Assessing and Explaining Local Government Efficiency in Natural Resource-Rich Countries

The case of Chilean Municipalities

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Motivation

Evidence on the **Trade-off** between **efficiency and equity** is not conclusive…

On the one hand …

> Pursuing **equality can reduce efficiency** (see Okun 1975; Browning & Johnson 1984; Andersen & Maibom 2016)

On the other hand …

> Equality **could also be an important ingredient in promoting and sustaining growth** (see Berg & Ostry 2011; kumhof, Rancière & Winant 2015)

But this **trade-off** is commonly used as an argument against reforms that could help reduce inequalities

Research so far

Local Government Efficiency (LGE) studies have been focus on:

Measuring LGE

- Single service vs overall efficiency
- Parametric (SFA) vs **non-parametric (DEA)** techniques
- Input oriented vs output oriented
- Selection of inputs and outputs

Explaining differences in LGE

- Discretionary factors (inputs and outputs)
- **Non-discretionary (contextual) factors**: Socio-economic, demographic, geographic, political, institutional, etc.

Research Question

What role does income inequality play in explaining differences in municipal efficiency?

Research Hypotheses

Income inequality has a negative effect on municipal efficiency

How could income inequality influence LGE?

Contextual factors, in general, could…

- influence competition among municipalities
- affect the degree of monitoring over local authorities
- affect the degree of incentives to perform efficiently (Paradox of Plenty)

In the case of income inequality:

- It is used to capture the degree of **heterogeneity in the demand for public services** that county population exerts over local authorities
- Small **richest groups** can exert a higher **influence over local authorities** resulting in low quality and quantity of services for most of the county population.
- It could be associated with a **lower monitoring and demand for an efficient performance** when is associated with a low average income.

Data

Inputs - Outputs used to measure LGE

- National System of Municipal Information, SINIM (2006-2017)
- Sample of 324 municipalities in 12 years (3888 observations)

County-Level Data on Contextual Factors

- National Socioeconomic Characterization Survey, CASEN (2006 - 2009 - 2011 - 2013 - 2015 - 2017)
- SINIM
- "Servicio de Impuestos Internos", SII
- National Institute of statistics, INE
- in total 1944 observations (324 municipalities in 6 years)

Methodology

Methodology: Two Stage Approach

First Stage: DEA analysis

- Input oriented assuming variable returns to scale
- Five inputs and four outputs.
- Result: A vector of **efficiency scores (ES)** for each municipality

Second Stage: Regression Analysis

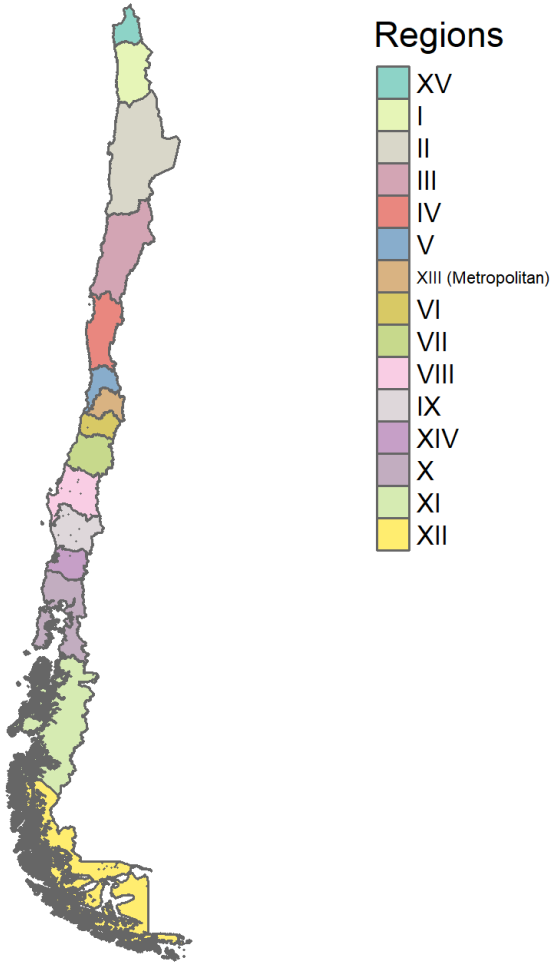
- **Dependent variable**: DEA efficiency scores
- **Independent variables**: Measure of Income inequality + remaining contextual factors including county (zone) specific and time fixed effects
- **Estimation method**: Censored regression + Instrumental Variable (IV)
- **Proposed Instrument**: $pss\_firms = \frac{\text{Number of firms in primary sector}}{\text{Total number of firms}}$

