Lionel Robbins Memorial Lecture

Designing Policies for Growth

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CENTRE *for* ECONOMIC PERFORMANCE

On Growth Policy Design in Developed Economies

Lionel Robbins Lectures

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Introduction

- The French government is engaging in supposedly growth-enhancing reforms
- And its new growth agenda appears to be partly inspired by ideas we have been pushing over the past five years

Introduction (2)

- These lectures reflect my own mixed feelings vis-a-vis the reform process engaged in France...
- ...even though France is finally getting out of years of no reform

Introduction (3)

- Available tool box on growth policy making
  - Washington consensus recommendation, stabilize-privatize-liberalize
  - Hausman-Rodrik´s growth diagnostic approach
  - Easterly´s horse race between growth policy and (long-term) institutions, in which policy loses

Introduction (4)

- Spence Report which points to basic ingredients of growth
  - Education, infrastructure, political stability, competitive pressure,....
- ...but also recommends pragmatism
  - the pasta story

Introduction (5)

- My own take
  - Use new growth theories to suggest interactions between policies and technological or institutional variables
  - Use growth regressions to test these interactions and thereby suggest appropriate growth policies

Introduction (6)

- Thus recent report to French PM, built on cross-country panel regressions
- These in turn suggest that growth in advanced countries hinges heavily on
  - Product market competition
  - Labor market flexibility
  - Higher education investments

EPL

Variable	eq5
Leader MFP growth	
Gap to Leader	
EPL	
EPL, for highest tercile	-0.00015***
EPL, for middle tercile	0.00001
EPL, for lowest tercile	0.00003
MFP Gap, for highest tercile	-0.00547
Gap, for middle tercile	-0.00210
Gap, for lowest tercile	-0.01173***
EPL*Gap, for highest tercile	-0.00029*
EPL*Gap, for middle tercile	-0.00003
EPL*Gap, for lowest tercile	0.00014**

legend: * p<.1; ** p<.05; *** p<.01

Regulation indexes across countries

	France	Pays anglo-saxons	Pays scandinaves	Pays rhénans
Enseignement supérieur				
. Proportion, en 2004, de diplômés dans la population				
De 25 à 65 ans, en %	24	38	34	28
De 25 à 34 ans, en %	38	42	38	33
. Coût de l'enseignement supérieur en % du PIB, en 2003	1,3	2,8	2,0	1,5
Rigidités, 2005				
Marché des biens	1,7	1,0	1,2	1,4
Marché du travail	2,9	1,0	2,2	2,4
Interaction	4,9	1,0	2,6	3,4

Introduction (7)

- Missing from that list
  - A proper understanding of how to organize and fund higher education and research
  - A better understanding of the interplay between macroeconomic policy and growth
  - A good framework to think about environment and sustainable growth
  - A better understanding of the role of trust in the growth process and its interplay with formal institutions

Outline of the lectures

- Governance of higher education
- Growth and fiscal policy over the cycle
- Environment and directed technical change
- Regulations and culture

Introduction (8)

- Themes for discussion that should emerge from the lectures
  - Complementarity between policies and institutions
  - Several layers of growth policy design
  - More than one model of growing market economy

Part 1
Governance of higher education

- Are European universities properly governed?
- What are the key ingredient to good performance?

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)

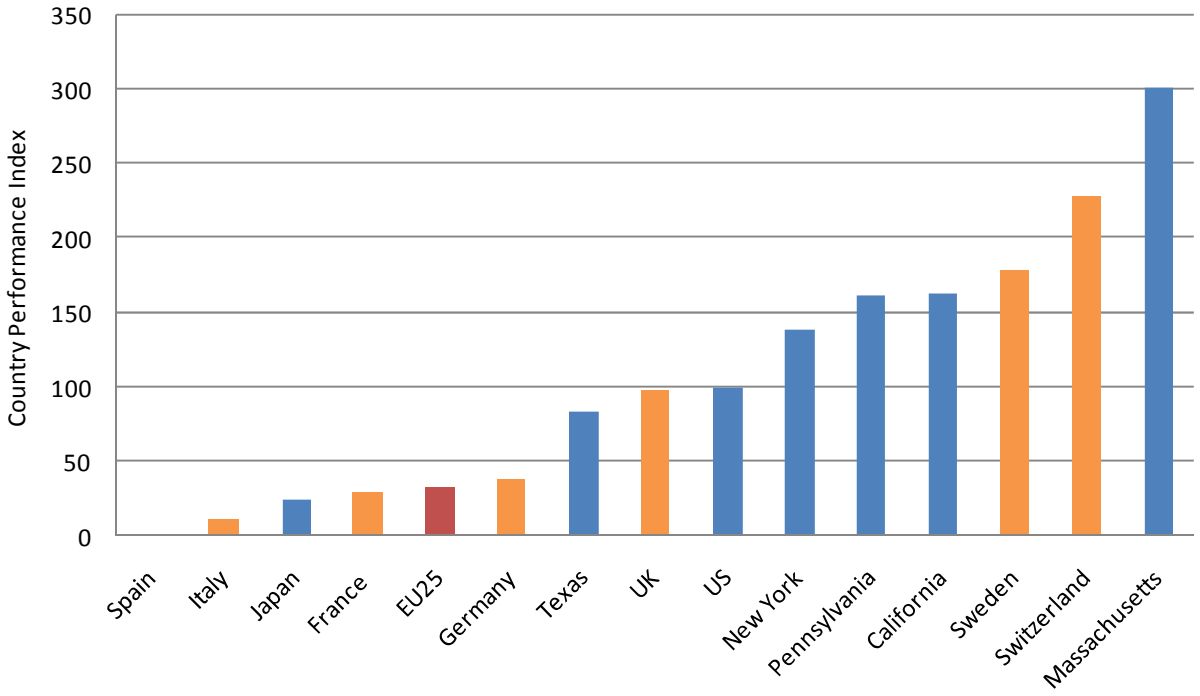


Table 1: Country performance index (US= 100)

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

Cross-section analysis

1. PERFORMANCE AND SPENDING PER STUDENT

Figure 2: Relationship between expenditure per student and country performance

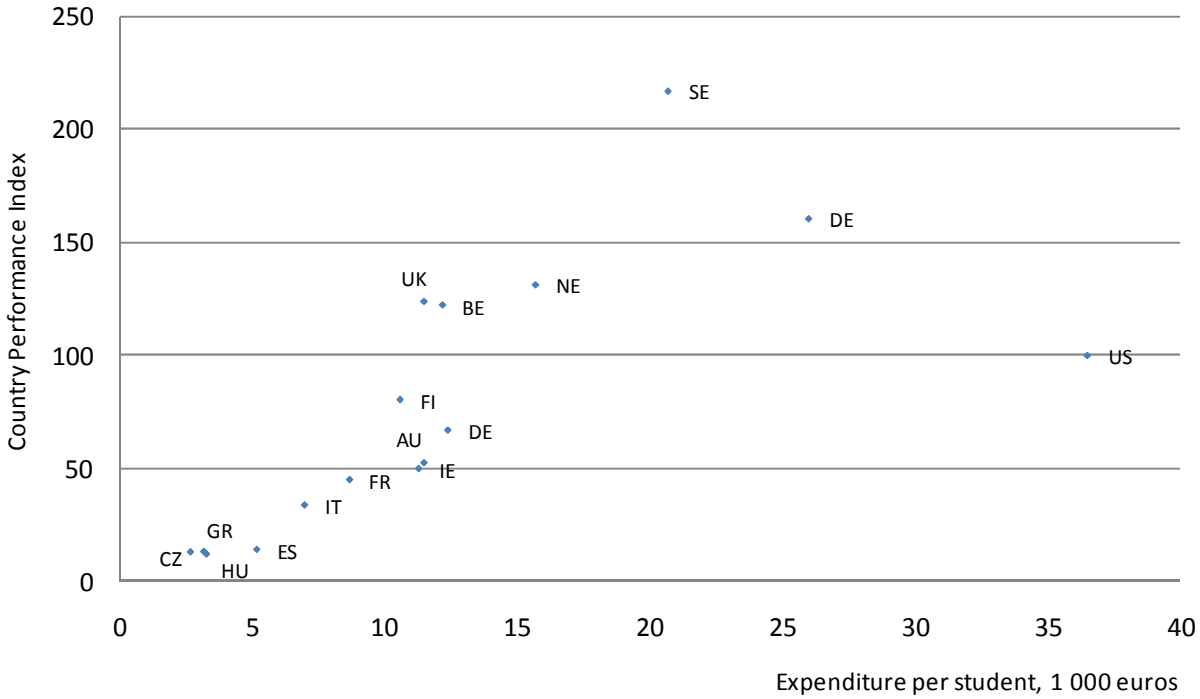


Table 2: Public and private expenditure on higher education, 2001

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?

