# Comment stimuler la recherche et l'innovation

# Dépenses intérieures brutes de R-D  Total, % du PIB, 2000 − 2014



Allemagne

France

2.8

2.7

2.6

2.5

2.4

2.3

2.2

2.1

2000    2002    2004    2006    2008    2010    2012    2014

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Comparer les pays sur data.oecd.org

OCDE
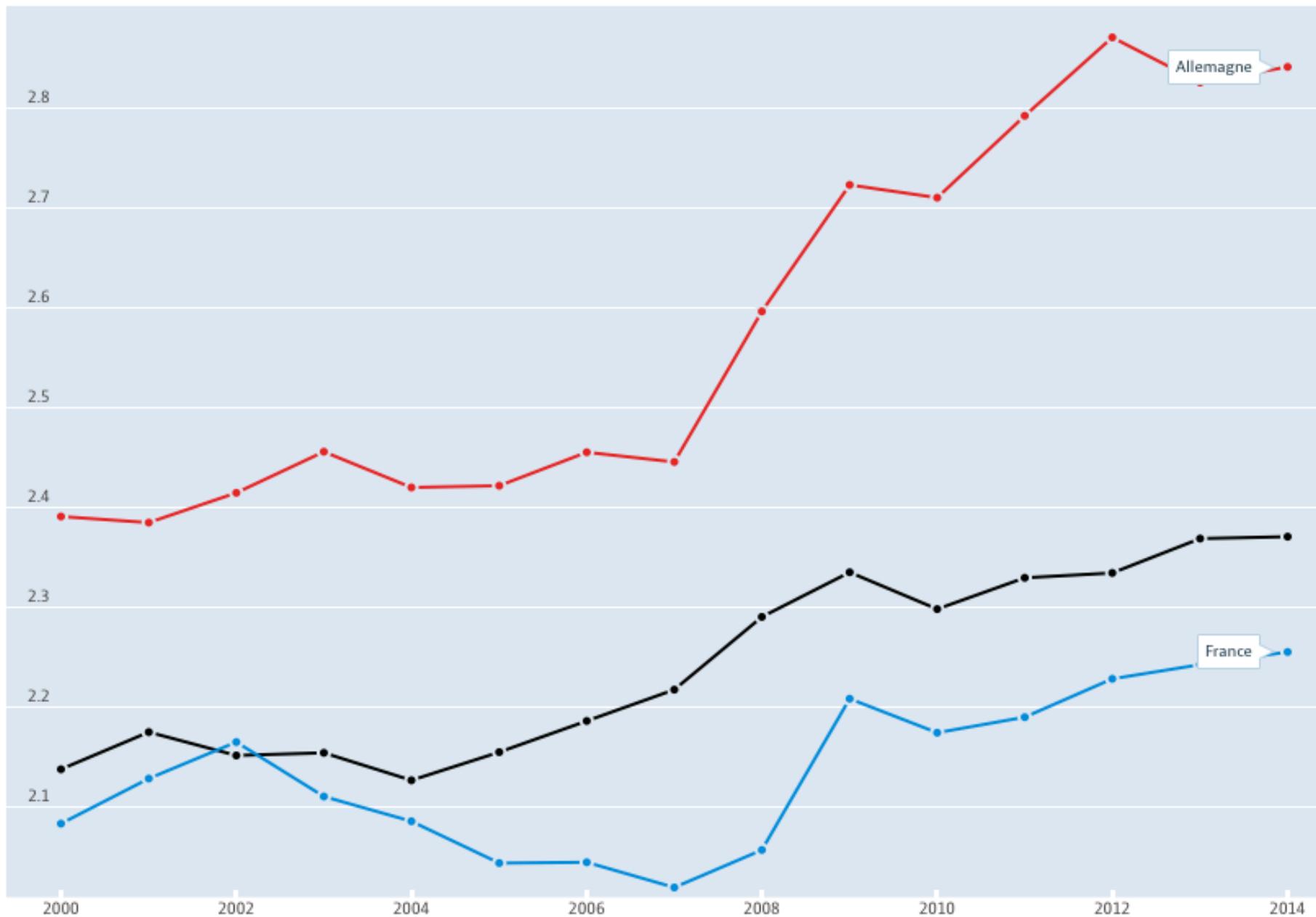
# Part des dépenses de R&D dans le PIB

En pourcentage du PIB, en 2012, sauf pour le Brésil (2010), l'Inde (2006) et la Suisse (2008).



Korea, Israel, Finland, Sweden, Japan, Denmark, Germany, Switzerland, Austria, United States, OECD (2,4), France (2,29), Belgium, Brazil, Estonia, Netherlands, EU28, Singapore, China, United Kingdom, Canada, Ireland, Norway, Portugal (1,5), Luxembourg, Spain (1,3), Italy, Russian Federation, Turkey, Poland (0,9), India, Greece
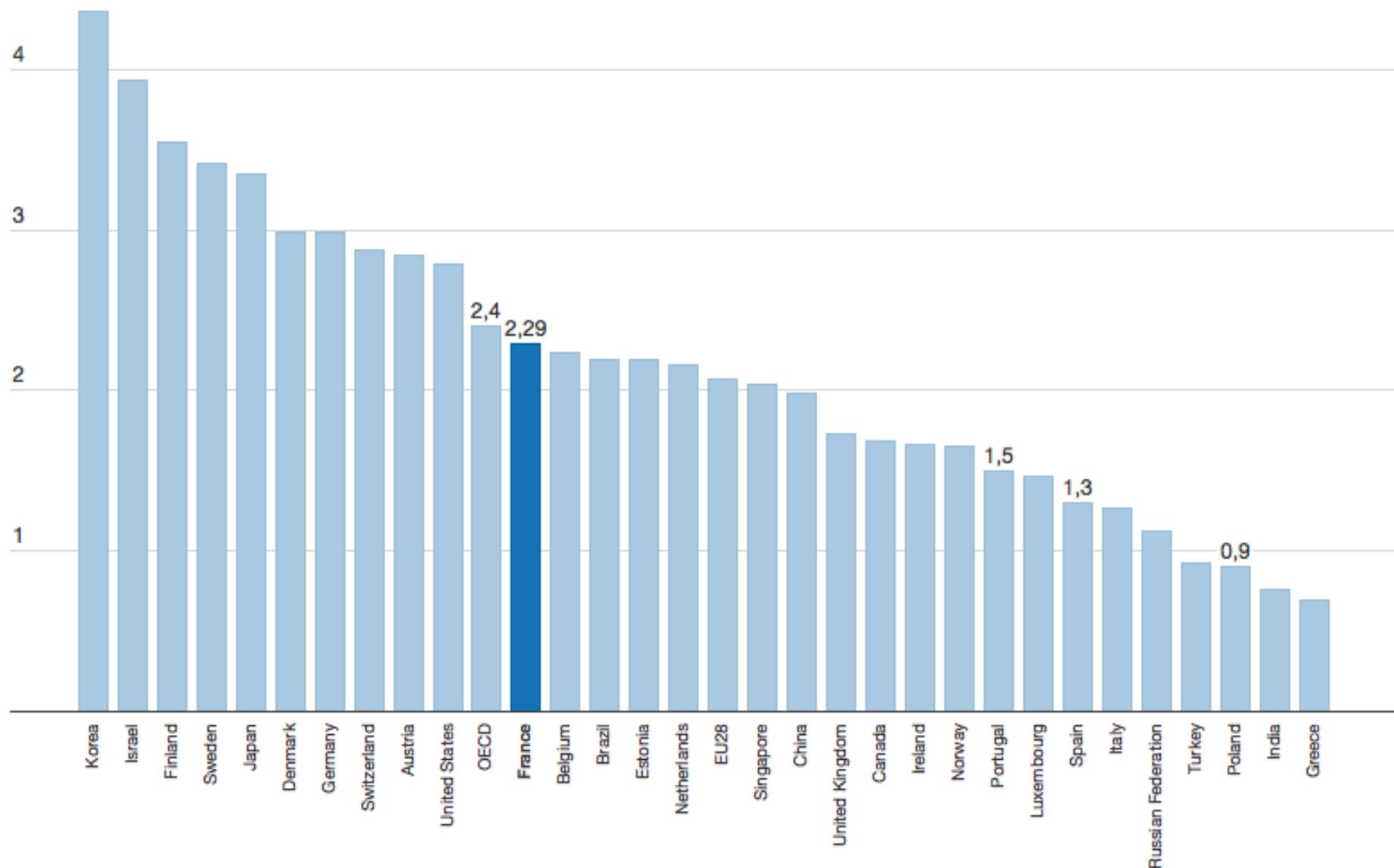
# Recherche en plusieurs etapes

