Measuring and Explaining Local Government Efficiency in Natural Resource Rich Countries:

The case of Chilean Municipalities

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Research Question:

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

What do we know about the Link between

(Local Government) Efficiency
and
Income Inequality?

Trade-off between efficiency and equity:

- Pursuing equality can reduce efficiency (see Okun 1975; Browning & Johnson 1984; Andersen & Maibom 2016)
- But, equality could also be an important ingredient in promoting and sustaining growth (see Berg & Ostry 2011; kumhof, Rancière & Winant 2015)

Local Government Efficiency (LGE): The interest has been on:

Measuring LGE

- Parametric (SFA) vs non-parametric (DEA) measurement techniques
- Provision of single services vs overall efficiency
- Selection of inputs and outputs (outcomes)
- Input oriented vs output oriented approach

Explaining differences in LGE

- Discretionary factors (associated with the measurement process)
- Non-discretionary (contextual) factors
    - Economic - Financial
    - Social - Demographic - Geographic
    - Political - Institutional

Hypotheses

About the level of inefficiency of Chilean municipalities

> Chilean municipalities show an average level of inefficiency of 30%.

See Pacheco, Sanchez & Villena, 2013

About the relationship between LGE and income inequality

> H_0: Higher income inequality could negatively affect municipal efficiency.

See Tandon ,2005; Jottier, Ashworth, & Heyndels, 2012; Ortega, Sanjuán, & Casquero, 2017

> H_1: Income inequality does not have a significant association with municipal efficiency

Data & Methodology

Data

- Sample of 324 municipalities

Inputs - Output Data used to measure LGE

- National System of Municipal Information, SINIM (2006-2017)
- In total 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

Methodology: Two Stage Approach

First Stage: DEA analysis

- Input oriented assuming variable returns to scale
- 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
  - County (zone) specific + time effects
- **Estimation method**: Censored regression + Instrumental Variable (IV)
- **Proposed Instrument**:

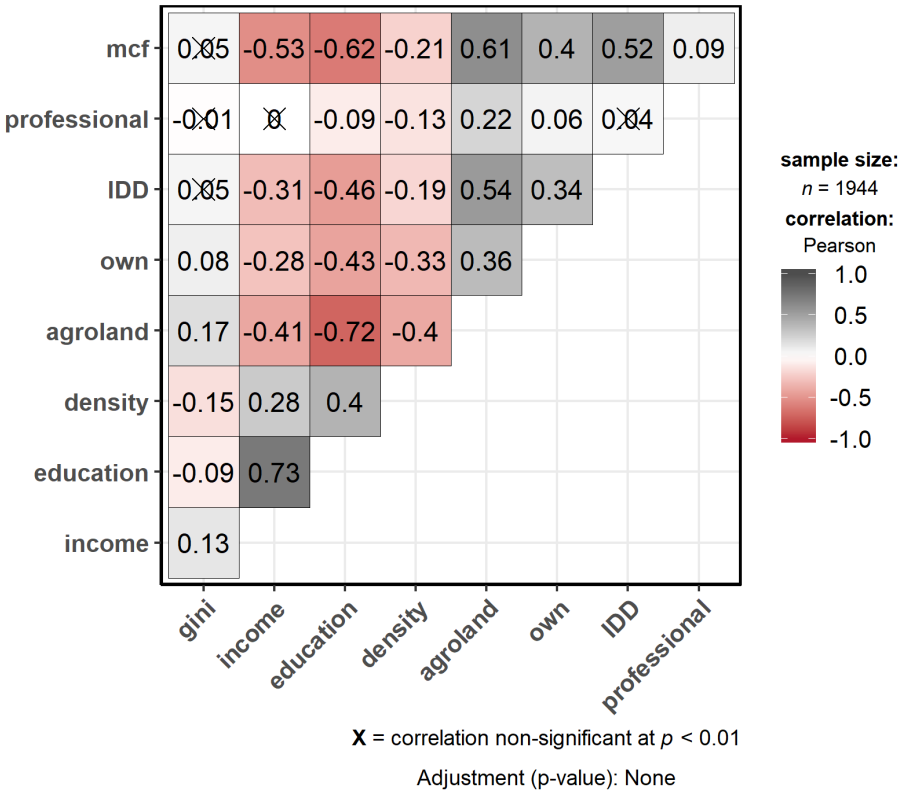
$$pss\_firms = \frac{\text{Number of firms in primary sector}}{\text{Total number of firms}}$$

Inputs and Outputs used in DEA: Summary Statistics

- All monetary data is in Chilean pesos of 2017
- All indicators in per capita terms