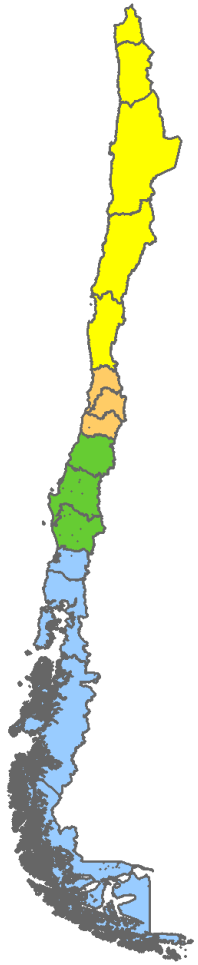
First Stage: DEA Results

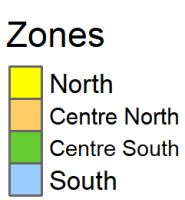
Inputs and outputs used in DEA: Summary Statistics

Statistic	Mean	St. Dev.	Min	Max
X1:Operational Expenditure	108.19	106.66	0.00	1,542.19
X2:Personnel Expenditure	47.94	40.67	7.66	629.25
X3:Education Expenditure	202.08	131.86	0.00	3,267.76
X4:Health Expenditure	68.36	46.41	0.00	415.80
X5:Municipal Facilities	0.001	0.001	0.00	0.02
Y1:Own Permanent Revenues	71.81	112.91	4	1,618
Y2:Enrollment Public Schools	0.61	0.26	0.03	2.08
Y3:Medical Consultations	1.83	1.16	0.00	27.88
Y4:Community Organizations	0.01	0.01	0.00	0.16

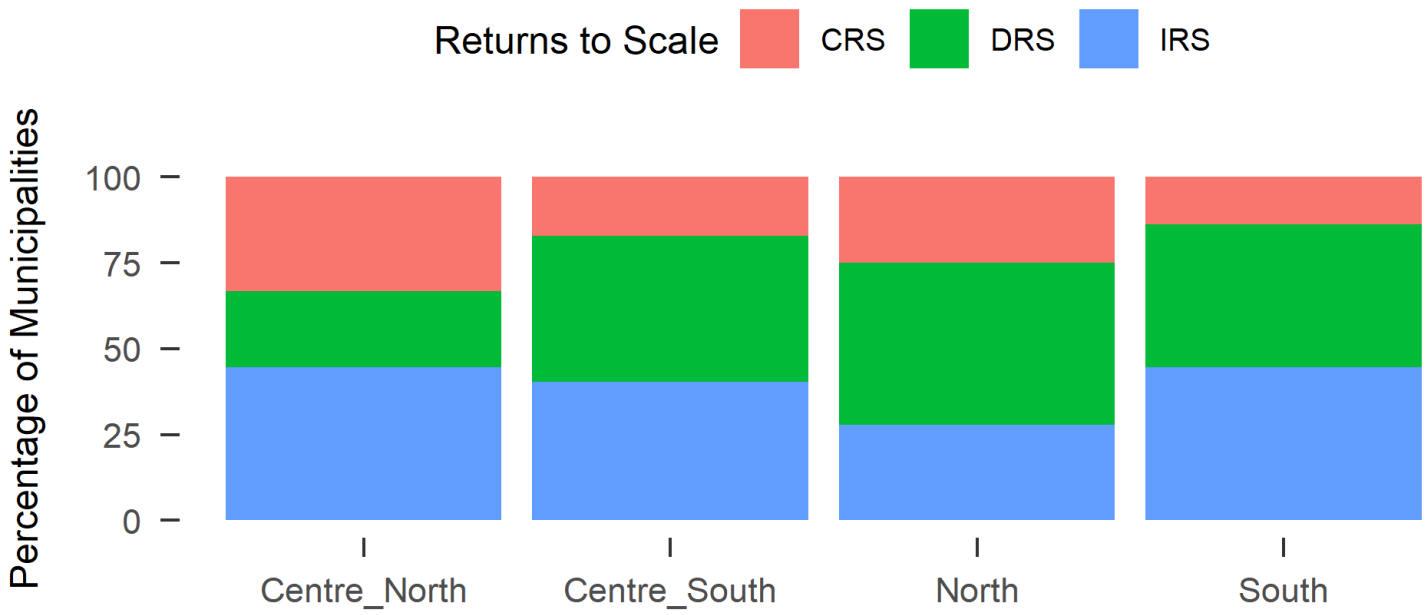
How do we capture geographical differences in LGE?