- Recherche fondamentale
  - Ouverture, Liberte academique

- Innovation commerciale
  - Focus, appropriabilite

# Stimuler la recherche fondamentale

- Universites
- Agences de recherche

# Gouvernance et performance des universites

# Do universities with different governance perform differently?

❖ in terms of productivity/influence measures like the Shanghai ranking?

❖ in terms of real outcomes like effects on economic growth?

# By "governance", we mean who decides academic, financial, and research questions.

❖ a central government?

❖ the university itself?

## Indices of university productivity and influence

## The Shanghai index puts weights on 6 criteria:

1. Alumni winning Nobel Prizes and Fields Medals (10%)

2. Faculty winning Nobel Prizes and Fields Medals (physics, chemistry, medicine and economics) and Field Medals in mathematics (20%)

3. Articles published in Nature and Science (20%)

4. Articles in Science Citation Index-expanded and Social Science Citation Index (20%)

5. Highly cited researchers in 21 broad subject categories (20%),

6. Academic performance with respect to the size of an institution (10%)

## The ranking is oriented towards pure science, as opposed to applied science, social science, or the humanities.

- We'll examine the overall index (500=top, 1=bottom) and highly cited researchers, the broadest-based component.

Figure 1: the EU-US performance gap for Shanghai Top 100 universities (US=100)
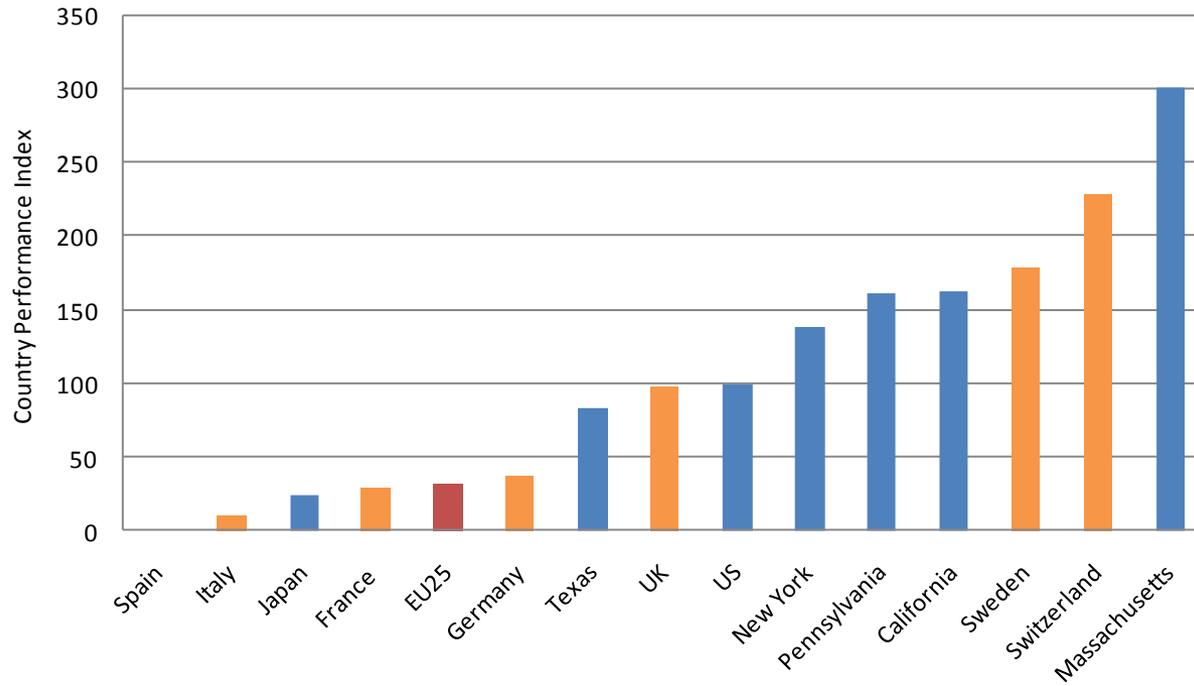
## Table 1: Country performance index ( US= 100)

| Country | Population (millions) | Shanghai ranking | | | |
|---|---|---|---|---|---|
| | | Top 50 | Top 100 | Top 200 | Top 500 |
| Austria | 8 | 0 | 0 | 0 | 53 |
| Belgium | 10 | 0 | 0 | 61 | 122 |
| CzechRepublic | 10 | 0 | 0 | 0 | 13 |
| Denmark | 5 | 0 | 75 | 114 | 161 |
| Finland | 5 | 0 | 46 | 75 | 81 |
| France | 60 | 3 | 15 | 29 | 45 |
| Germany | 83 | 0 | 17 | 37 | 67 |
| Greece | 11 | 0 | 0 | 0 | 12 |
| Hungary | 10 | 0 | 0 | 0 | 13 |
| Ireland | 4 | 0 | 0 | 0 | 50 |
| Italy | 58 | 0 | 0 | 11 | 34 |
| Netherlands | 16 | 20 | 51 | 76 | 131 |
| Poland | 38 | 0 | 0 | 0 | 4 |
| Spain | 43 | 0 | 0 | 0 | 14 |
| Sweden | 9 | 7 | 117 | 179 | 217 |
| UK | 60 | 72 | 86 | 98 | 124 |
| EU15 | 383 | 13 | 26 | 41 | 67 |
| EU25 | 487 | 10 | 21 | 32 | 54 |
| Australia | 20 | 0 | 31 | 66 | 101 |
| Canada | 32 | 39 | 54 | 63 | 104 |
| Japan | 128 | 14 | 17 | 24 | 27 |
| Norway | 5 | 0 | 66 | 91 | 107 |
| Switzerland | 7 | 97 | 166 | 228 | 230 |
| US | 294 | 100 | 100 | 100 | 100 |
| California | 36 | 234 | 199 | 163 | 103 |
| Massachusetts | 6 | 449 | 308 | 302 | 263 |
| New York | 19 | 196 | 167 | 139 | 148 |
| Pennsylvania | 12 | 111 | 177 | 161 | 115 |
| Texas | 23 | 33 | 61 | 83 | 103 |