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

Correlation Matrix Numeric Contextual Factors

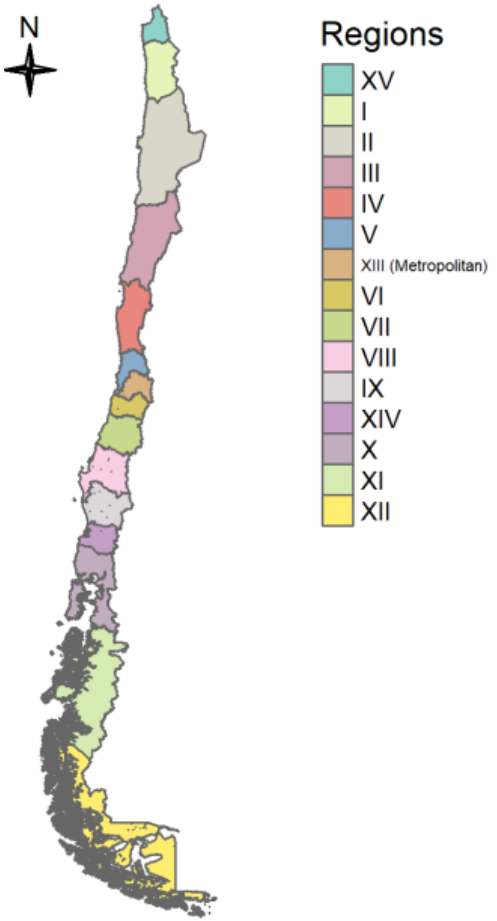


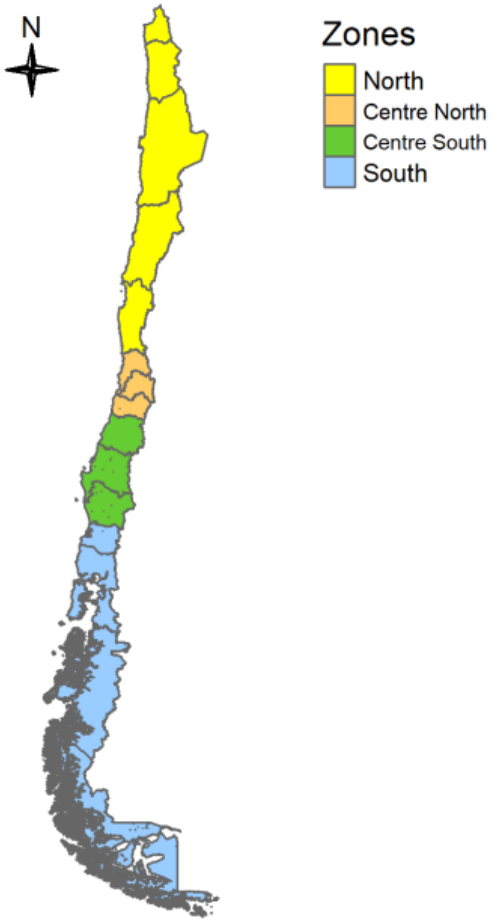
Analysis & Results

First Stage:

