equivalent faculty
  - **STAFF**: number of staff members
  - **GEXPENSES**: General operative expenses
- *1 Fixed input.*
  - **STPBUDGET**: Subject to performance budget
- *3 Outputs.*
  - **ENROLMENT**: total enrolled students.
  - **GRADUATES**: total graduated students
  - **WSNI**: Researchers belonging to the National Researcher's System weighted by level *(Candidate, I, II and III)*
- **Budget** for current expenses.
- **Prices** for variable inputs.

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Two complemintary DEA sequential technologies

Direct Technology

$$T(x,y) = \left\{(y,x) : \sum_{j=1}^{J} \lambda_j \, y_j^s \geq y, \sum_{j=1}^{J} \lambda_j \, x_j^s \leq x, \lambda \geq 0\right\}$$

$$D_o(x,y) = min\{\theta : y/\theta \in T(x,y)\}$$

Indirect Technology

$$IT(y,x_f,w/c) = \left\{(y,x_f,w/c) : \sum_{j=1}^{J} \lambda_j \, y_j^s \geq y, \sum_{j=1}^{J} \lambda_j \, x_j^s \leq x, w_v x_v \leq c, \lambda \geq 0\right\}$$

$$ID_o\left(x_f, w_v/c, y\right) = min\{\alpha : y/\alpha \in IT\left(x_f, w_v/c\right)\}$$

Relationship between direct and indirec technologies.

Two output case.
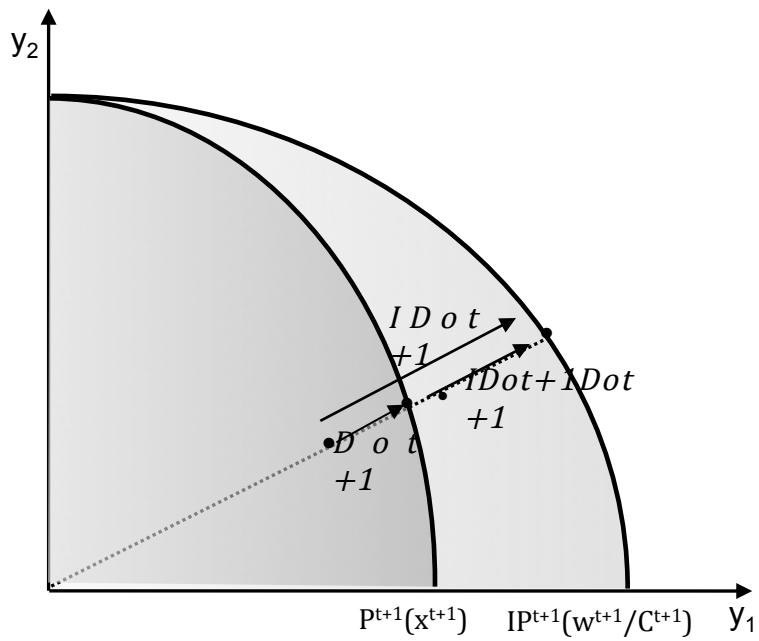
Two input one output case
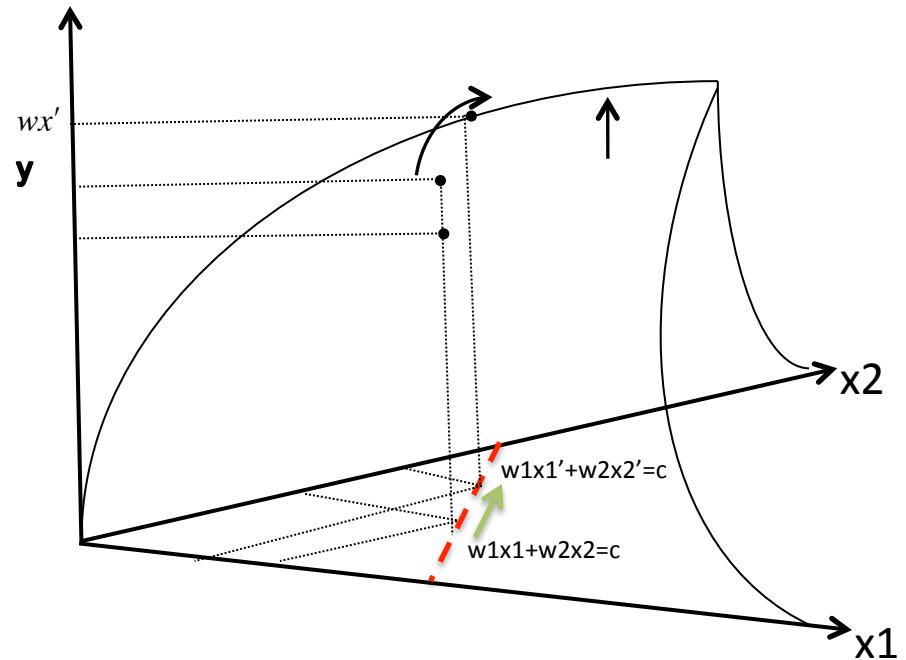
$$w'x_v \leq c \rightarrow ID_0(x_f, w/c, y) \leq D_0(x_f, x_v, y)$$