Figure 2: Relationship between expenditure per student and country performance
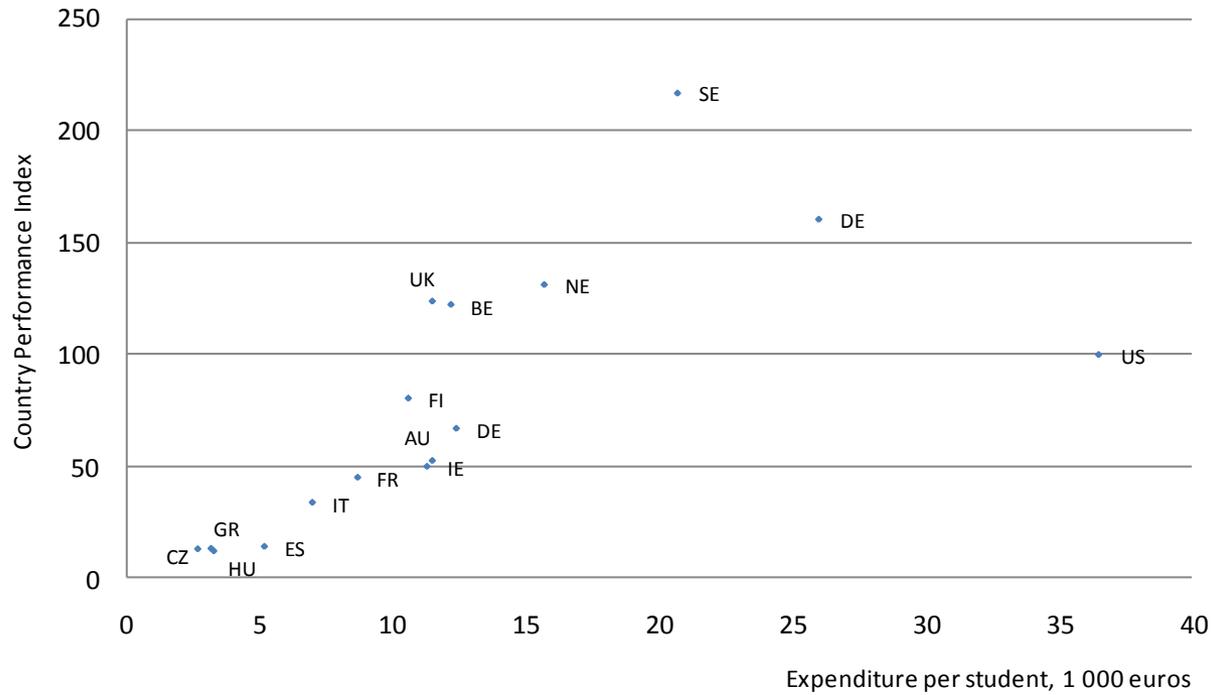
## Table 2: Public and private expenditure on higher education, 2001

| Country | As % of GDP | | | In thousand euros per student | | |
|---|---|---|---|---|---|---|
| | Public | Private | Total | Public | Private | Total |
| Austria | 1.4 | 0.1 | 1.5 | 11.0 | 0.5 | 11.5 |
| Belgium | 1.4 | 0.2 | 1.6 | 10.6 | 1.6 | 12.2 |
| Czech Republic | 0.8 | 0.1 | 0.9 | 2.3 | 0.4 | 2.7 |
| Denmark | 2.7 | 0.0 | 2.7 | 25.6 | 0.4 | 26.0 |
| Finland | 2.1 | 0.1 | 2.2 | 10.3 | 0.3 | 10.6 |
| France | 1.0 | 0.2 | 1.2 | 7.5 | 1.2 | 8.7 |
| Germany | 1.1 | 0.1 | 1.2 | 11.5 | 0.9 | 12.4 |
| Greece | 1.2 | 0.0 | 1.2 | 3.3 | 0.0 | 3.3 |
| Hungary | 1.1 | 0.3 | 1.4 | 2.6 | 0.6 | 3.2 |
| Ireland | 1.2 | 0.2 | 1.4 | 9.7 | 1.6 | 11.3 |
| Italy | 0.8 | 0.2 | 1.0 | 5.6 | 1.4 | 7.0 |
| Netherlands | 1.3 | 0.3 | 1.6 | 13.0 | 2.7 | 15.7 |
| Poland | 1.1 | .* | .* | 1.7 | .* | .* |
| Spain | 1.0 | 0.3 | 1.3 | 4.0 | 1.2 | 5.2 |
| Sweden | 2.1 | 0.2 | 2.3 | 18.9 | 1.8 | 20.7 |
| UK | 0.8 | 0.3 | 1.1 | 8.4 | 3.1 | 11.5 |
| EU25 | 1.1 | 0.2 | 1.3 | 7.3 | 1.4 | 8.7 |
| Japan | 0.5 | 0.6 | 1.1 | 6.5 | 7.3 | 13.8 |
| US | 1.5 | 1.8 | 3.3 | 16.6 | 19.9 | 36.5 |

## 2. GOVERNANCE: A SURVEY OF EUROPEAN UNIVERSITIES

A survey on governance was sent to European universities in the top 500 of the Shanghai ranking in 2006

➢ 196 universities, 14 countries
➢ University characteristics: age, public/private, # of students, faculties (medicine, law, natural sciences…).
➢ University operating independence:
   • Does the university set its own curriculum?
   • Does the university select its own students or is there centralized allocation?
   • To what degree does the university select its own professors?
   • Is there strong endogamy (% of professors with PhD from their university), which suggests that hiring is not open?
   • What is the role of state in setting wages?
   • Are all professors with the same seniority paid the same wage?
   • What share of funding is core public funding that the university can influence only through politics?
   • What share of funding can be controlled by the university?  For instance, does the university control its tuition or compete for research grants?
   • What is the composition of the university board (# of faculty, students, scientific personnel...).
   • What are the voting rights of board members?