2 (cont.). GOVERNANCE: AUTONOMY OF UNIVERSITIES ACROSS US STATES

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

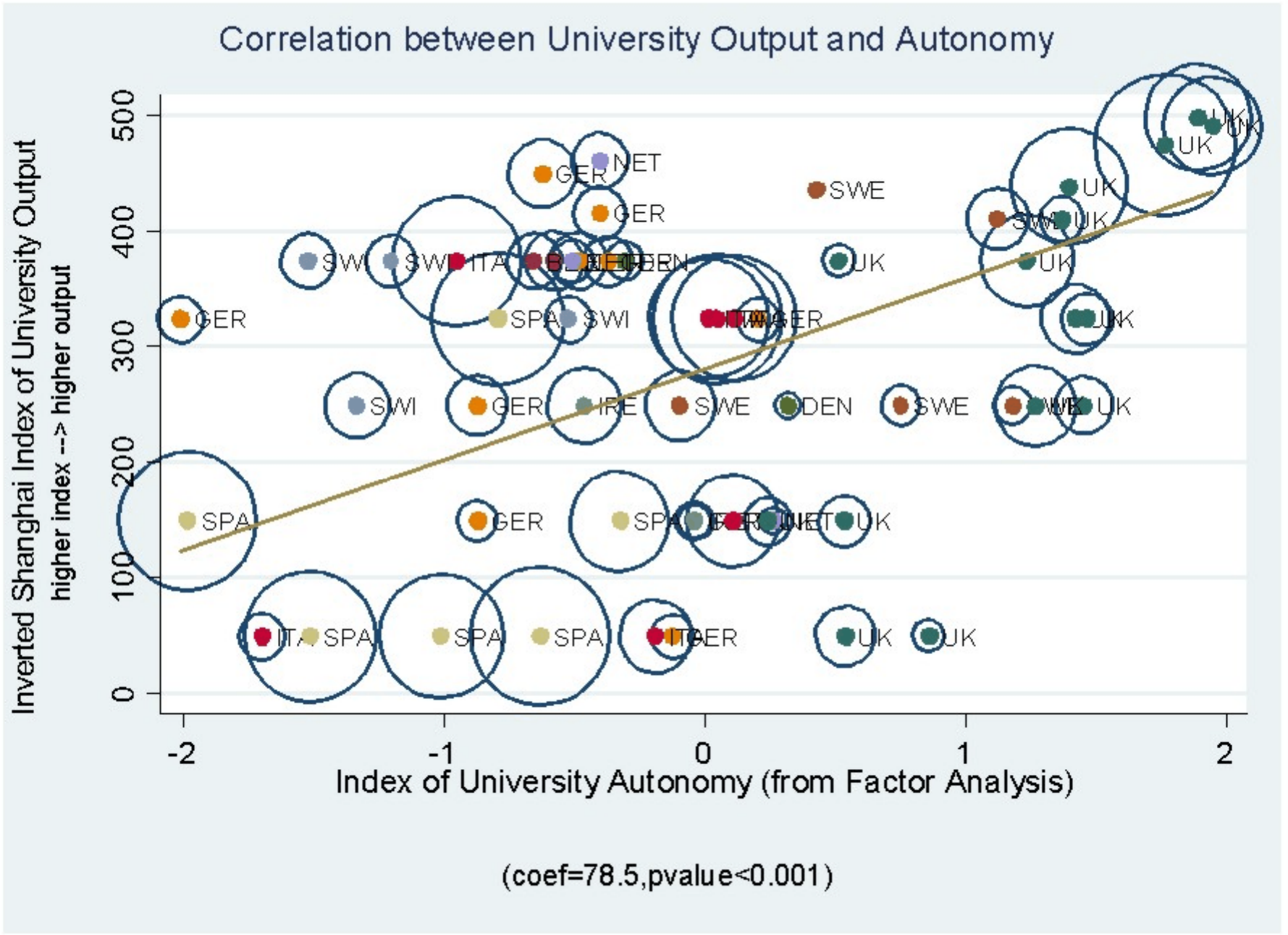
- Percentage of private universities in the State
- Autonomy characteristics among public universities: three 1950 variables
  - University freedom from centralized purchasing
  - Budget independence vis+a+vis the State government
  - Freedom to hire, fire, and set faculty wages

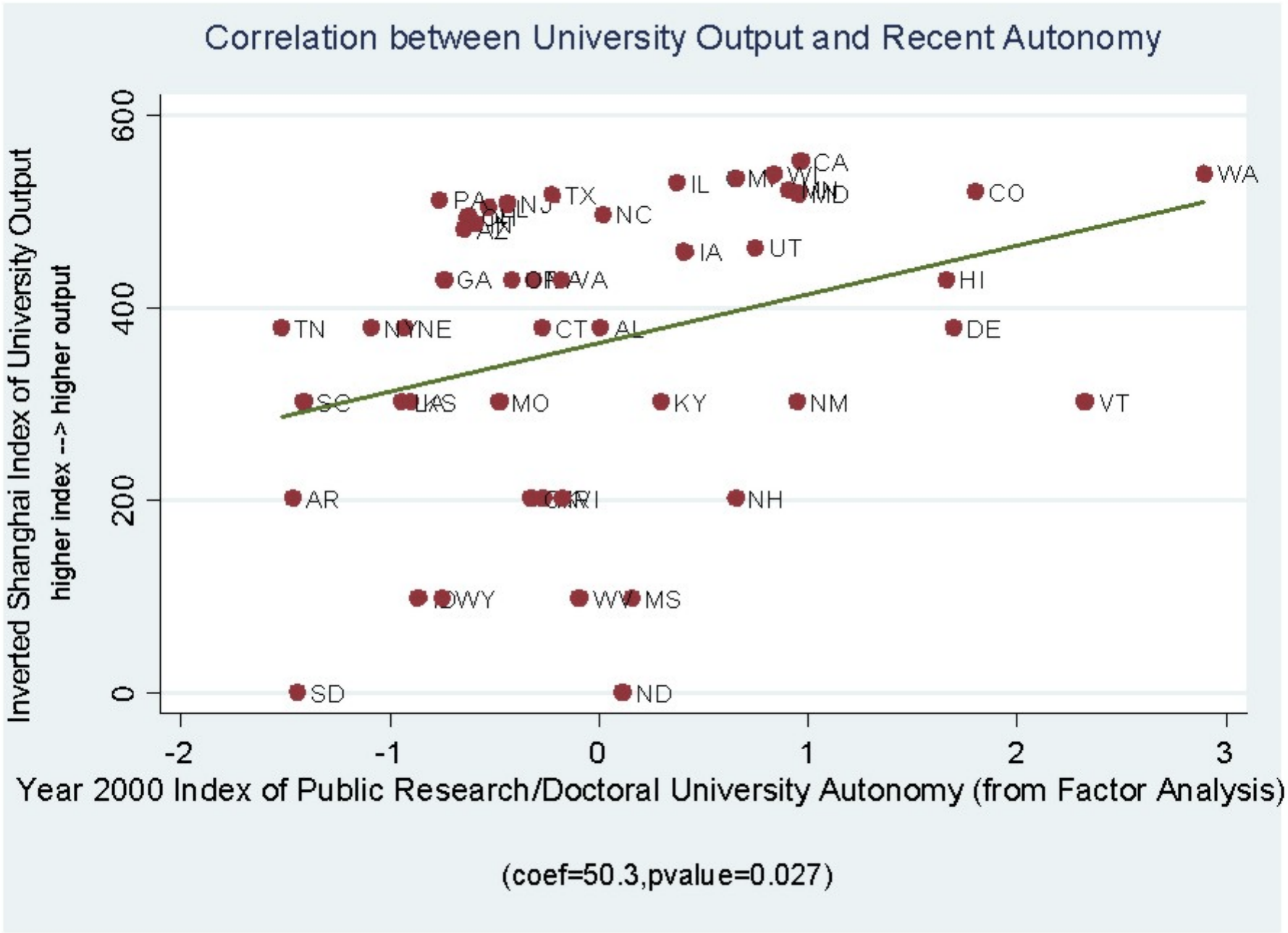
Table 3: Characteristics of the universities in the sample (country averages)