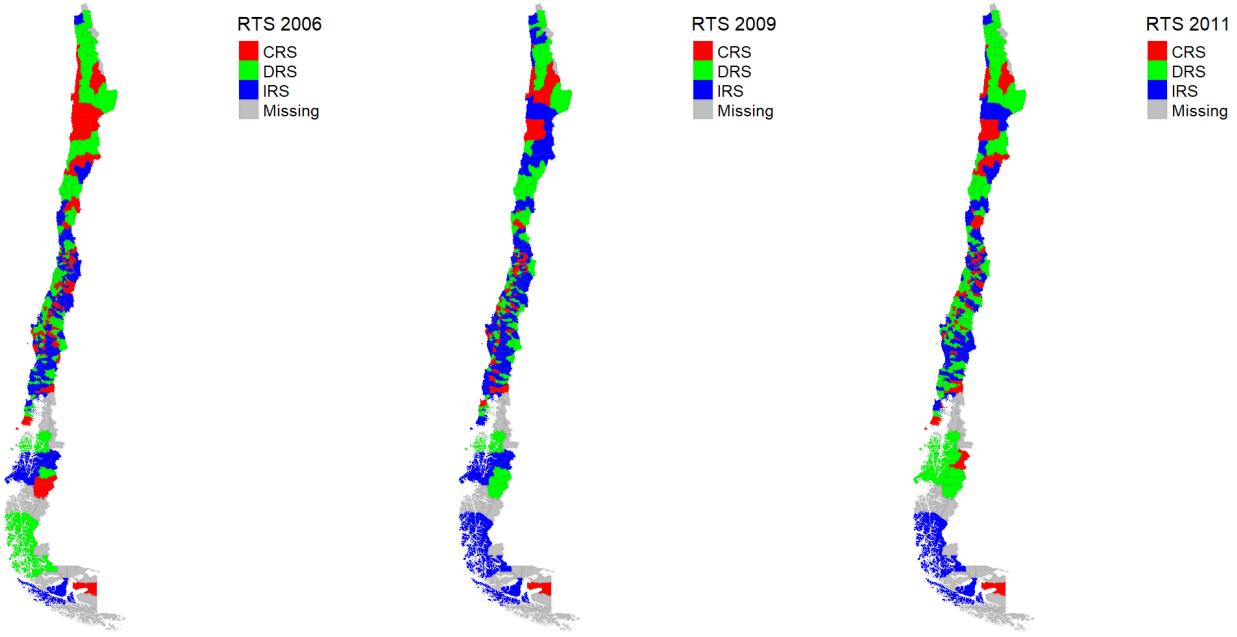




Returns to scale by zone



RTS	Centre_North	Centre_South	North	South
CRS	33.33	17.1	25.00	13.77
DRS	21.97	42.6	47.15	41.67