An original decomposition of an Indirect Malmquist

Direct Technical Efficiency Change

Input mix selection efficiency change

$$IM^{t+1} = \frac{D_o^{t+1}\left(x_f^{t+1}, x_v^{t+1}, y^{t+1}\right)}{D_o^t\left(x_f^t, x_v^t, y^t\right)} \times \frac{\dfrac{ID_o^{t+1}\left(x_f^{t+1}, w^{t+1}/C^{t+1}, y^{t+1}\right)}{D_o^{t+1}\left(x_f^{t+1}, x_v^{t+1}, y^{t+1}\right)}}{\dfrac{ID_o^t\left(x_{f,}^t w^t/C^t, y^t\right)}{D_o^t\left(x_f^t, x_v^t, y^t\right)}}$$

$$\times \frac{ID_o^t\left(x_{f,}^t w^t/C^t, y^t\right)}{ID_o^{t+1}\left(x_f^t, w^t/C^t, y^t\right)}$$

Indirect Frontier Shift

We can know understand if managers are allocating their resources smartly and if they respond to incentives

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# Geometri Avg all years Indirect Malmquist
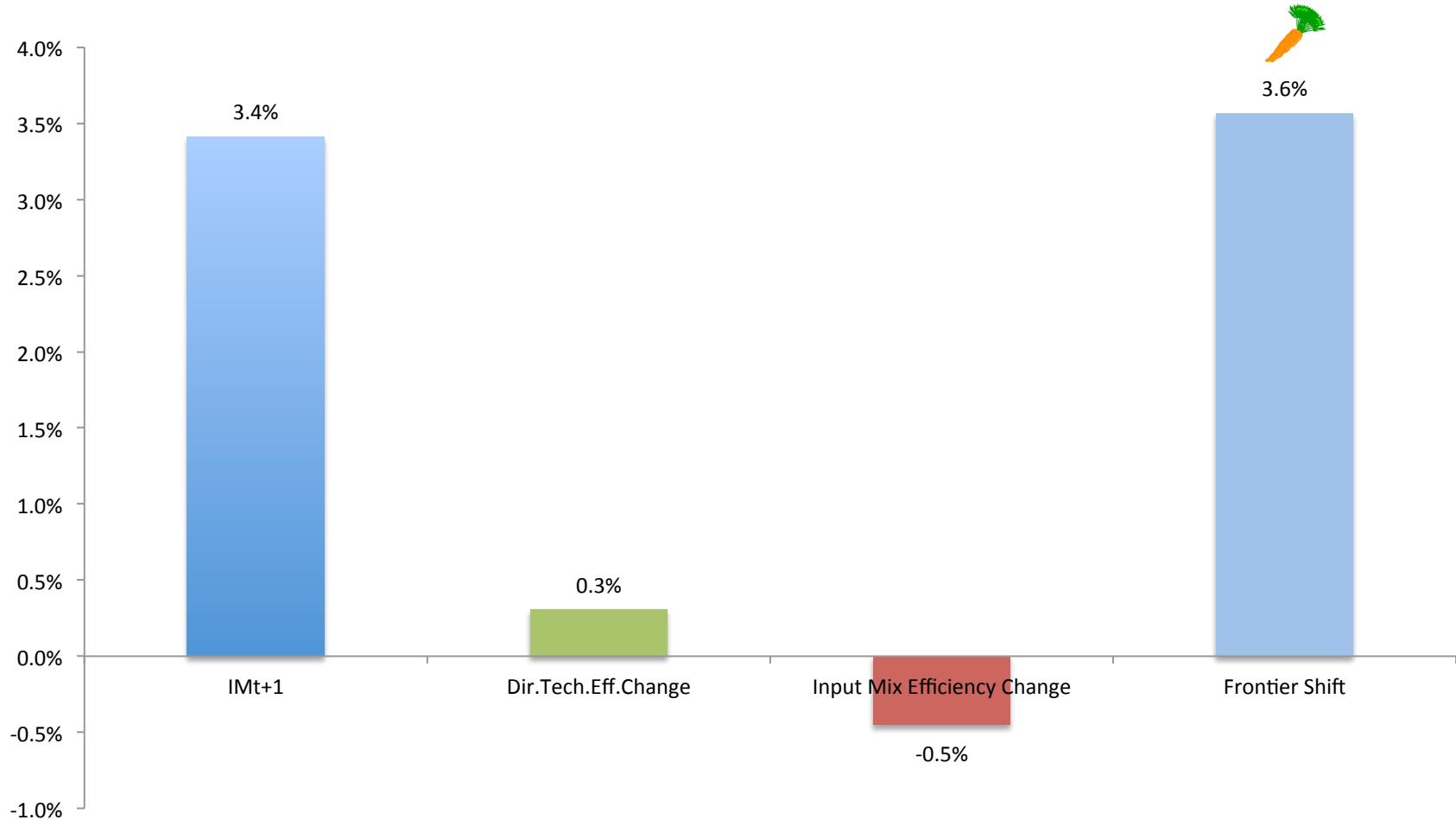
Big room to gain efficiency...