Use combination of administrative data and existing surveys since the early 1950s

➢ Percentage of private universities in the State

➢ Autonomy characteristics among public universities: three 1950 variables

- University freedom from centralized purchasing
- Budget independence vis+a+vis the State government
- Freedom to hire, fire, and set faculty wages

## Table 3: Characteristics of the universities in the sample (country averages)

| Country | Age (years) | Number of students (thousands) | Budget per student (1 000€)* | Public status[*] | Budget autonomy[$] | Building ownership[$] | Hiring autonomy[$] | Wage-setting autonomy[$] | Faculty with in-house PhD (%) |
|---|---|---|---|---|---|---|---|---|---|
| Belgium | 284 | 21.7 | 11.3 | 0.5 | 0.4 | 1.0 | 1.0 | 0.0 | 63 |
| Denmark | 59 | 18.2 | 11.4 | 1.0 | 1.0 | 0.3 | 0.5 | 0.5 | 40 |
| Germany | 289 | 26.2 | 9.6 | 0.9 | 0.0 | 0.5 | 0.8 | 0.0 | 40 |
| Ireland | 259 | 16.3 | 12.7 | 0.5 | 0.5 | 1.0 | 1.0 | 0.0 | 49 |
| Italy | 444 | 44.9 | 10.1 | 1.0 | 0.9 | 1.0 | 0.4 | 0.0 | 24 |
| Netherlands | 217 | 21.4 | 20.5 | 0.8 | 0.8 | 1.0 | 0.8 | 0.2 | 33 |
| Spain | 342 | 44.8 | 7.0 | 1.0 | 0.5 | 1.0 | 0.5 | 0.0 | 69 |
| Sweden | 266 | 27.1 | 16.2 | 0.8 | 0.8 | 0.2 | 1.0 | 1.0 | 58 |
| Switzerland | 326 | 12.8 | 26.2 | 0.8 | 0.1 | 0.4 | 0.8 | 0.0 | 24 |
| UK | 242 | 14.6 | 24.5 | 0.5 | 0.9 | 0.9 | 1.0 | 0.8 | 8 |
| Total | 290 | 24.9 | 16.1 | 0.8 | 0.6 | 0.8 | 0.8 | 0.3 | 29 |

Source: Bruegel survey.
* PPP adjusted. [*] 1 if public, 0 if private. [$] 1 if yes, 0 if no.

Correlation between University Output and Autonomy

(coef=78.5,pvalue<0.001)
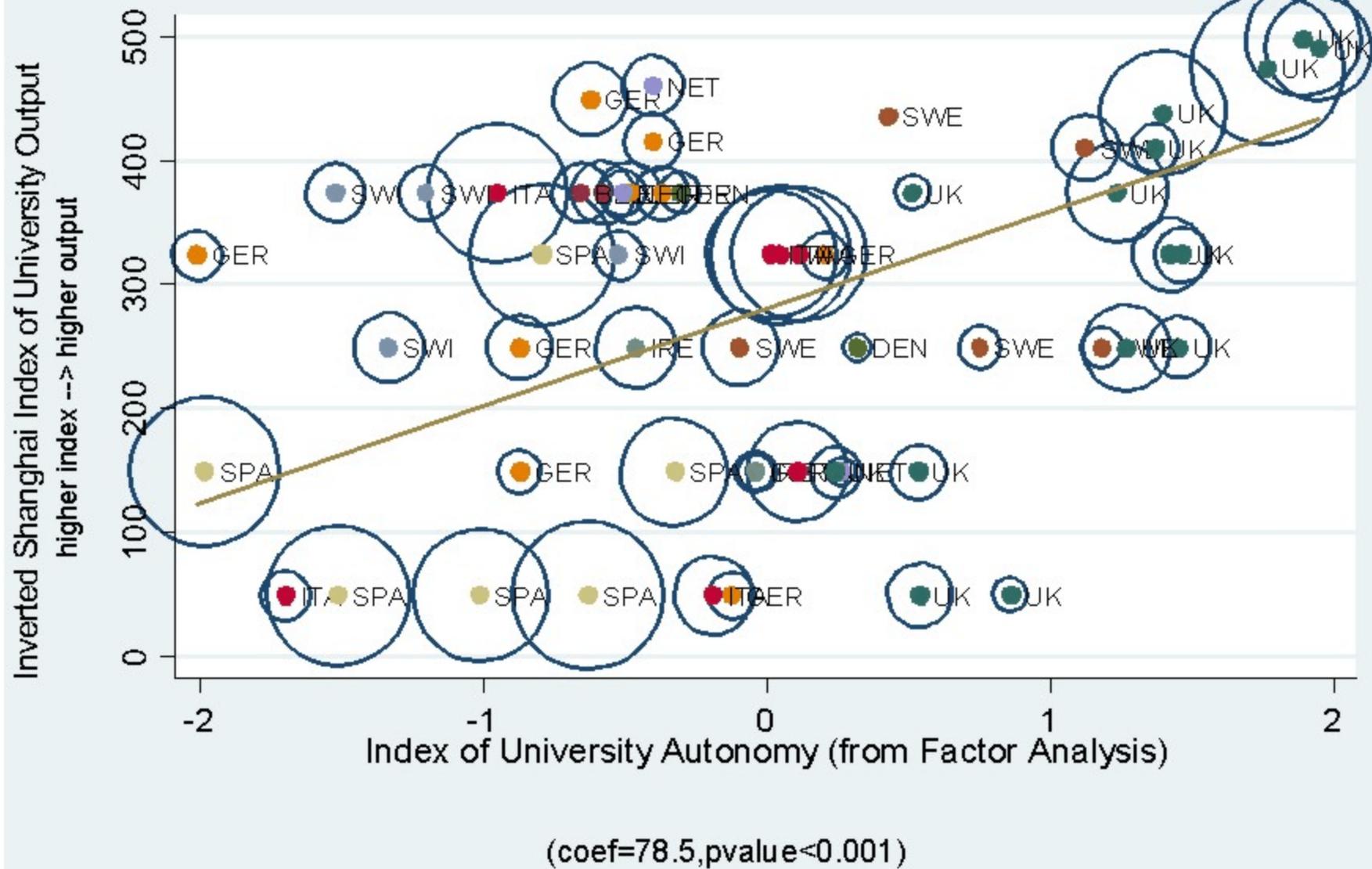
Correlation between University Output and Recent Autonomy
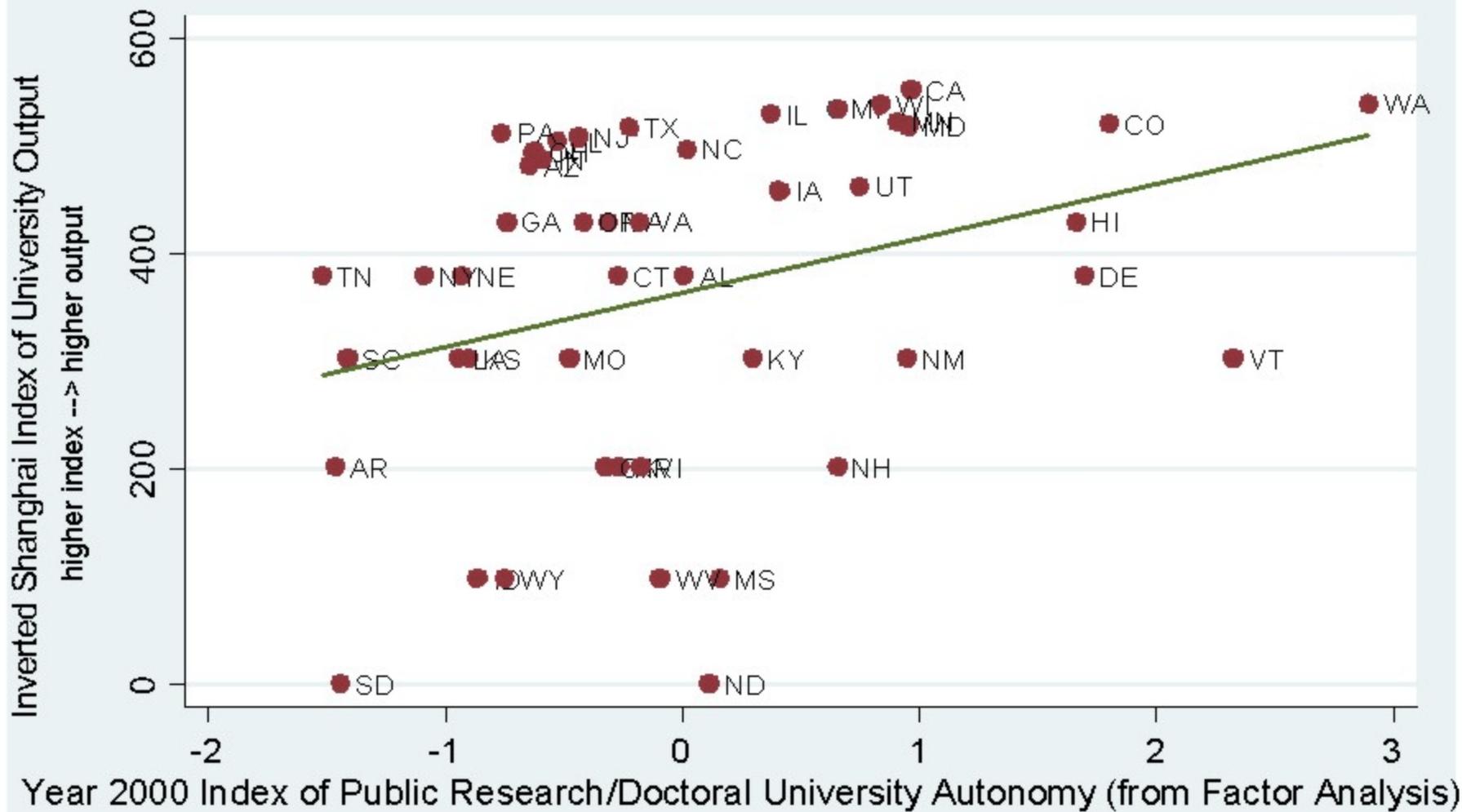
(coef=50.3,pvalue=0.027)