IRS	44.70	40.3	27.85	44.56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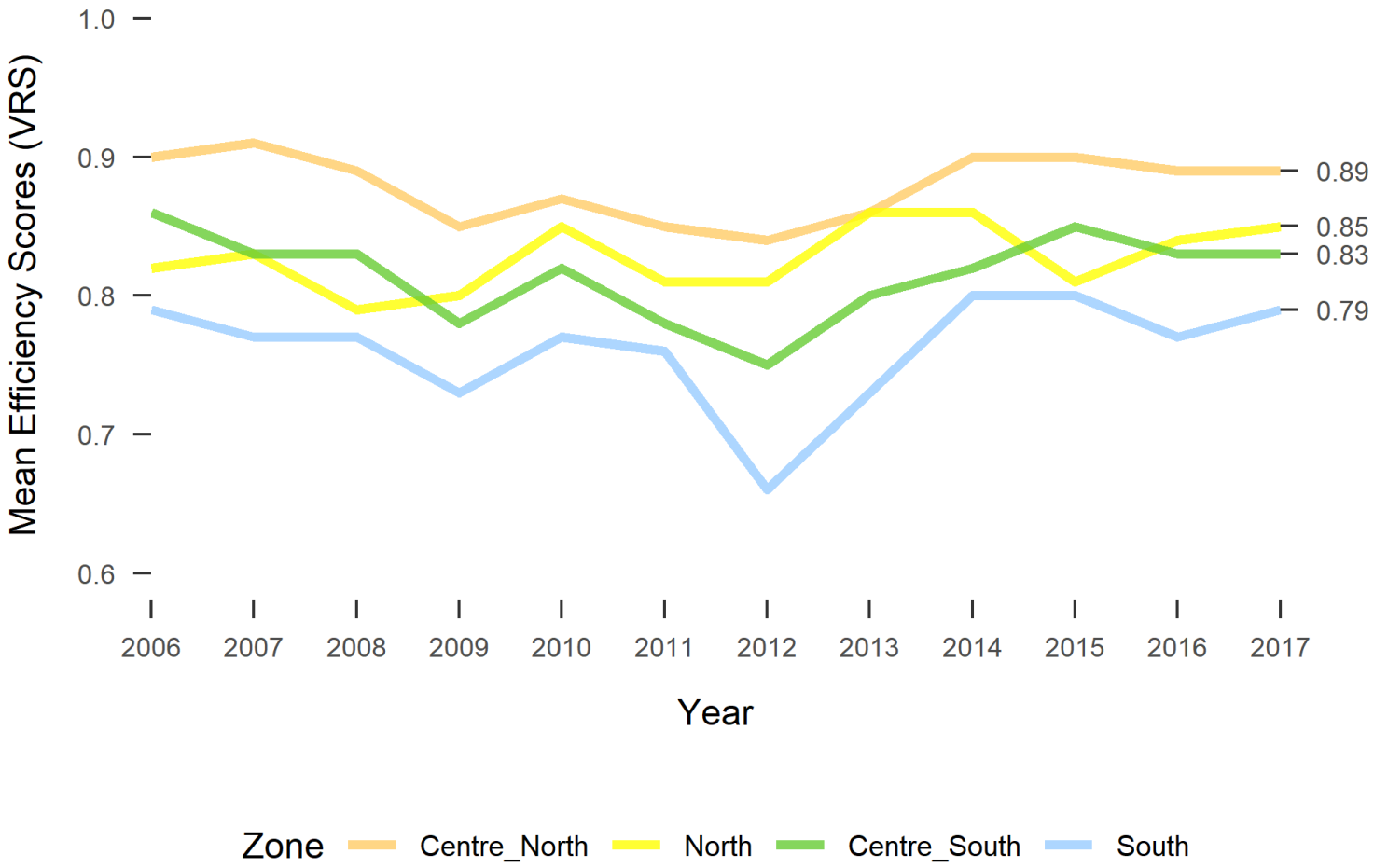
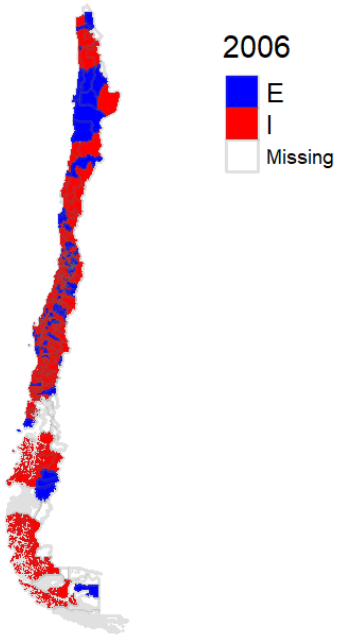
Evolution Efficiency Scores by Zone (Full Period)