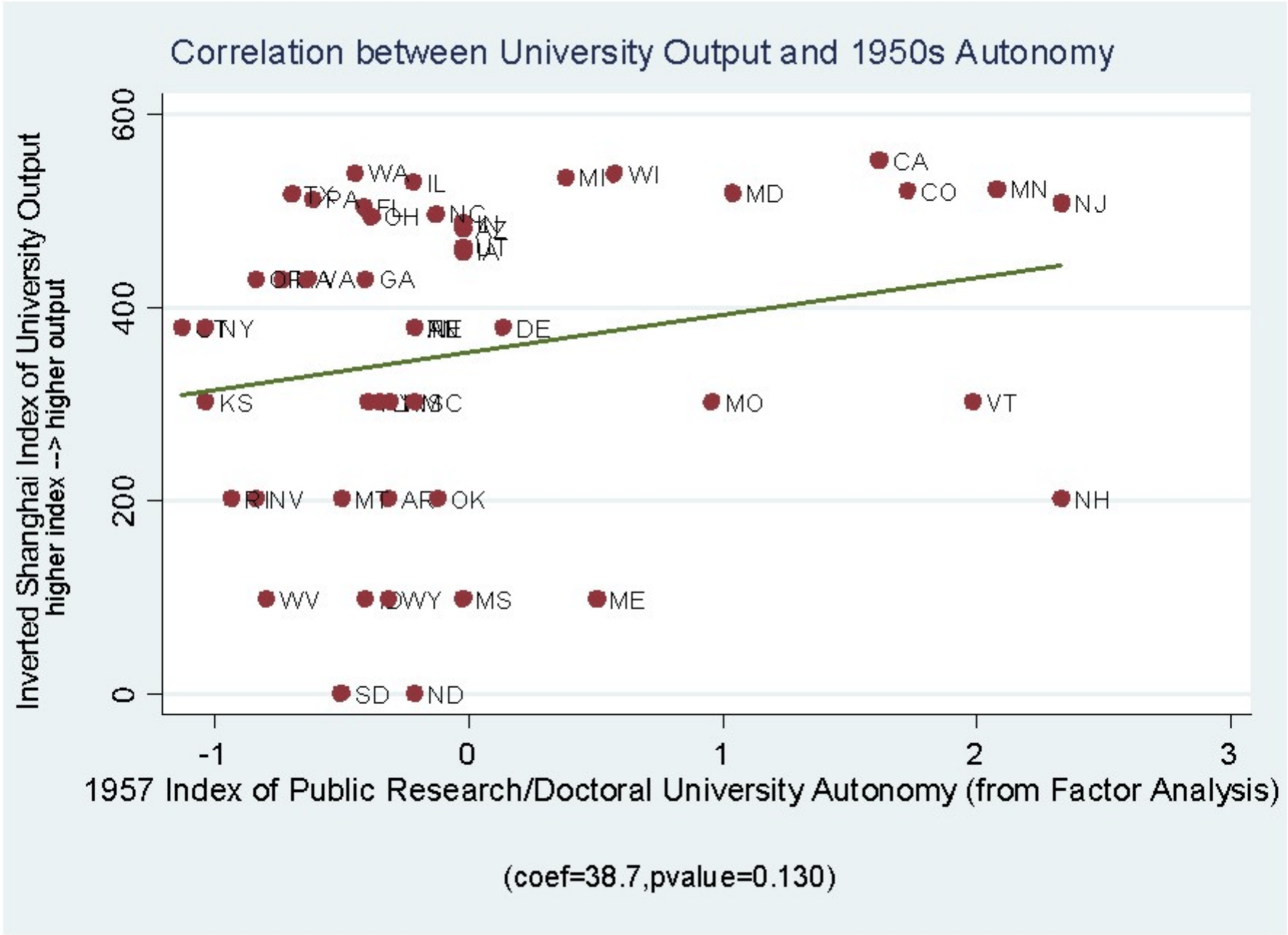
Country	Age (years)	Number of students (thousands)	Budget per student (1 000€)*	Public status*	Budget autonomy§	Building ownership§	Hiring autonomy§	Wage-setting autonomy§	Faculty with in-house PhD (%)
Belgium	284	21.7	11.3	0.5	0.4	1.0	1.0	0.0	63
Denmark	59	18.2	11.4	1.0	1.0	0.3	0.5	0.5	40
Germany	289	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**

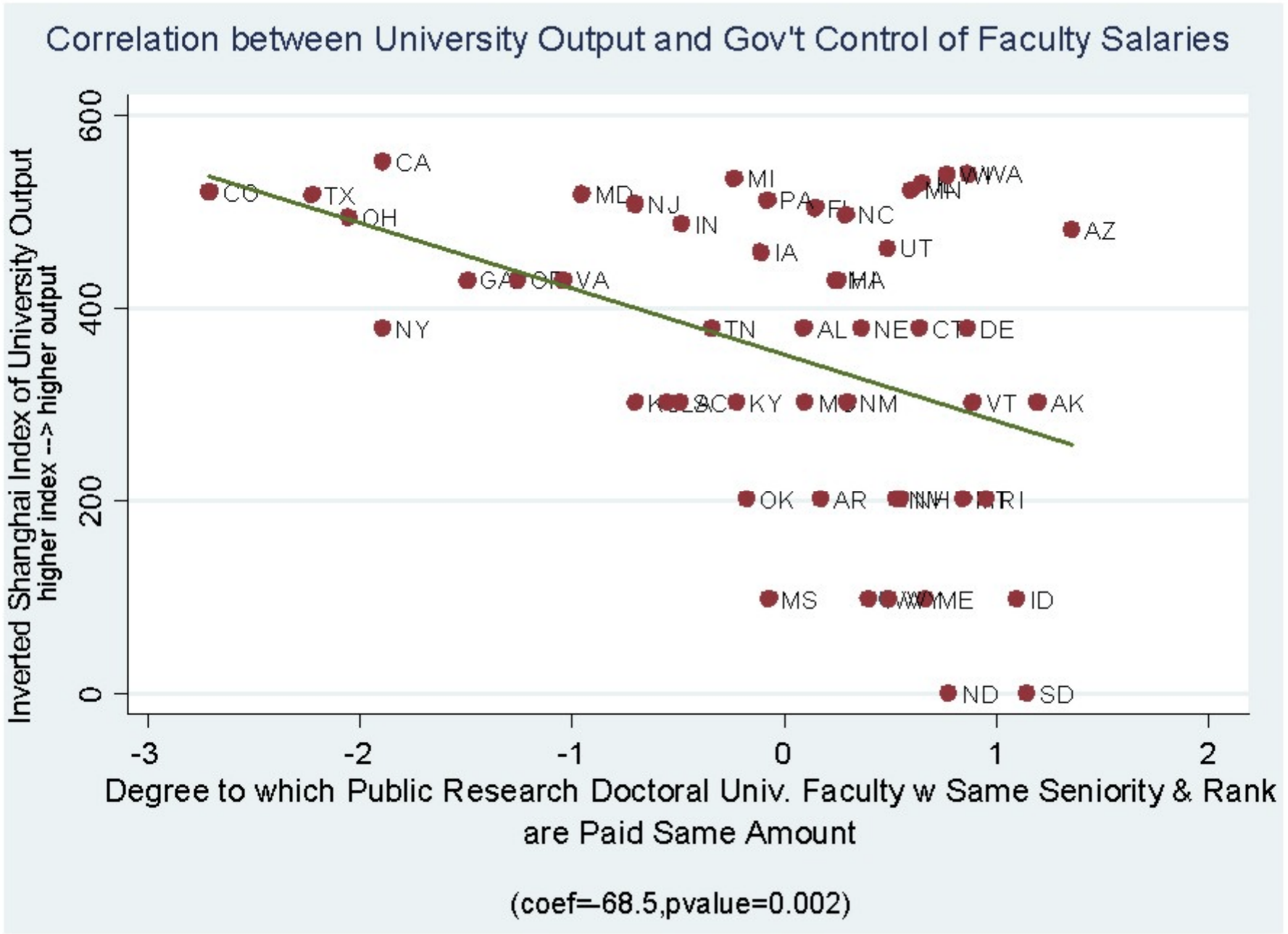
Source: Bruegel survey.

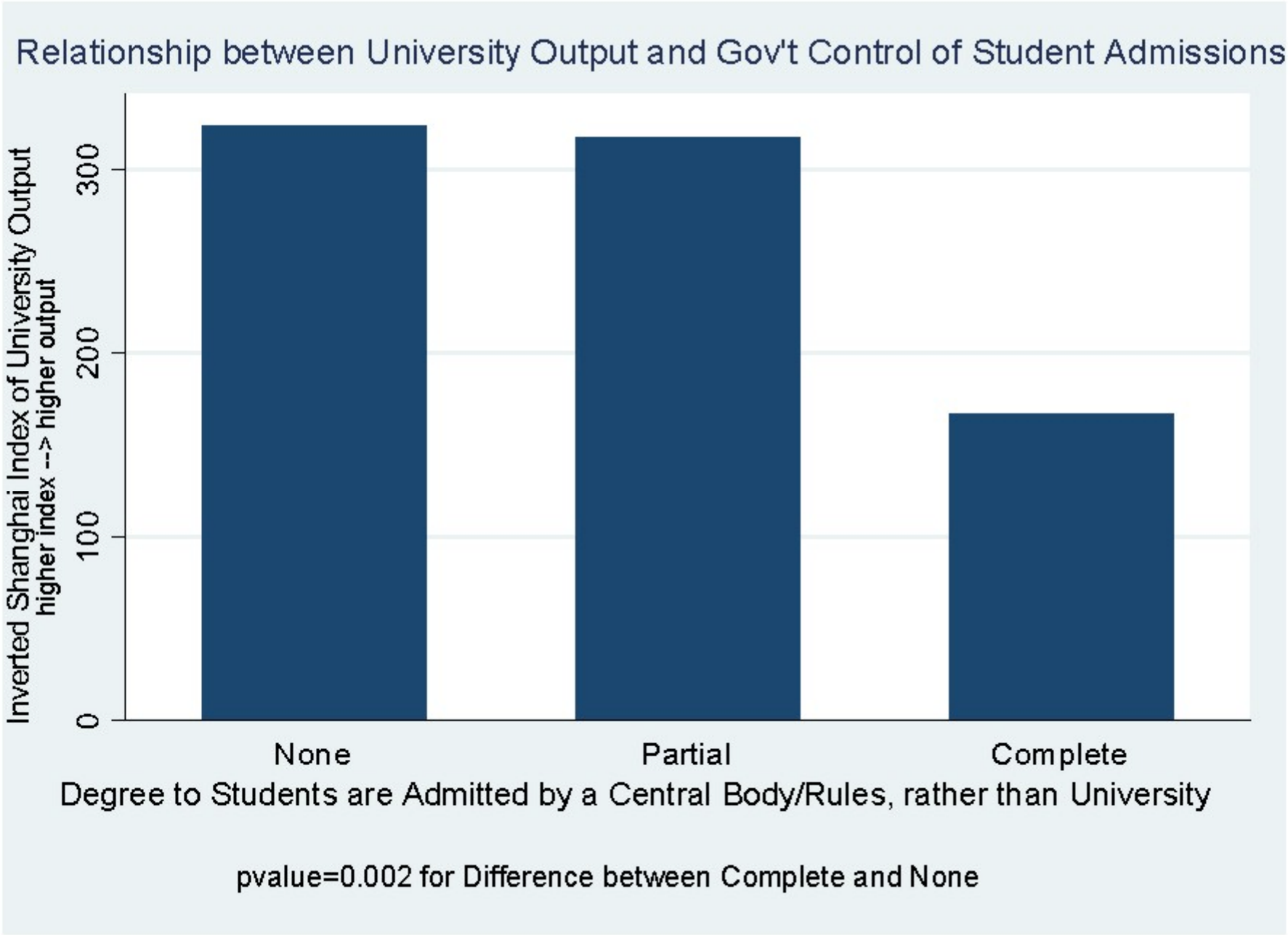
* PPP adjusted. * 1 if public, 0 if private. § 1 if yes, 0 if no.