Correlation between University Output and 1950s Autonomy
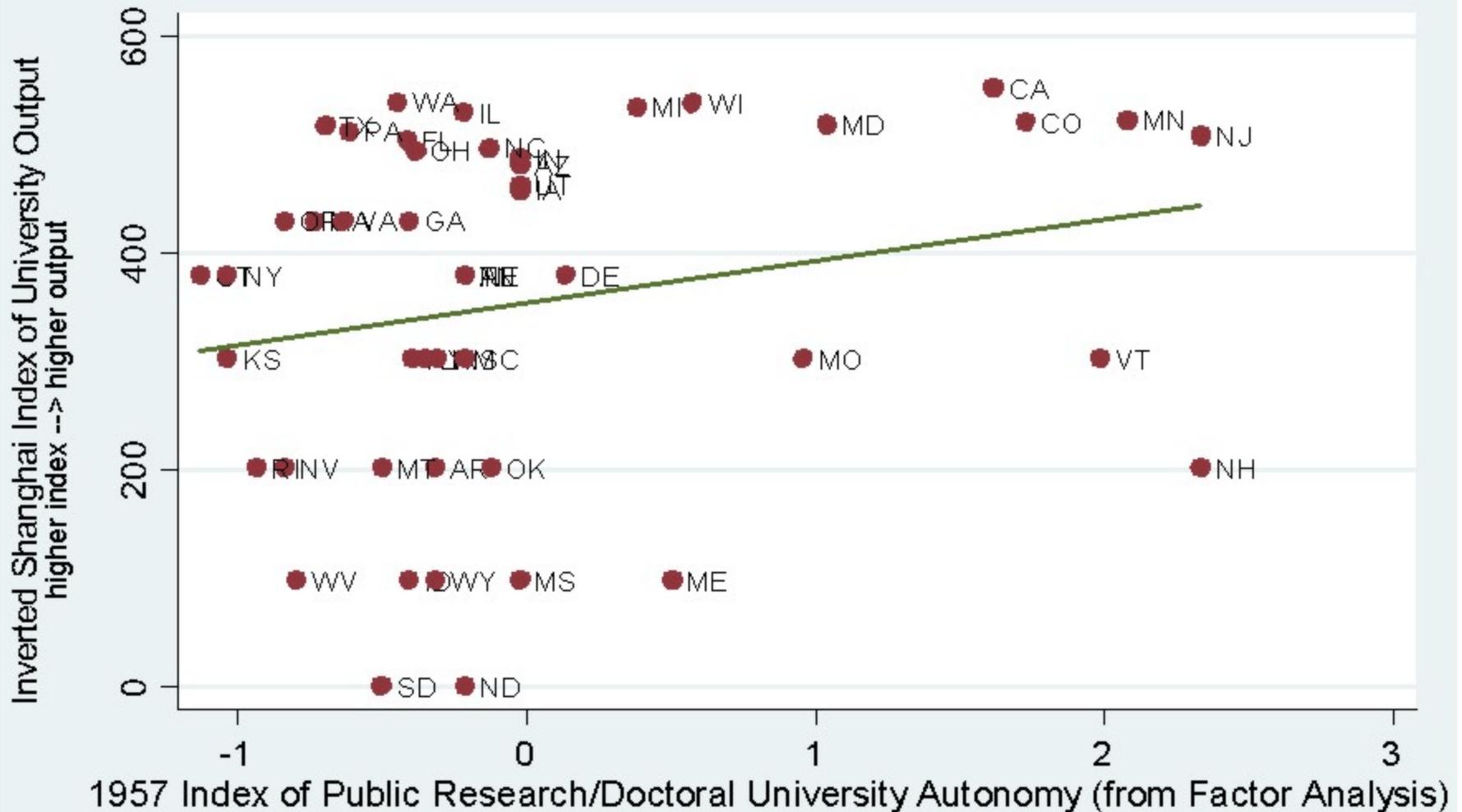
(coef=38.7,pvalue=0.130)