GEOMETRIC AVERAGE INDIRECT AND DIRECT DISTANCE SCORES
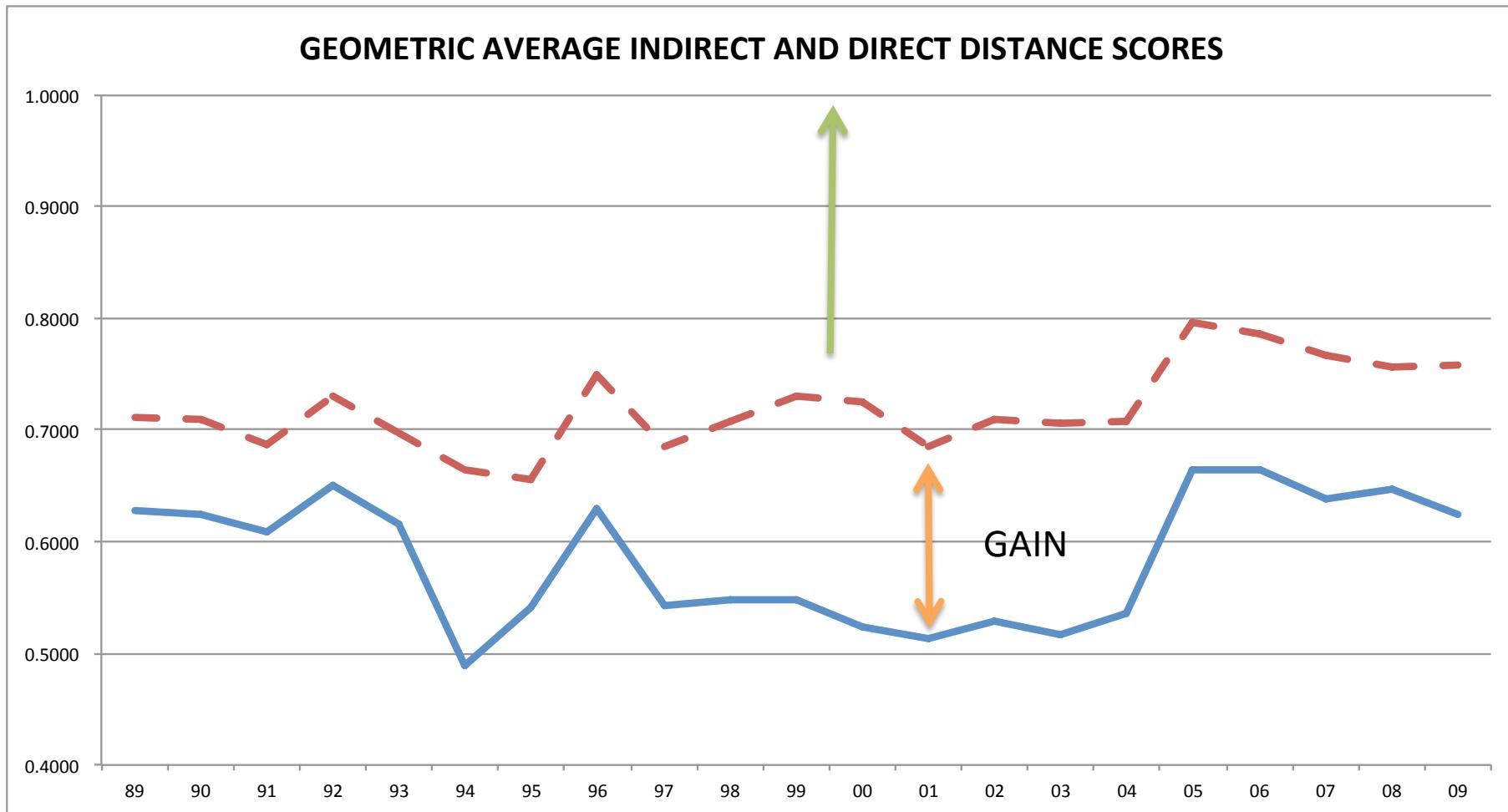
Consistent with previous works...