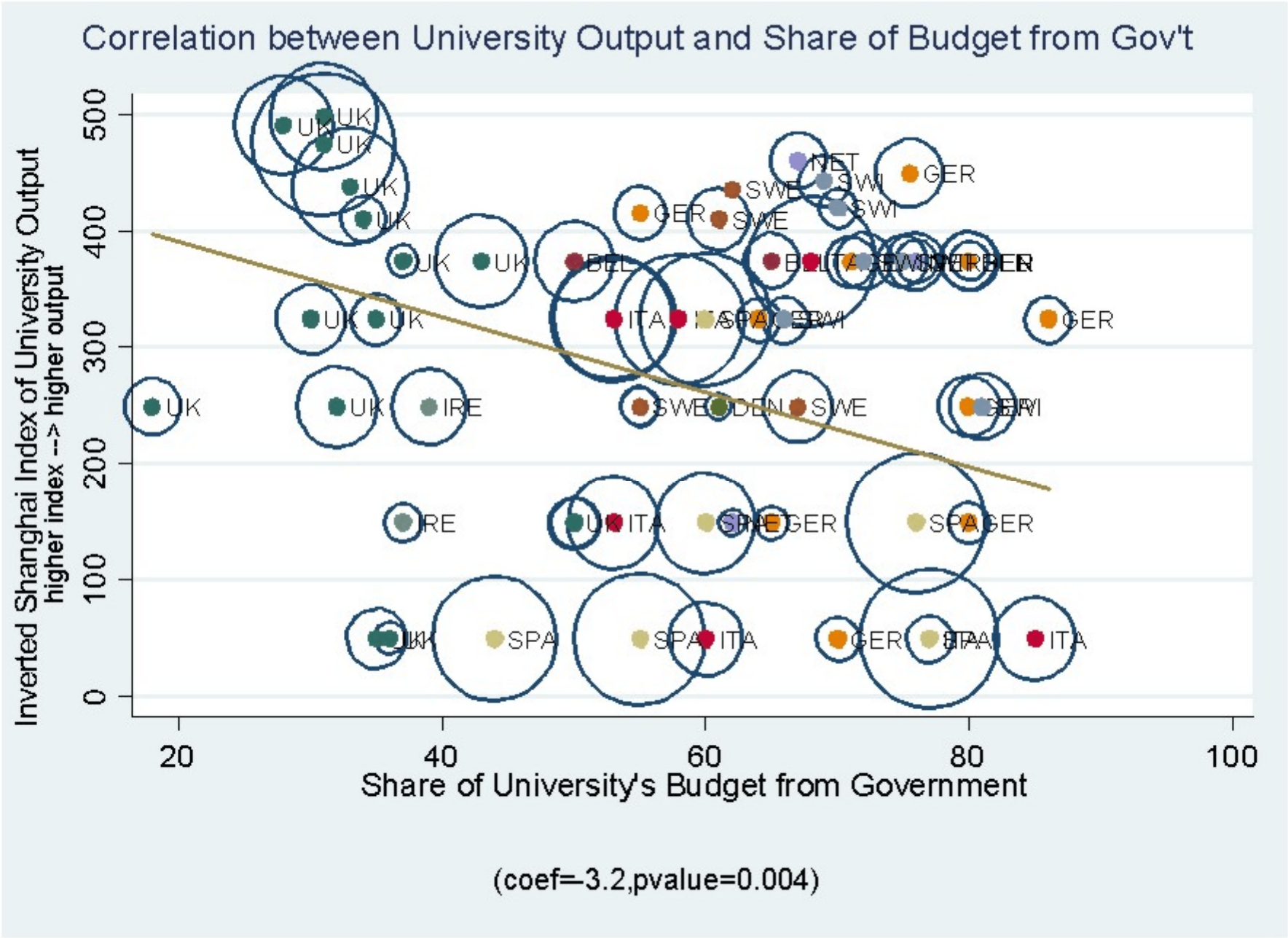

Correlation between University Output and Autonomy
Inverted Shanghai Index of University Output
higher index --> higher output
0
100
200
300
400
500
-2
-1
0
1
2
Index of University Autonomy (from Factor Analysis)
(coef=78.5,pvalue<0.001)
GER
NET
SWE
UK
SWI
ITA
SPA
DEN
IRE

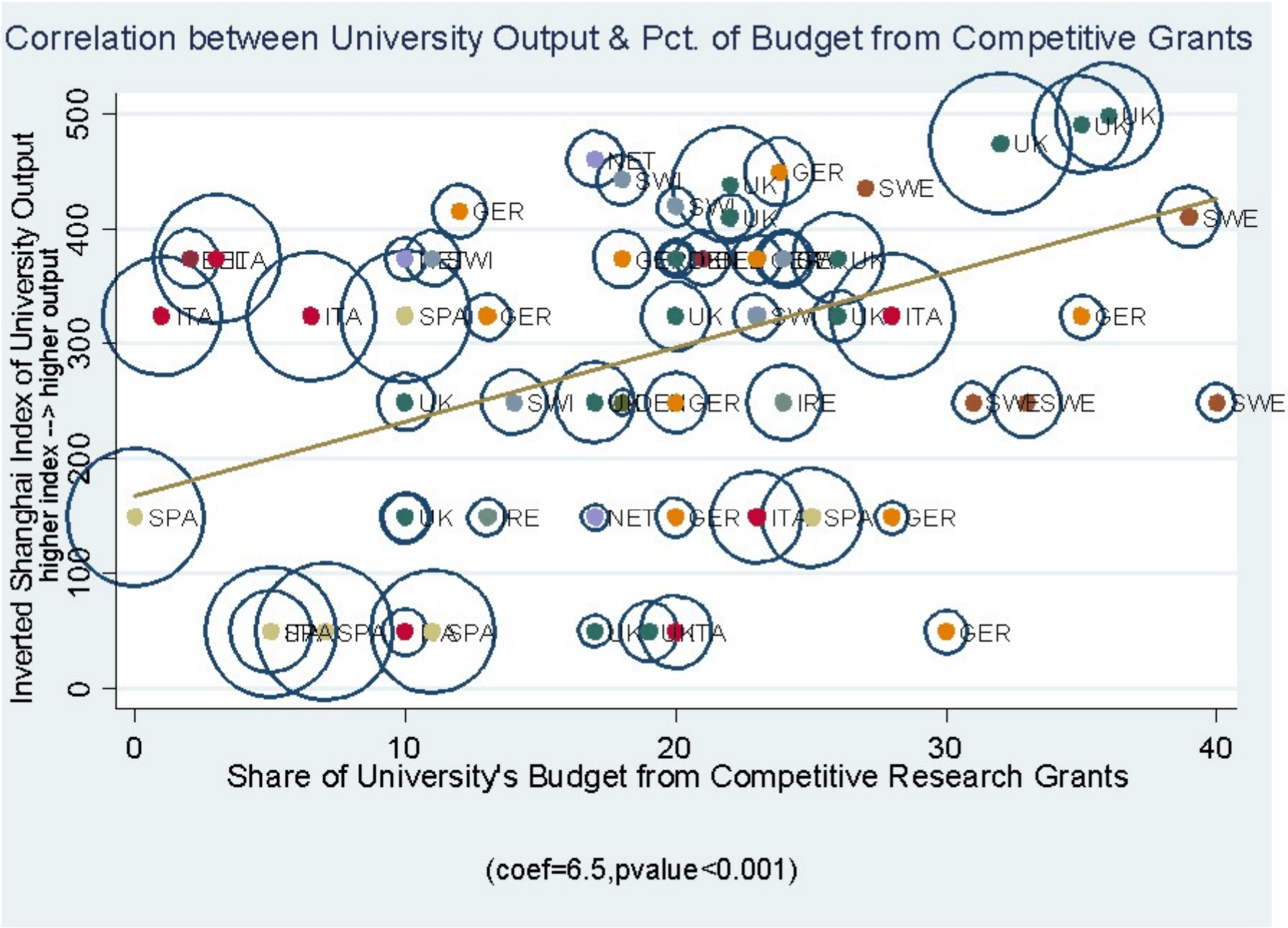

Correlation between University Output and Recent Autonomy
Inverted Shanghai Index of University Output
higher index --> higher output
600
400
200
0
-2
-1
0
1
2
3
Year 2000 Index of Public Research/Doctoral University Autonomy (from Factor Analysis)
(coef=50.3,pvalue=0.027)
CA
WA
IL
TX
NC
CO
IA
UT
GA
HI
TN
CT
AL
DE
MO
KY
NM
VT
AR
NH
MS
SD
ND