Correlation between University Output and Gov't Control of Faculty Salaries
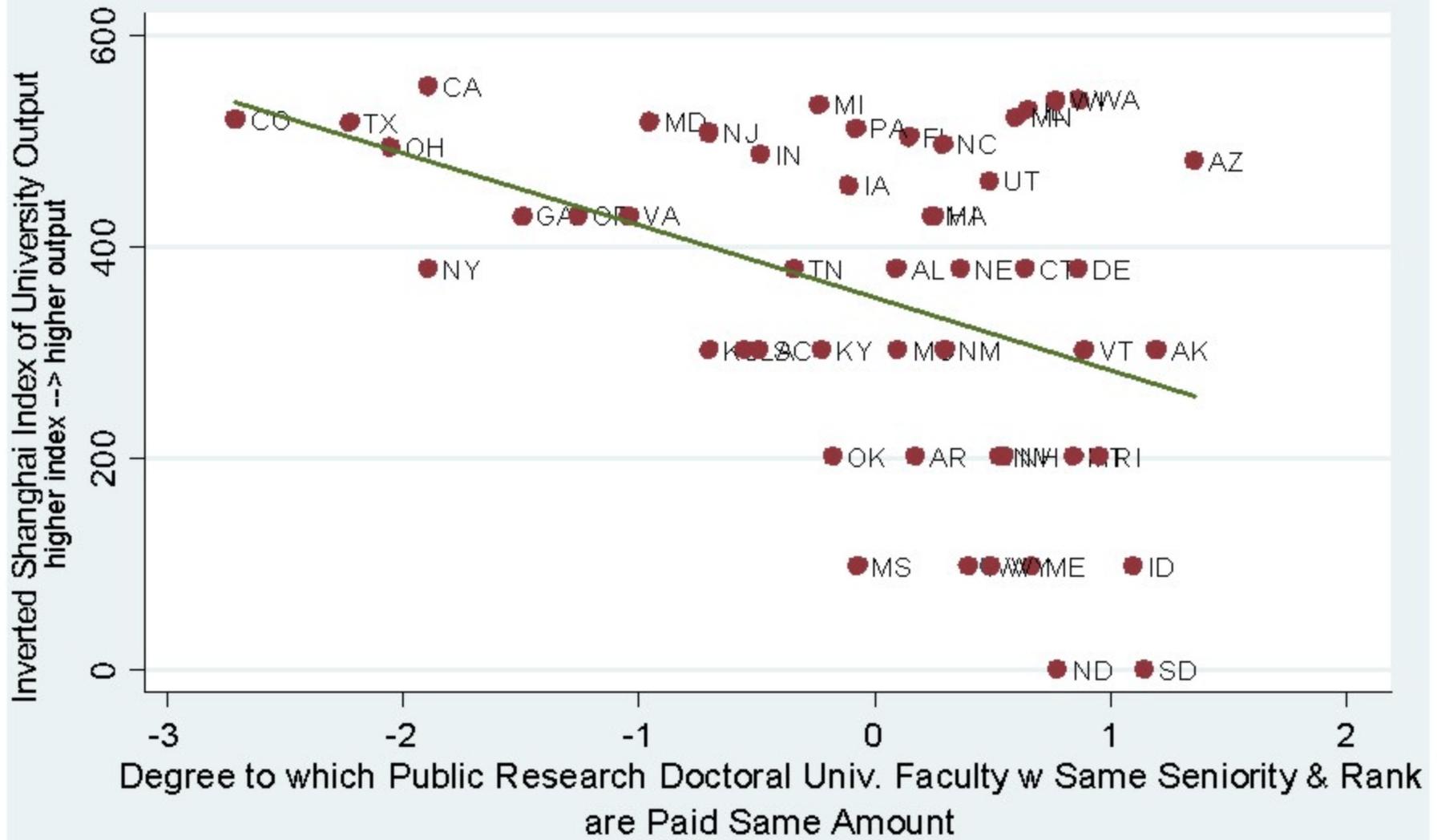
(coef=-68.5,pvalue=0.002)

Relationship between University Output and Gov't Control of Student Admissions

Inverted Shanghai Index of University Output
higher index --> higher output

None       Partial       Complete

Degree to Students are Admitted by a Central Body/Rules, rather than University
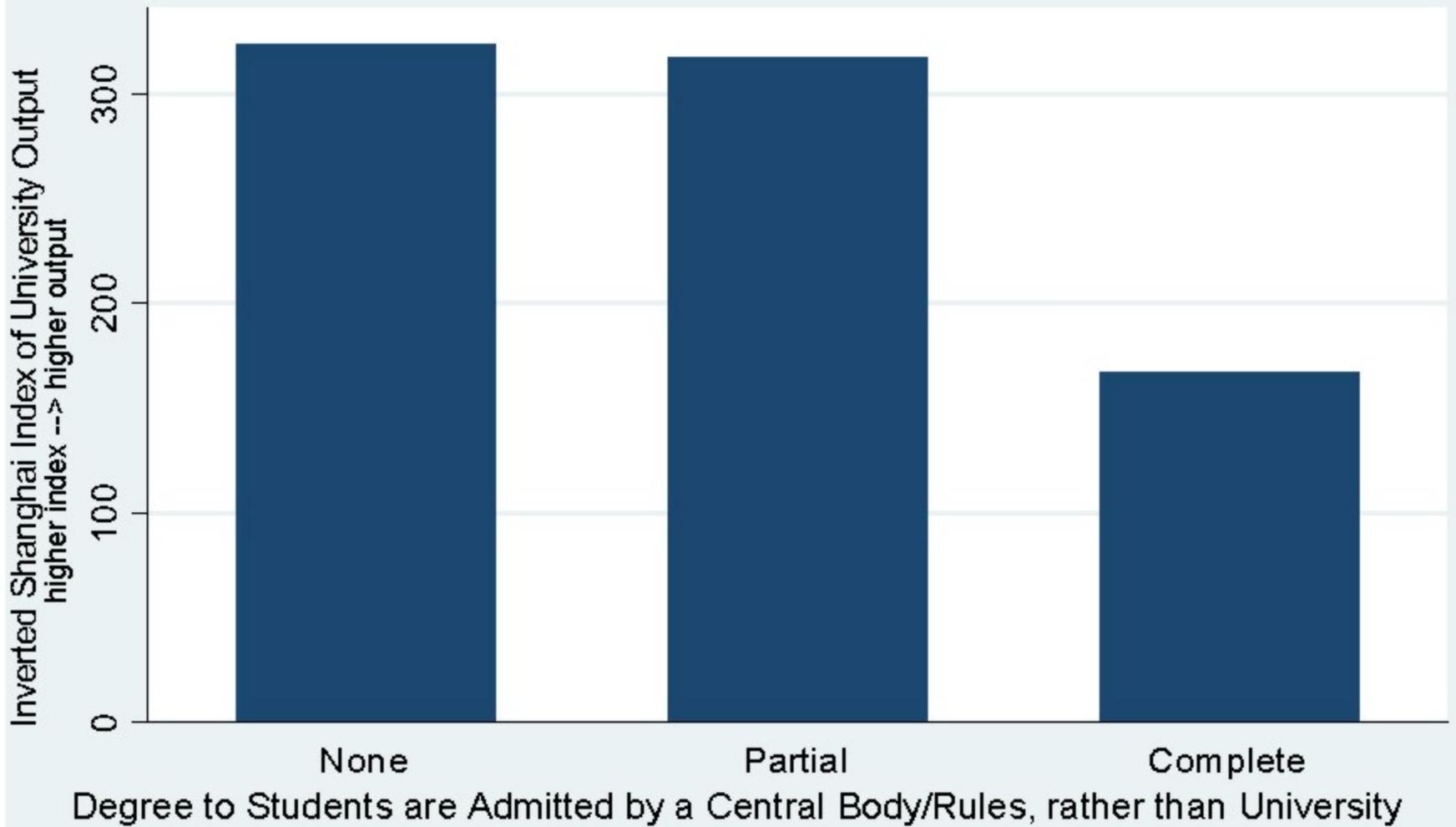
pvalue=0.002 for Difference between Complete and None