Few good years…

Indirect Malmquist t+1 Geometric Average
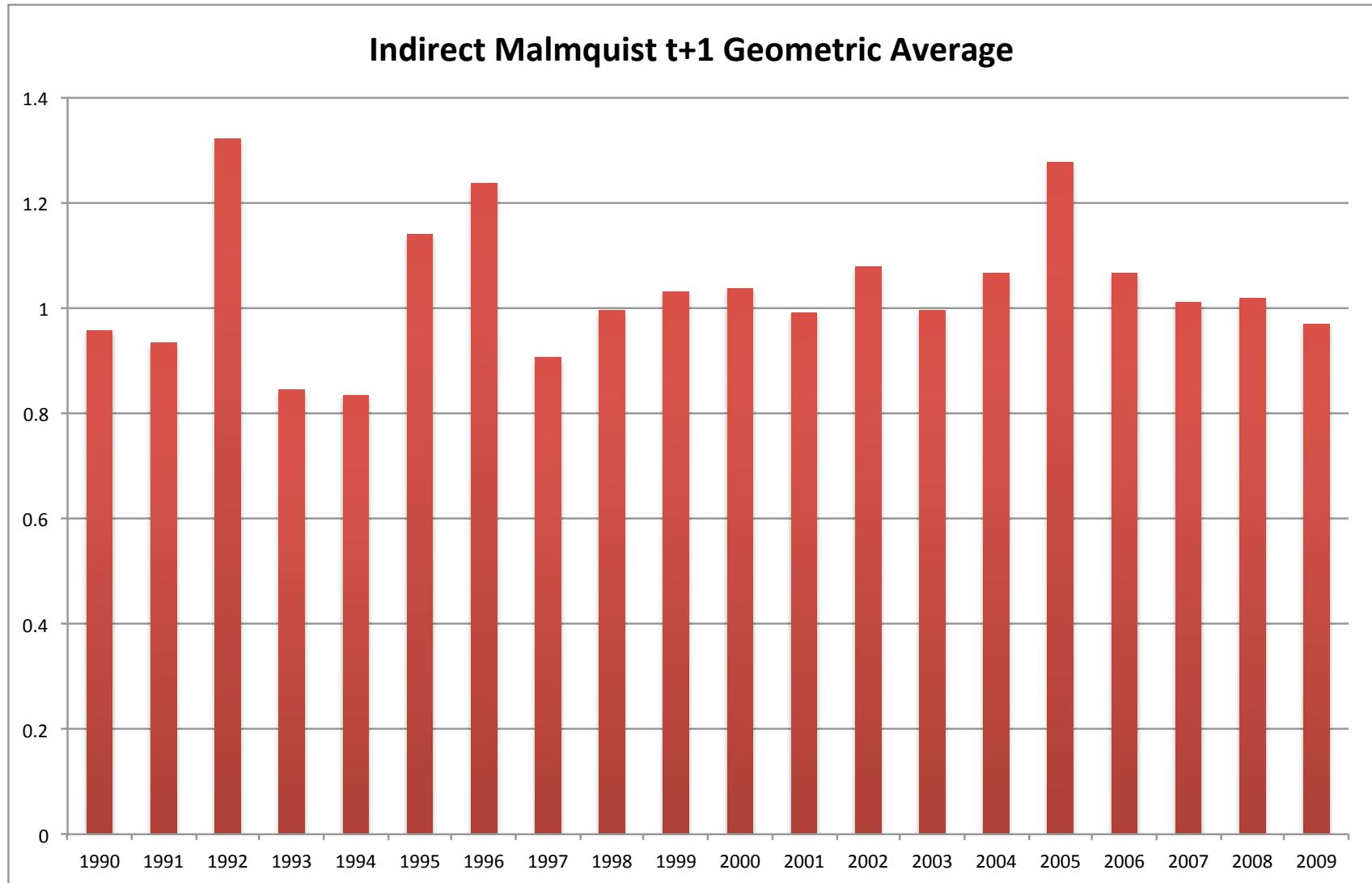
The indirect technology: less efficient HEIs