Correlation between University Output and 1950s Autonomy
Inverted Shanghai Index of University Output
higher index --> higher output
600
400
200
0
-1
0
1
2
3
1957 Index of Public Research/Doctoral University Autonomy (from Factor Analysis)
WA
IL
MI
WI
CA
CO
MN
NJ
MD
OH
NC
GA
DE
KS
MO
VT
NH
OK
WV
MS
ME
SD
ND
(coef=38.7,pvalue=0.130)


Correlation between University Output and Gov't Control of Faculty Salaries
Inverted Shanghai Index of University Output
higher index --> higher output
600
400
200
0
CA
CO
TX
OH
MD
NJ
IN
MI
PA
NC
AZ
IA
UT
GA
VA
NY
TN
AL
NE
CT
DE
KY
VT
AK
OK
AR
RI
MS
ME
ID
ND
SD
-3
-2
-1
0
1
2
Degree to which Public Research Doctoral Univ. Faculty w Same Seniority & Rank
are Paid Same Amount
(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
0
100
200
300
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
Inverted Shanghai Index of University Output
higher index --> higher output
0
100
200
300
400
500
20
40
60
80
100
Share of University's Budget from Government
(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
0
100
200
300
400
500
0
10
20
30
40
Share of University's Budget from Competitive Research Grants
(coef=6.5,pvalue<0.001)

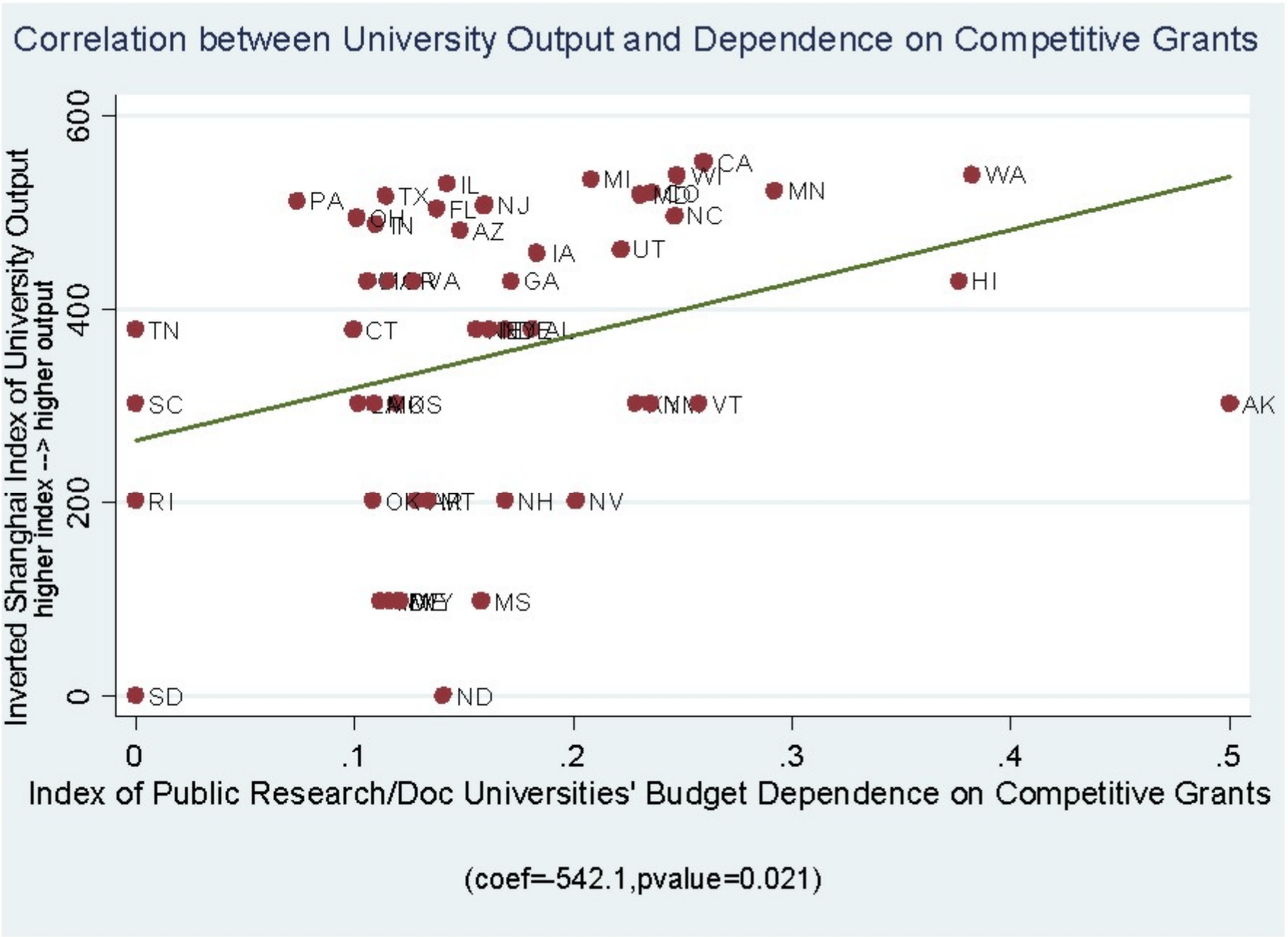

Correlation between University Output and Dependence on Competitive Grants
Inverted Shanghai Index of University Output
higher index --> higher output
600
400
200
0
CA
WA
MI
WI
MN
PA
TX
IL
NJ
FL
NC
AZ
IA
UT
GA
HI
TN
CT
SC
VT
AK
RI
NH
NV
MS
SD
ND
0
.1
.2
.3
.4
.5
Index of Public Research/Doc Universities' Budget 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

Cross-US state panel regressions

Why U.S. states?

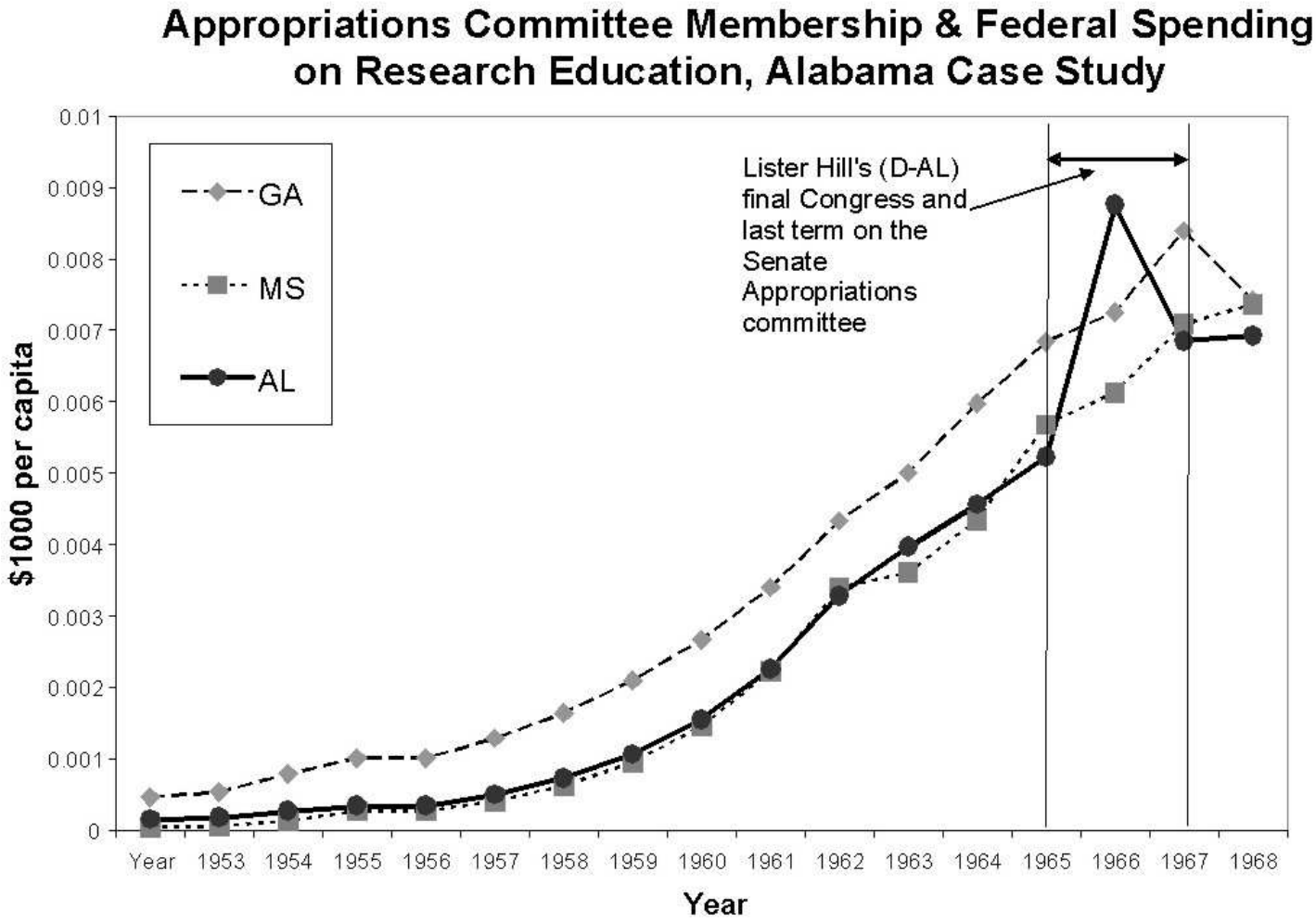
- Can analyze 26 cohorts in 48 states
- Strengths:
  - much more credible instruments available
  - data quality/comparability