Correlation between University Output and Share of Budget from Gov't
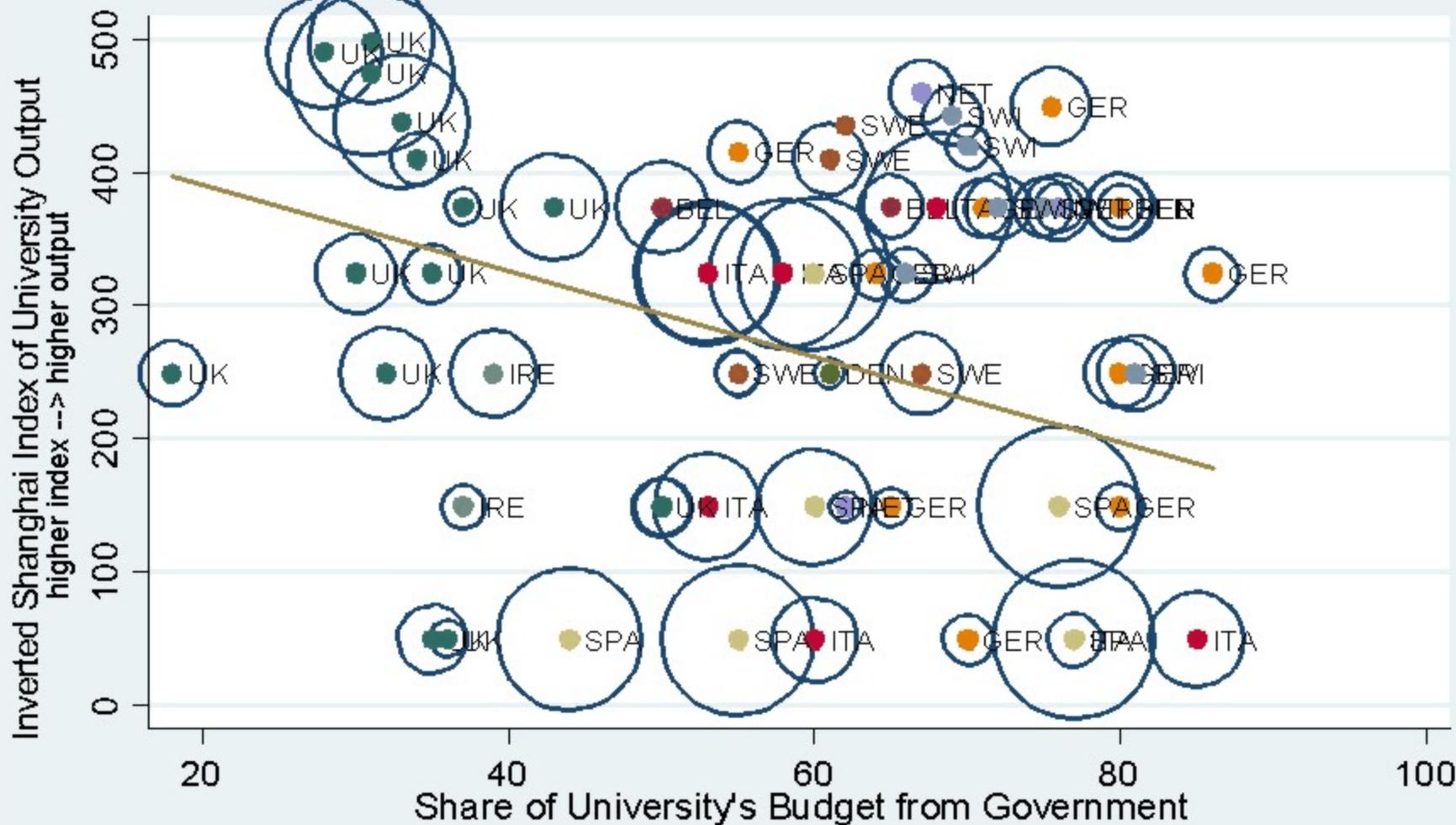
(coef=3.2,pvalue=0.004)

Correlation between University Output & Pct. of Budget from Competitive Grants

Inverted Shanghai Index of University Output
higher index --> higher output

Share of University's Budget from Competitive Research Grants

(coef=6.5,pvalue<0.001)

Correlation between University Output and Dependence on Competitive Grants
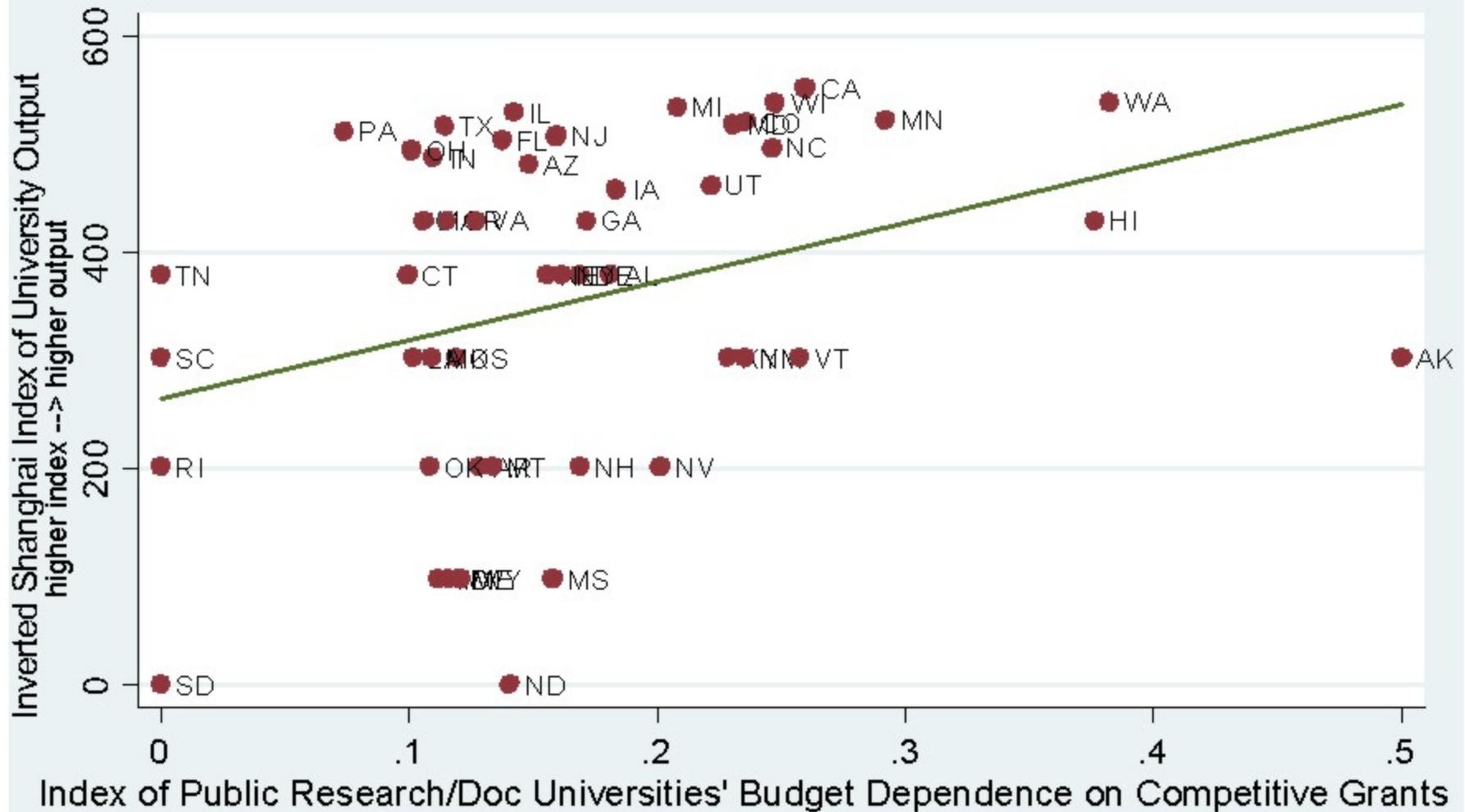
(coef=542.1,pvalue=0.021)