No. of Eff. Scores Defining Sequential Frontiers

Good Direct Performers
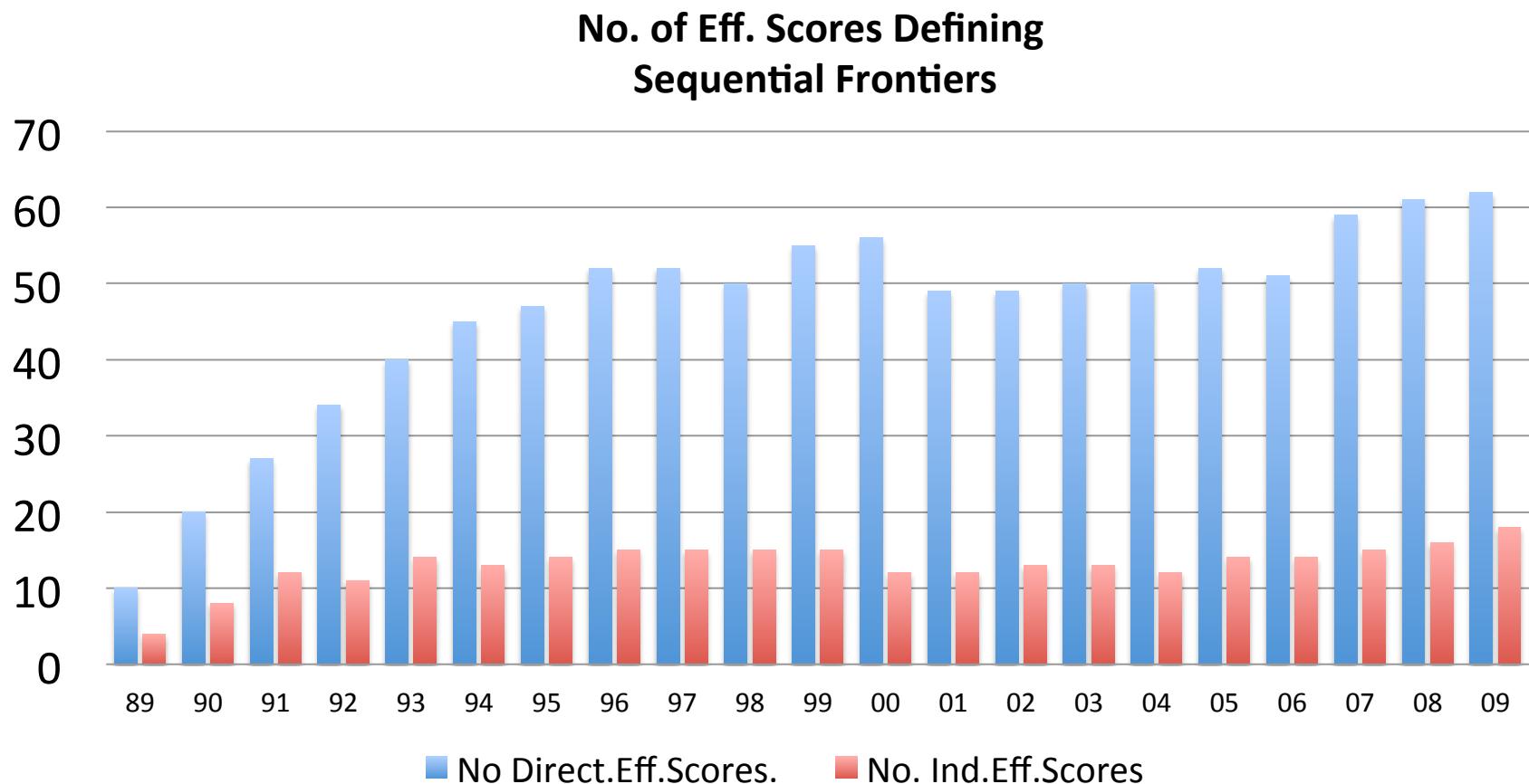
Number of efficient scores
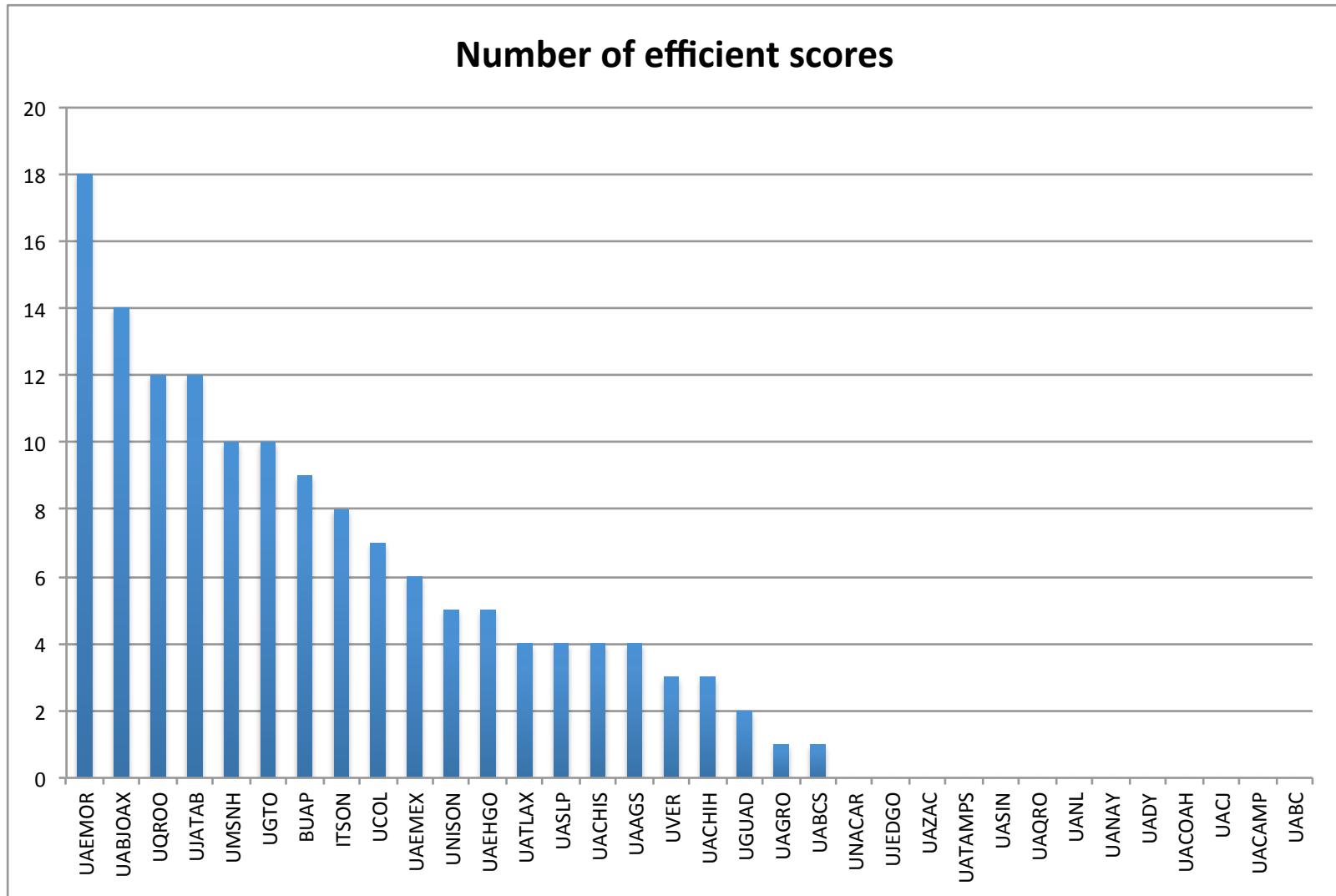
But fewer good indirect performers