Logic of our Instruments

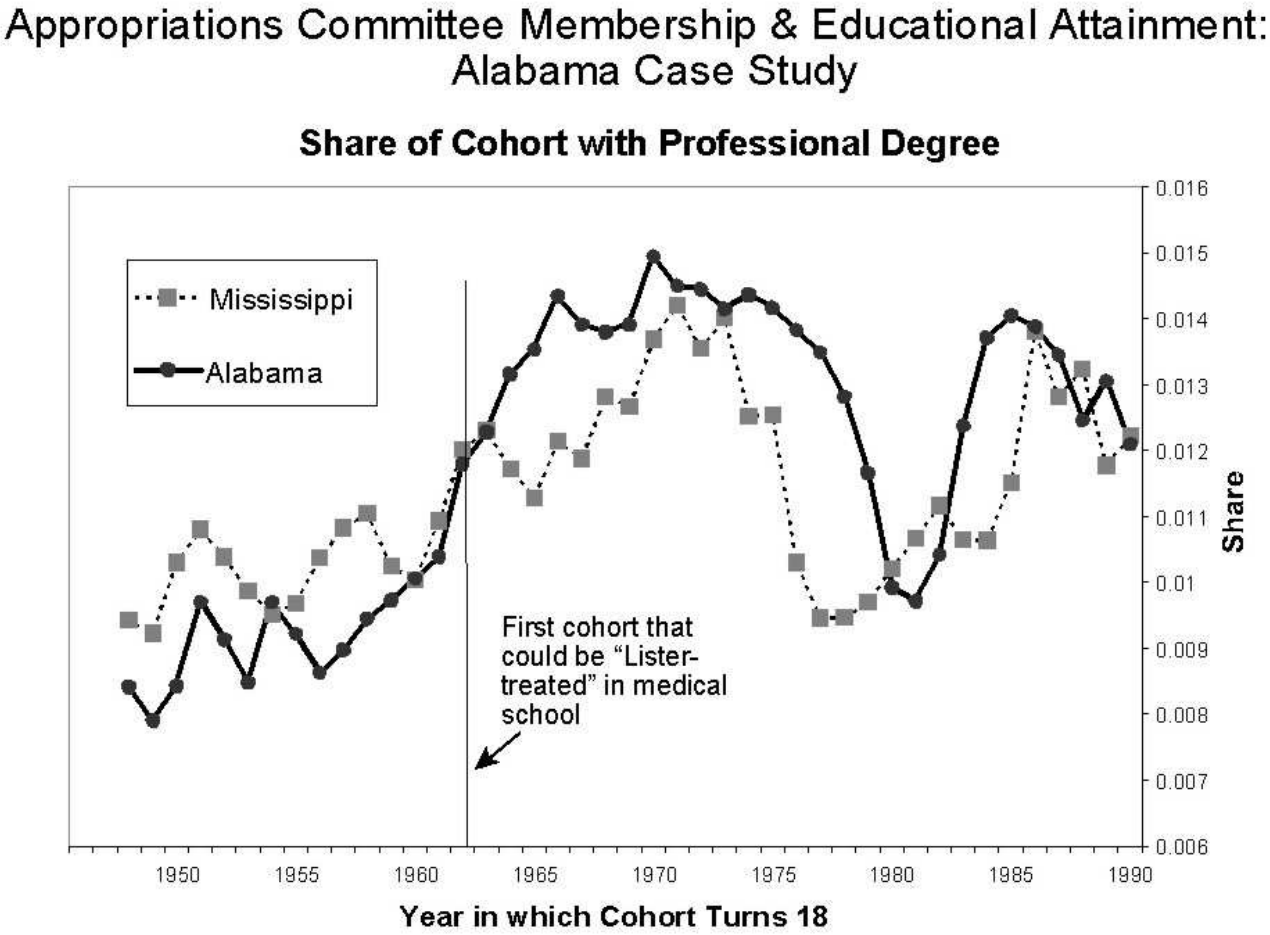
- Individual appointments to key appropriations committees generate state “mistakes” (arbitrary shocks) to education investments

- A vacancy on a appropriations committee happens to arise when the state’s representative is “first in line” based on seniority & geography
- Once on the committee, the legislator needs to pay back his constituents.
- His position only gives him ability to deliver in specific forms especially “earmarked” grants to universities and highway funds.
- He ends up making education investments based on the forms of pork he can deliver.

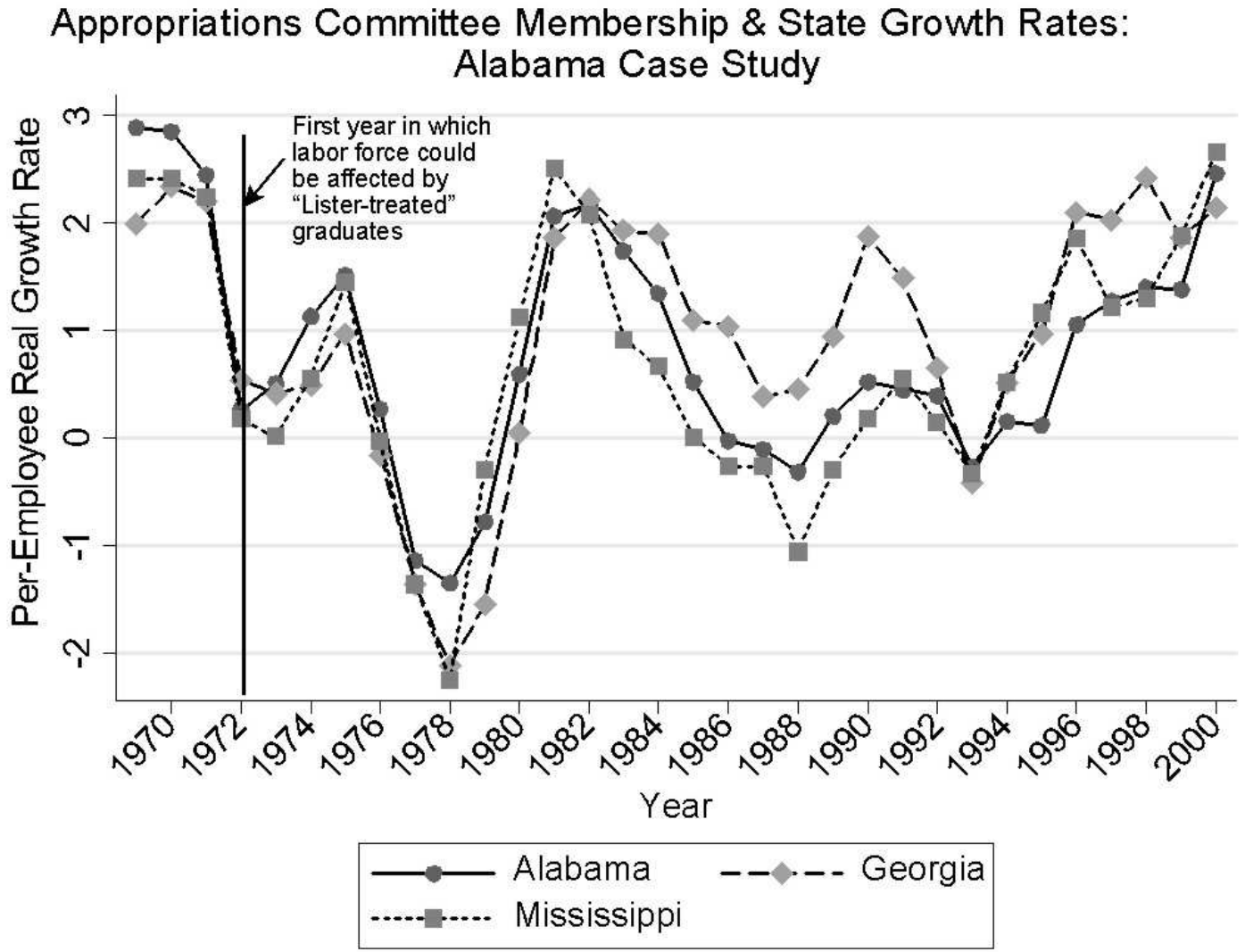
Case Study: Alabama (Lister Hill)