**Table 4: Correlation between budget and university governance, and research performance***

| Characteristics | Correlation coefficient |
|---|---|
| Budget per student | +0.61 |
| University governance: | |
|   Public status[+] | -0.35 |
|   Budget autonomy[§] | +0.16 |
|   Building autonomy[§] | -0.01 |
|   Hiring autonomy[§] | +0.20 |
|   Wage setting autonomy[§] | +0.27 |
| Faculty with in-house PhD | -0.08 |

* Measured by the (logarithm of the) Shanghai ranking
[+] 1 if public, 0 if private. [§] 1 if yes, 0 if no.

## Table 5: Effect of budget and autonomy on research performance*

| Variable | Effect on research performance |
|---|---|
| Size of the university | + |
| Age of the university | + |
| Budget per student | + |
| Budget autonomy | + |
| Interaction between budget and autonomy | + |

\* Measured by the (logarithm of the) Shanghai ranking

# Introducing competition

Federal Research & Development Budget for Merit-Based Grants from NSF, NIH & NASA*
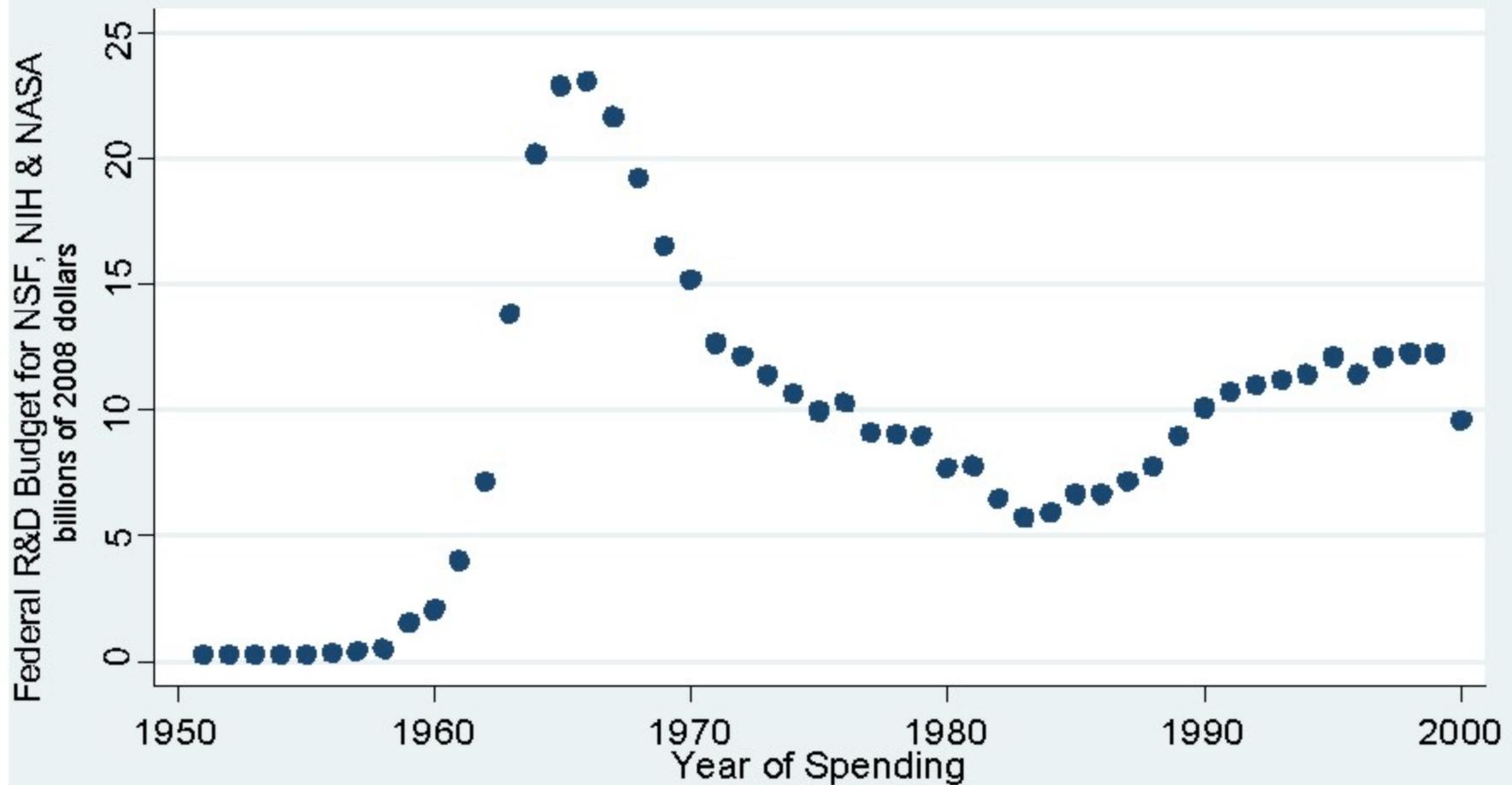
*NSF=National Science Foundation
NIH=National Institutes of Health
NASA=National Aeronautics & Space Admin

# Conclusion (1)

- La performance de recherche des universites repose a la fois sur un bon financement et une bonne gouvernance
- Plusieurs facons d'atteindre ces objectifs

# Conclusion (2):
# L'experience des Idex

- Trop rigides sur l'integration
  - On a trop insiste sur la fusion des universites existantes
  - On a voulu imposer une grille uniforme de gouvernance
- Permettre l'emergence d'universites federales

# Conclusion (3): Les agences de recherche

- L'ANR est un bon concept
  - Bottom-up
  - Evaluation par les pairs
- L'ANR souffre d'etre sous-financee
  - Taux de reussite de 10% seulement a cause du manque de moyens
  - Reduction de son budget de 800 a 520 millions (La DFG allemande dispose de 2 milliards d'euro)
  - Financer projets de long terme?