Number of Efficient Indirect Scores
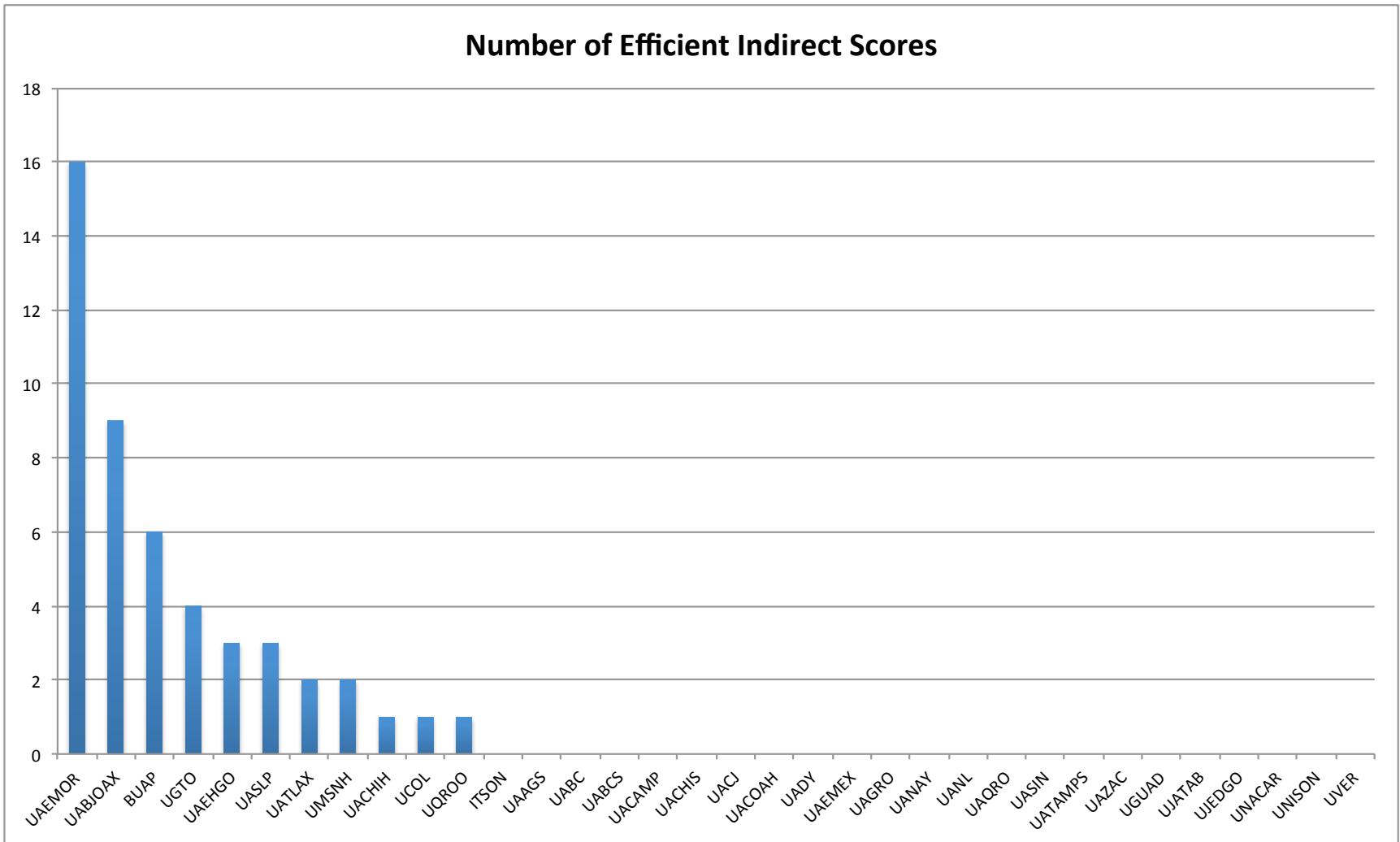
Must of the HEIs are improving…