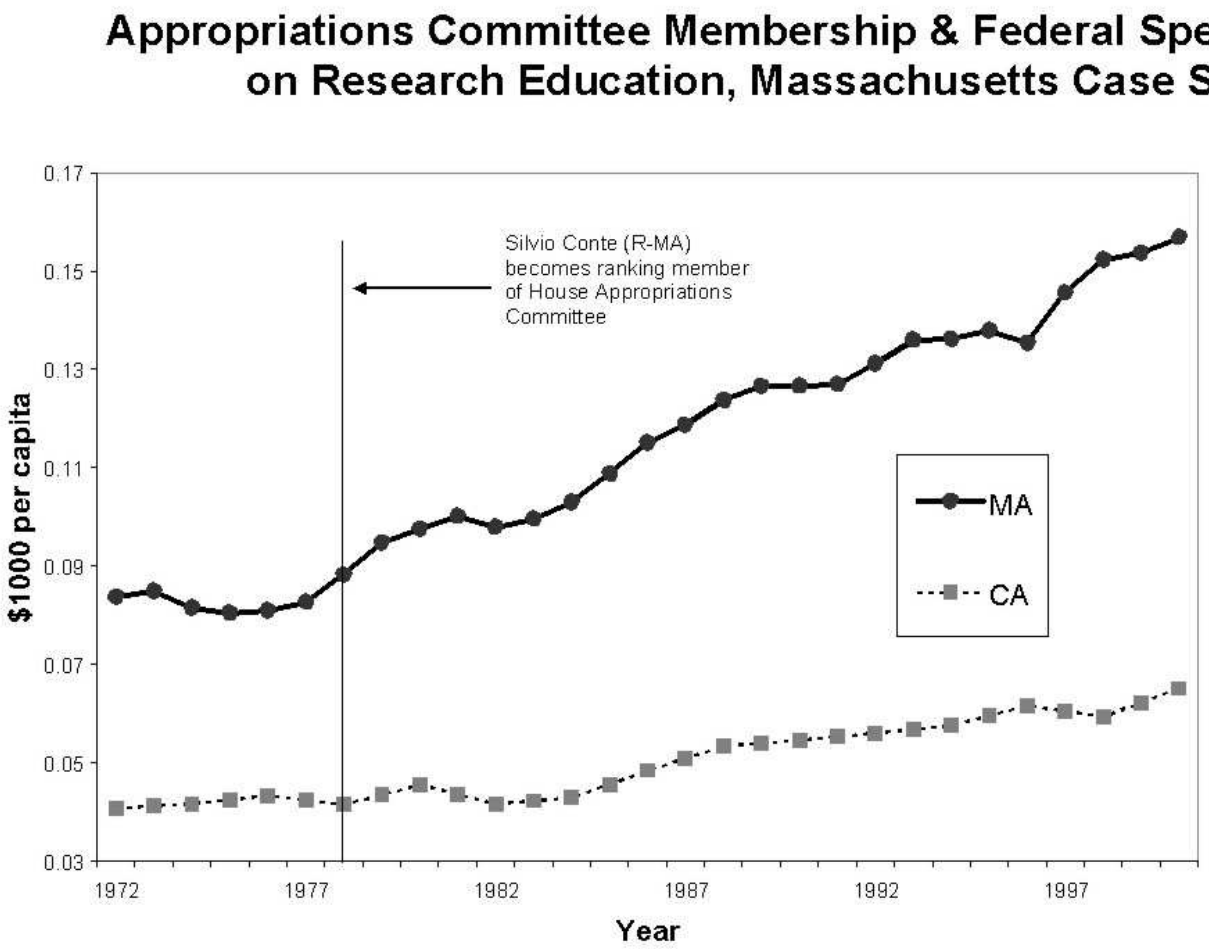
Case Study: Alabama (Lister Hill)



Case Study: Alabama (Lister Hill)



Case Study: Massachusetts (Conte)



Data (very lightly)

- the 1947 to 1972 birth cohorts, 48 states
- observations are at the cohort-by-state level (a “cell”)
- investment = sum of all education spending associated with a cell’s educational opportunities
  - e.g. how much spent per cohort member on four-year type education while cohort was age 18-21?
- LHS variable = number of patents in state j when cohort c is aged 26 to 35
- state fixed effects
- numerous controls for contemporary partisan politics
- “states’ mistakes” instruments are lagged two years to give political decisions a chance to hit schools’ budgets
- proximity to frontier = labor productivity/frontier labor productivity (instrumented with initial proximity based on patents to get rid of correlated measurement error)

The estimating equations

An Exemplary First-Stage Equation:

Expenditure on research universities per person in cohort (c,j) = α_0 +

$\alpha_1 \cdot$ (Most senior in Census region x party)(c,j) * (vacancy in region x party) (c,j) +

$\alpha_2 \cdot$ (Top seniority decile in Census region x party) (c,j) * (vacancy in region x party) (c,j)+ Political variables (%vote by party in last election etc.) $\cdot \boldsymbol{\alpha}_3$ +

$\boldsymbol{\gamma}^{state} + \boldsymbol{\gamma}^{cohort} + time \cdot \mathbf{I}^{region} \boldsymbol{\delta} + \varepsilon$

The Second-Stage Equation:

Patenting (c,j) = β0 +

$\beta_1 \cdot$ Expenditure on research universities per person in cohort (c,j)+

$\beta_2 \cdot$ Expenditure on 4-year colleges per person in cohort (c,j)+

$\beta_3 \cdot$ Expenditure on 2-year colleges per person in cohort (c,j) +

+ interaction terms between expenditures, autonomy and competition (c,j)+

$\boldsymbol{\gamma}^{state} + \boldsymbol{\gamma}^{cohort} + time \cdot \mathbf{I}^{region} \boldsymbol{\delta} + \varepsilon$

First-Stage for Research-Type Spending

	Exp on Research Univ per Person in Cohort
Excluded instruments:	
House: (Most senior in Census region x party) * (vacancy in region x party)	**135.2** **(42.1)**
House: (Top senority decile in Census region x party) * (vacancy in Census region x party)	**103.1** **(31.8)**
Senate: (Most senior in Census region x party) * (vacancy in region x party)	**180.2** **(77.3)**
Senate: (Top senority decile in Census region x party) * (vacancy in Census region x party)	**93.1** **(46.7)**
Other covariates listed on previous slide	**Yes**
State & Cohort indicator variables	**Yes**
Census division linear time trends	**Yes**
F-statistic, excluded instruments	**9.08**

First-Stage for 4-Year College Spending

	Exp on 4-Year Colleges per Person in Cohort
Excluded instruments:	
State's lower chamber: (Most senior has a 4-year college in constituency) * (committee vacancy)	**63.5** **(22.8)**
State's lower chamber: (% among top seniority decide w/ 4-year college in constituency) * (committee vacancy)	**8.2** **(2.9)**
State's upper chamber: (Most senior has a 4-year college in constituency) * (committee vacancy)	**81.9** **(29.9)**
State's upper chamber: (% among top senority decile w/ 4-year college in constituency) * (committee vacancy)	**9.4** **(4.6)**
Political covariates	**Yes**
State & Cohort indicator variables	**Yes**
Census division linear time trends	**Yes**
F-statistic, excluded instruments	**11.14**

Measures of University Autonomy

- Percent Private
  - Private research universities are assumed to be more autonomous than any public research university since they would score high on every measure of financial and academic autonomy

Measures of University Autonomy (cont.)