Efficiency Scores by Zone and Region

Unit	n_counties	mean	median	sd	min	max
North	41	0.83	0.86	0.19	0.26	1
XV	3	0.88	1.00	0.22	0.27	1
I	6	0.73	0.80	0.28	0.26	1
II	8	0.98	1.00	0.07	0.70	1
III	9	0.79	0.79	0.14	0.53	1
IV	15	0.80	0.81	0.16	0.49	1
Centre_North	121	0.88	0.94	0.14	0.32	1
V	36	0.82	0.84	0.15	0.39	1
XIII	52	0.95	1.00	0.09	0.47	1
VI	33	0.81	0.82	0.15	0.32	1
Centre_South	116	0.82	0.83	0.15	0.34	1
VII	30	0.81	0.82	0.15	0.40	1
VIII	54	0.84	0.88	0.15	0.34	1
IX	32	0.77	0.77	0.16	0.40	1
South	46	0.77	0.77	0.18	0.31	1
XIV	12	0.74	0.74	0.13	0.46	1
X	25	0.74	0.75	0.19	0.31	1
XI	6	0.89	0.98	0.15	0.44	1
XII	3	0.85	0.91	0.17	0.52	1
Country	324	0.83	0.86	0.16	0.26	1

- **Mean efficiency** score is **0.83**.
- So, **municipalities could, on average, reduce the use of inputs in 17%** to get the same level of outputs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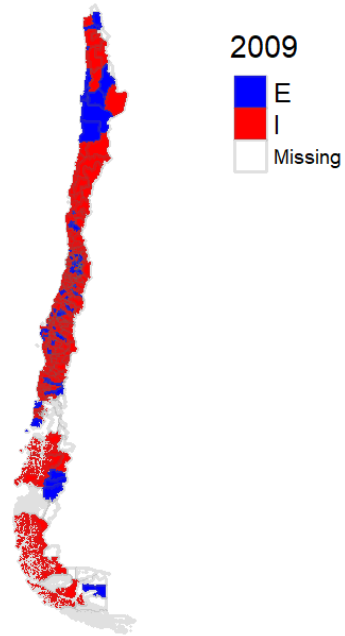
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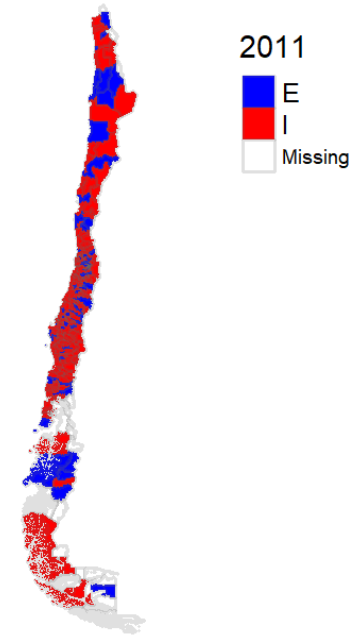
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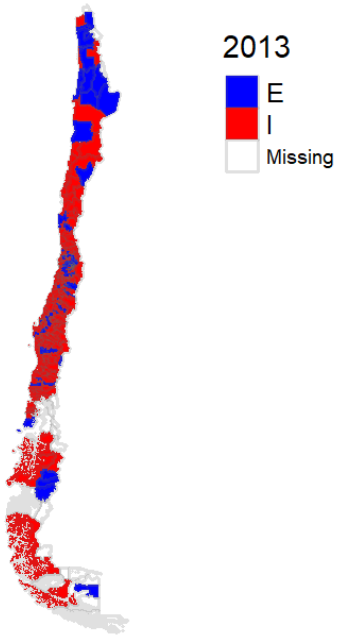
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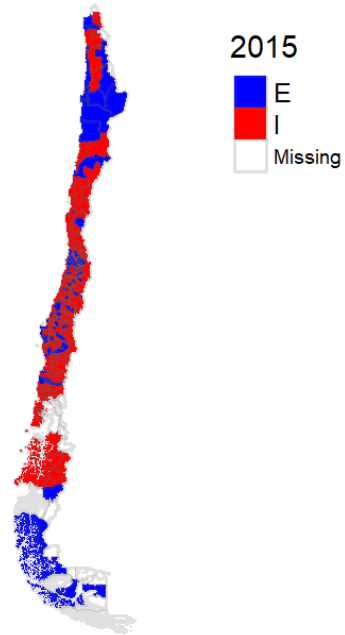
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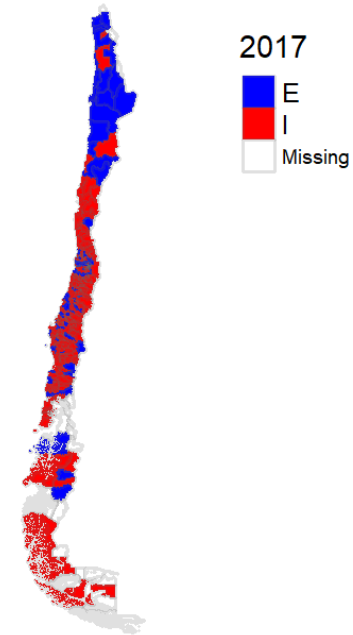
2017
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Second Stage