Malmquist GeomAvg
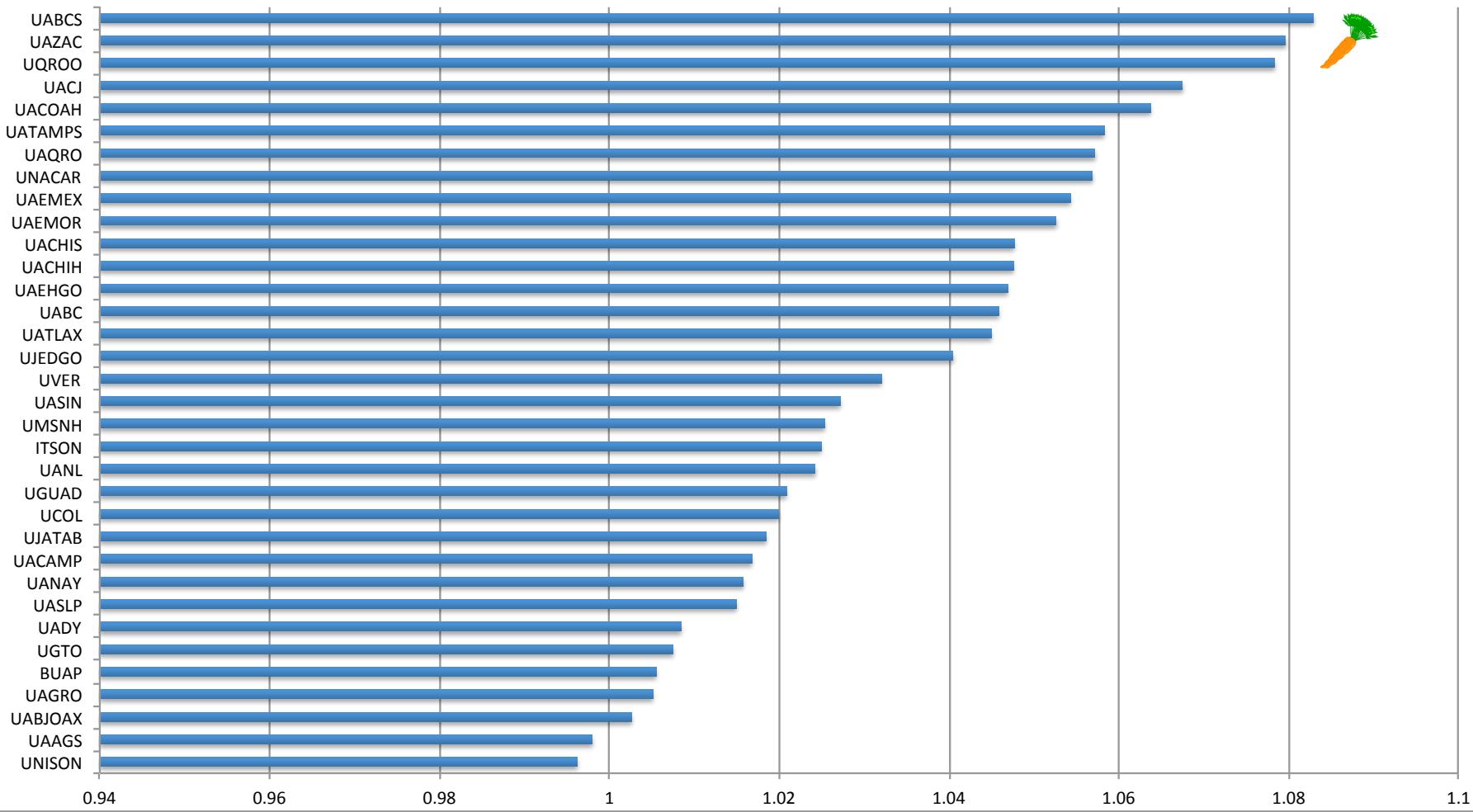
Have some presidents performed better than others?

	1990-1994	1994-2000	2000-2006	2006-2009
Mexican Presidents	**Carlos Salinas**	**Ernesto Zedillo**	**Vicente Fox**	**Felipe Calderón**
		🥕	🥕	
IMt+1	**0.963**	**1.152**	**1.075**	**0.999**
Dir.Tech.Eff.Change	0.984	1.130	1.014	0.988
Allocative Eff. Change	0.964	1.120	1.026	0.991
Frontier Shift	1.015	1.147	1.033	1.020

Can we explain productivity by means of STP Budget?