- A public (state) university is maximally autonomous if...
  - Budget independence vis-a-vis the state
  - Freedom from centralized purchasing
  - Freedom to hire, fire, and set faculty wages

Measures of University Autonomy, Summing Up

- We have 2 key measures of autonomy of research universities
  - Percent of research universities that are private
    - Normalized to have mean zero and a standard deviation of 1
  - Index of autonomy for public research universities
    - Factor analysis is used to create a single index that gives weight to each of the factors listed on the previous slide
    - Index is normalized to have mean zero and a standard deviation of 1
- We record these measures as early as possible (1965 approx.) to avoid endogeneity
    - They don't change a great deal over time within a state anyway

Table 1
The Effect of a State's Education Investment on Its Patents[a],
the Effect Allowed to Vary with the Autonomy of and Competition Facing its Universities
(for interpretation of coefficients, see Figures 12-14)

Dependent Variable: Patents per Person in the State
(higher education investment variables are instrumented, see notes)

	coeff.	std.err
Expenditure (thousands) on research universities per person in the cohort[b]	**-0.173**	(0.102)
Expenditure (thousands) on 4-year colleges per person in cohort[b]	**-0.334**	(0.051)
Expenditure (thousands) on 2-year colleges per person in cohort[b]	**0.557**	(0.123)
Expenditure (thousands) on K-12 public schools per person in the cohort	**0.194**	(0.044)
Autonomy Index[c] ☝Exp. (thousands) on research univ per person in cohort	**0.029**	(0.008)
Autonomy Index[c] ☝Exp. (thousands) on 4-year colleges per person in cohort	**0.009**	(0.002)
Autonomy Index[c] ☝Exp. (thousands) on 2-year colleges per person in cohort	**-0.013**	(0.004)
%Universities Private[d] ☝Exp. (thousands) on research univ per person in cohort	**0.110**	(0.038)
%Universities Private[d] ☝Exp. (thousands) on 4-year colleges per person in cohort	**0.141**	(0.011)
%Universities Private[d] ☝Exp. (thousands) on 2-year colleges per person in cohort	**-0.216**	(0.031)
Proximity to the Frontier[e] ☝Exp. (thousands) on research univ per person in cohort	0.242	(0.157)
Proximity to the Frontier[e] ☝Exp. (thousands) on 4-year colleges per person in cohort	**0.504**	(0.078)
Proximity to the Frontier[e] ☝Exp. (thousands) on 2-year colleges per person in cohort	**-0.796**	(0.178)
Proximity to the Frontier[e] ☝Exp. (thousands) on K-12 public schools per person in cohort	**-0.310**	(0.070)
contemporaneous political variables[f]	yes	
state indicator variables, cohort indicator variables (equivalent to year indicator variables)	yes	
state-specific linear time trends	yes	

Introducing competition

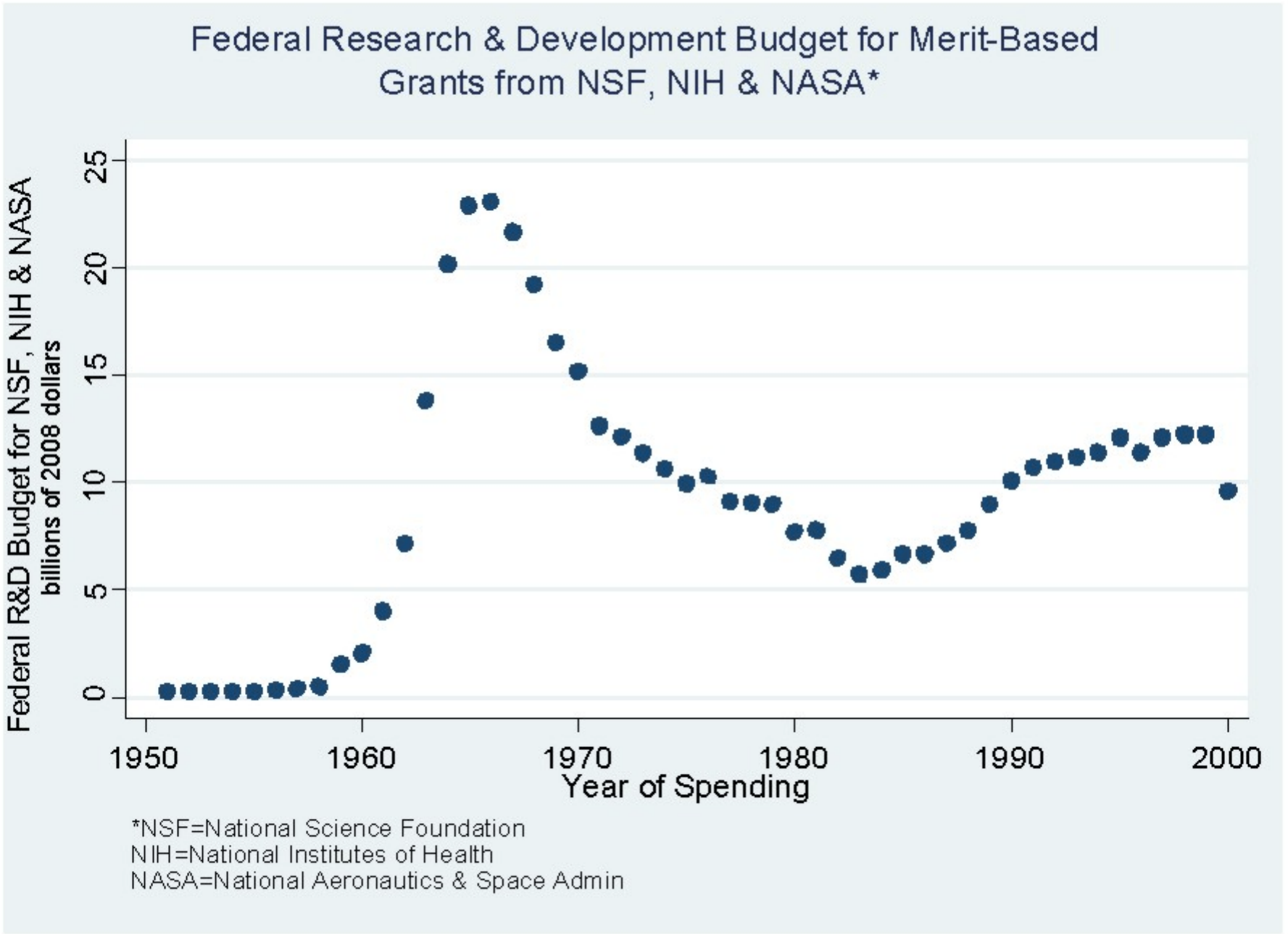

Federal Research & Development Budget for Merit-Based Grants from NSF, NIH & NASA*
Federal R&D Budget for NSF, NIH & NASA
billions of 2008 dollars
0
5
10
15
20
25
1950
1960
1970
1980
1990
2000
Year of Spending
*NSF=National Science Foundation
NIH=National Institutes of Health
NASA=National Aeronautics & Space Admin

Table 2
The Effect of a State's Education Investment on Its Patents[a],
the Effect Allowed to Vary with the Autonomy of and Competition Facing its Universities
(for interpretation of coefficients, see Figure 16)

Dependent Variable: Patents per Person in the State
(higher education investment variables are instrumented, see notes)

	coeff.	std.err.
Expenditure (thousands) on research universities per person in the cohort[b]	**-0.208**	(0.072)
Expenditure (thousands) on 4-year colleges per person in cohort[b]	**-0.151**	(0.026)
Expenditure (thousands) on 2-year colleges per person in cohort[b]	**0.348**	(0.069)
Expenditure (thousands) on K-12 public schools per person in the cohort	0.014	(0.030)
Autonomy Index[c] ✋Exp. (thousands) on research univ per person in cohort	**-0.042**	(0.015)
Autonomy Index[c] ✋Exp. (thousands) on research univ per person in cohort	**0.006**	(0.002)
Autonomy Index[c] ✋Exp. (thousands) on research univ per person in cohort	**-0.007**	(0.004)
%Universities Private[d] ✋Exp. (thousands) on research univ per person in cohort	**-0.232**	(0.046)
%Universities Private[d] ✋Exp. (thousands) on 4-year colleges per person in cohort	0.017	(0.011)
%Universities Private[d] ✋Exp. (thousands) on 2-year colleges per person in cohort	**-0.123**	(0.018)
Proximity to the Frontier[e] ✋Exp. (thousands) on research univ per person in cohort	**0.265**	(0.109)
Proximity to the Frontier[e] ✋Exp. (thousands) on 4-year colleges per person in cohort	**0.252**	(0.037)
Proximity to the Frontier[e] ✋Exp. (thousands) on 2-year colleges per person in cohort	**-0.481**	(0.095)
Proximity to the Frontier[e] ✋Exp. (thousands) on K-12 public schools per person in cohort	-0.030	(0.045)
Competitive Research Grants (billions)[f] ✋Autonomy Index[c] ✋Exp. (thousands) on research univ per person in cohort[b]	**0.004**	(0.001)
Competitive Research Grants (billions)[f] ✋%Universities Private[d] ✋Exp. (thousands) on research univ per person in cohort[b]	**0.029**	(0.003)
contemporaneous political variables[g]	yes	
state indicator variables, cohort indicator variables (equivalent to year indicator variables)	yes	
state-specific linear time trends	yes	

Thus….

- Growth in advanced countries or regions benefit more from more performing universities
- Performance hinges on a combination between finance, autonomy, and competition for grants
- More than one model for achieving this combination

Policy 1: Funding

- Increase public finding by 1% of GDP
- Fees backed by loans+income-contingent repayment schemes
- Endowments
- EU funding of graduate schools

Policy 2: Autonomy

- Set up academic boards to decide university policy
- Avoid self-governance with entirely internal selection of university presidents

Policy 3: Competition and mobility

- Competition for students: introduce “Standardized European Test”
- Competition for faculty: avoid endogamy, favor portable pension schemes
- Competition for research funds: ERC,…
- Graduate fellowships to finance students entering master programs