The model

To test our hypothesis, the empirical model is defined as:

$$\theta_{it} = \beta_1 gini_{it} + Z_{it}\beta + \delta_t + \alpha_i + \epsilon_{it}$$

Where:

- θ_{it} is the vector of efficiency scores from the DEA analysis,
- $gini_{it}$ is the Gini coefficient of each county,
- Z is a vector of controls.
- δ_t are year-specific effects,
- α_i are municipality-specific constants,
- ϵ_{it} is a vector of error terms and

Model Comparisons - Cross-sectional Censored Regressions

	Dependent variable: Efficiency Score (VRS)					
	2006	2009	2011	2013	2015	2017
gini	−0.228	−0.447**	−0.393*	−0.242	−0.189	−0.371*
log(income)	0.119*	0.249***	0.208***	0.164**	0.221***	0.257***
agroland	−0.002***	−0.003***	−0.003***	−0.001	−0.002***	−0.001
log(density)	0.019**	0.032***	0.021***	0.034***	0.017**	0.005
own	−0.002*	−0.002	−0.003**	−0.004***	0.002*	−0.002
education	−0.018	−0.038*	−0.046**	−0.026	−0.009	−0.020
IDD	−0.005**	−0.006***	−0.004*	−0.001	−0.004*	−0.006***
professional	0.001	−0.0001	−0.0002	0.003**	0.002	0.0003
mcf	0.002*	0.002**	0.002**	0.0003	0.0004	0.0004
LEFT mayor	−0.016	0.012	0.008	0.003	0.020	−0.022
RIGHT mayor	0.007	−0.002	0.032	0.013	0.038	0.002
reg_cap	−0.039	−0.061	−0.043	−0.106*	0.0004	−0.012
Centre South	0.068**	0.126***	0.050	0.028	0.054*	0.040
North	−0.019	0.099**	0.056	0.135***	0.006	0.034
South	−0.051	0.044	0.015	−0.025	−0.019	−0.065*
Observations	324	324	324	324	324	324
Log Likelihood	-14.778	12.330	-15.924	-24.773	-1.200	6.937
Akaike Inf. Crit.	63.555	9.339	65.848	83.546	36.400	20.127