Variable Bdgt as % of Total — IMt+1
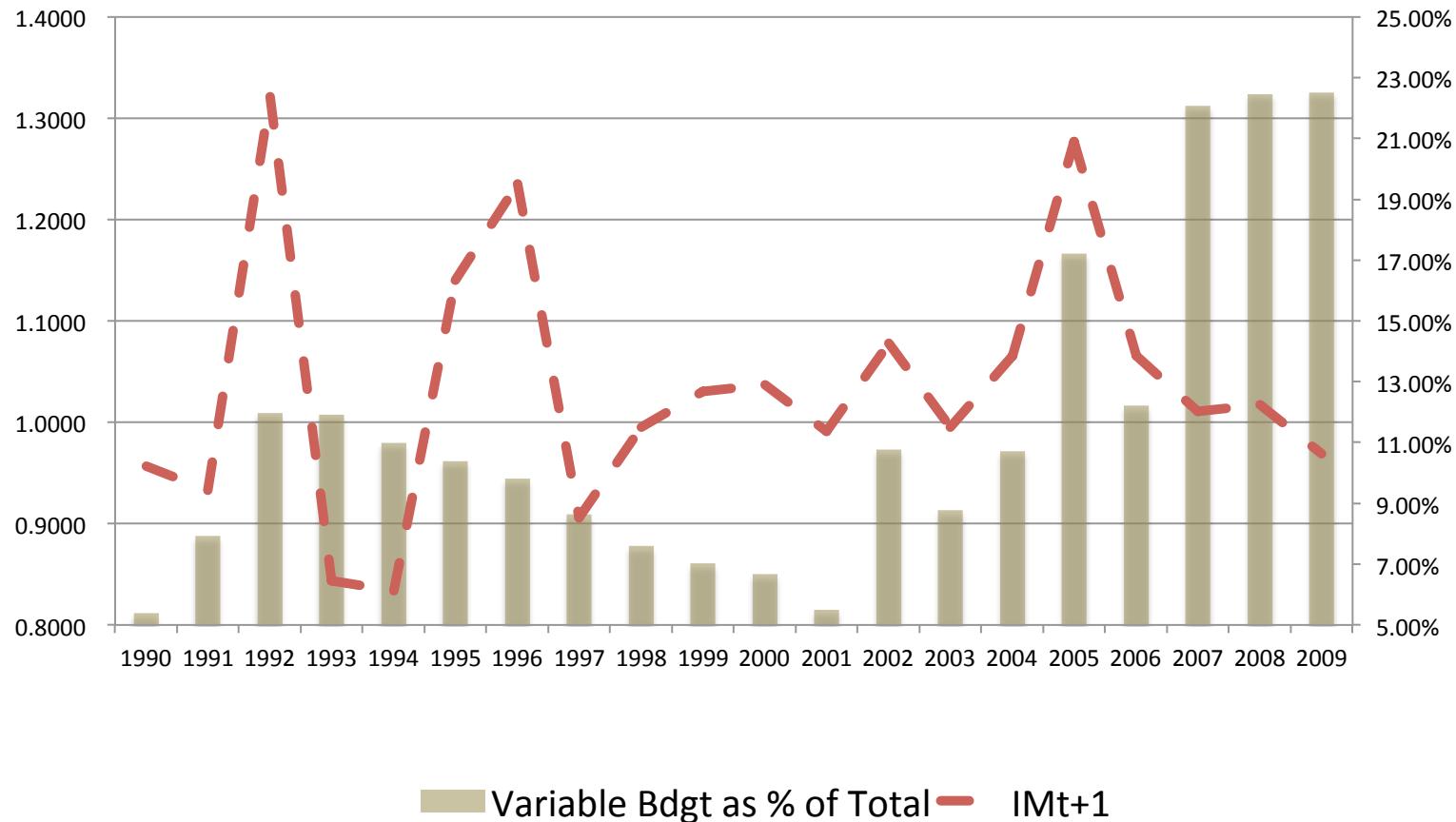
What can we learn?

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Possible explanations

- We assumed that HEIs managers are able to change input mix; do they actually can?
  - The power of the unions
  - The political incentives: give jobs
  - Staff is cheaper than faculty
  - Managers do not have information
  - They are so busy growing 🥕

Main conclusions until now…

- The system in general is still inefficient but slowly improving
- The improvement is explained more for the shift in the frontier
- Some HEIs are doing very well and are moving the frontier
- Input mix selection improvement is almost inexistent
- But our approach works!

Future research

- Try to find if particular HEIs are responding
  - Running Panel Data regressions with efficiency explained by incentives. (Causality)

- If results are significant, try to compute an "ideal" level of incentives.

- Suggest some funding policy issues: what works and what doesn't

Thank you!