Note: *p<0.1; **p<0.05; ***p<0.01

Panel Data Regressions : Dependent variable - Efficiency Score (VRS)						
			censored regression		*instrumental variable*	
	Pooled	RE	Pooled	RE	OLS IV	Tobit IV
	(1)	(2)	(3)	(4)	(5)	(6)
gini	−0.033	−0.049	−0.282***	−0.189***	−1.434***	−1.196*
	(0.082)	(0.068)	(0.081)	(0.073)	(0.432)	(0.538)
log(income)			0.184***	0.106***	0.258***	0.292***
			(0.026)	(0.025)	(0.054)	(0.069)
agroland			−0.002***	−0.002***	−0.002***	−0.002***
			(0.0003)	(0.0004)	(0.0003)	(0.0003)
log(density)			0.022***	0.020***	0.012***	0.021***
			(0.003)	(0.005)	(0.003)	(0.003)
own			−0.002***	−0.001**	−0.001***	−0.001***
			(0.001)	(0.001)	(0.0004)	(0.0005)
education			−0.022***	−0.005	−0.034***	−0.033**
			(0.008)	(0.008)	(0.008)	(0.010)
IDD			−0.004***	−0.005***	−0.002**	−0.003**
			(0.001)	(0.001)	(0.001)	(0.001)
professional			0.001*	−0.00004	0.0004	0.0008
			(0.0005)	(0.0005)	(0.0004)	(0.0005)
mcf			0.001***	0.002***	0.001***	0.001**
			(0.0003)	(0.0004)	(0.0003)	(0.0004)
LEFT mayor			−0.001	0.006	−0.007	−0.005
			(0.011)	(0.010)	(0.009)	(0.011)
RIGHT mayor			0.017	0.005	0.003	0.013
			(0.012)	(0.011)	(0.010)	(0.012)
reg_cap			−0.047**	−0.069**	0.024	−0.021
			(0.023)	(0.034)	(0.022)	(0.028)
Centre South	−0.089***	−0.086***	0.058***	0.022	0.123***	0.113**
	(0.012)	(0.019)	(0.014)	(0.022)	(0.028)	(0.035)
North	−0.054***	−0.045	0.050***	0.059*	0.030*	0.061**
	(0.016)	(0.033)	(0.019)	(0.032)	(0.016)	(0.020)
South	−0.142***	−0.124***	−0.019	−0.033	0.036	0.021
	(0.016)	(0.044)	(0.016)	(0.026)	(0.023)	(0.029)
Year Dummies?	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Note:						*p<0.1; **p<0.05; ***p<0.01

Panel data regressions

	Dependent variable: Efficiency Score (VRS)					
			censored regression		*instrumental variable*	
	Pooled	RE	Pooled	RE	OLS IV	Tobit IV
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			(0.0003)	(0.0004)	(0.0003)	(0.0003)
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			(0.008)	(0.008)	(0.008)	(0.010)
IDD			−0.004***	−0.005***	−0.002**	−0.003**
			(0.001)	(0.001)	(0.001)	(0.001)
professional			0.001*	−0.00004	0.0004	0.0008
			(0.0005)	(0.0005)	(0.0004)	(0.0005)
mcf			0.001***	0.002***	0.001***	0.001**
			(0.0003)	(0.0004)	(0.0003)	(0.0004)

Main results and future research

DEA

- The **"municipal production function"** shows variable returns to scale.
- The **average level of inefficiency is 17%**, with higher levels in the South area of the country.

Regression analysis

- Empirical **evidence of a negative relationship between inequality and efficiency**.
- A **reduction of income inequality could have positive effects on economic efficiency**, at least at the **level of local governments**.

Future research

- **Spatial dependence-heterogeneity in LGE**.
- Is the negative coefficient for *education* explained by the reduction in **electoral participation**?
- What about the issue of **reverse causality?**

Thanks for Listening!

Questions?