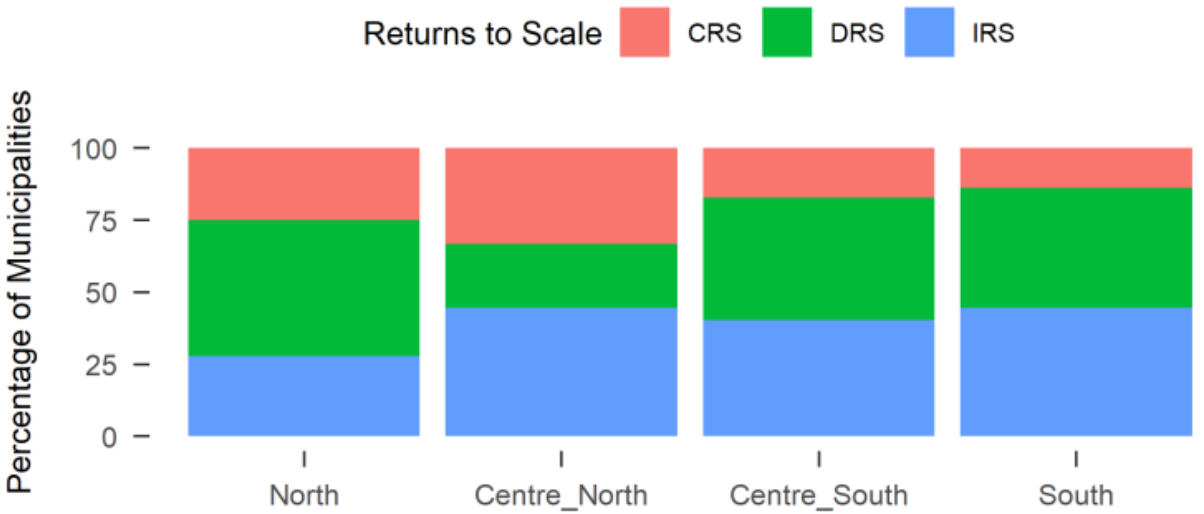
DEA

Chile: Geographic and Regional Administrative Division





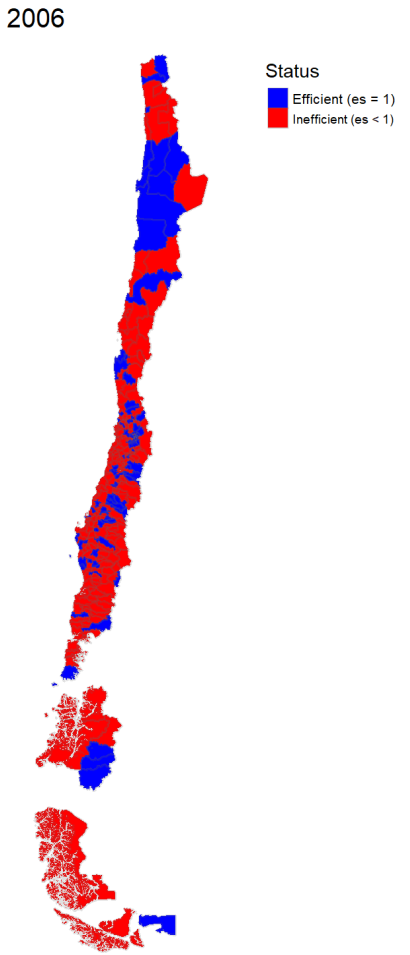
Results: Returns to Scale by Zone



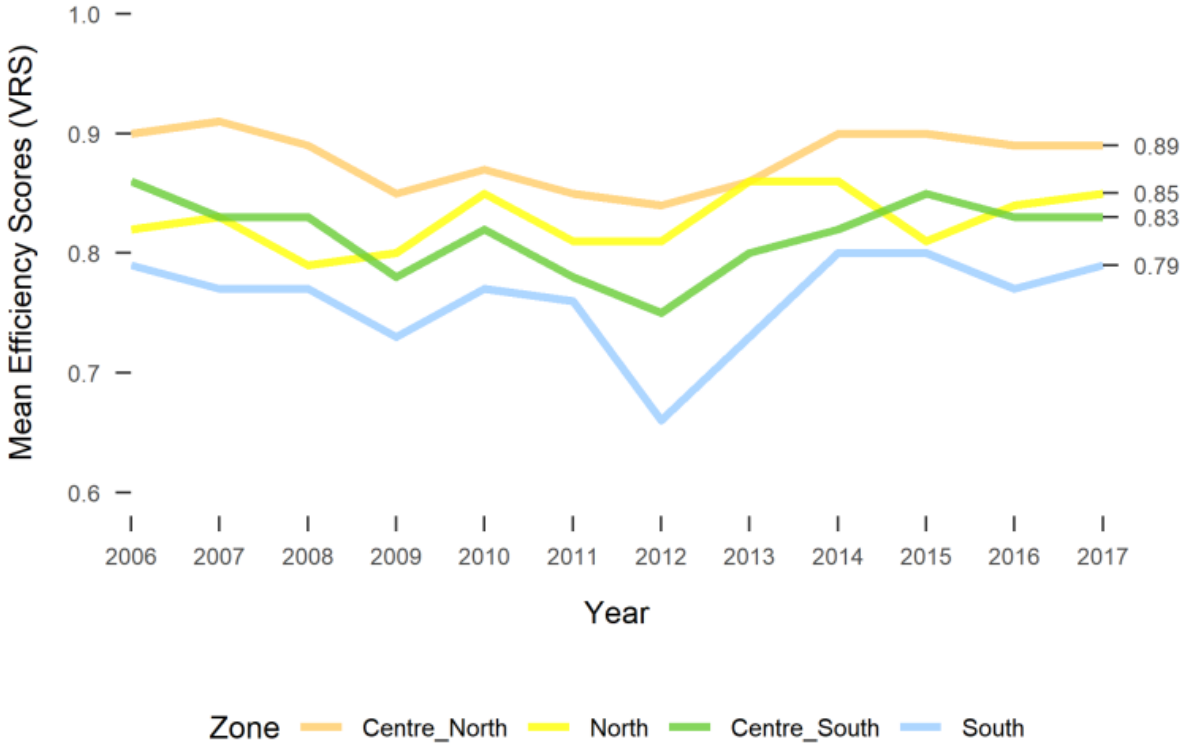
RTS	North	Centre_North	Centre_South	South
CRS	25.00	33.33	17.1	13.77
DRS	47.15	21.97	42.6	41.67
IRS	27.85	44.70	40.3	44.56

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**



Evolution Efficiency Scores by Zone (Full Period)



Second Stage:

Regression Analysis

Model Comparisons - Censored Cross-sectional 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

Model Comparisons - Panel Data

	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)

Conclusions & Future Research

Conclusions

DEA

- The "production function" of municipalities can be described by one showing variable returns to scale.
- About 3/4 of municipalities shows some degree of ineficiency.
- The average level of inefficiency is 17%, with higher levels in the Centre area of the country and lower levels in the South.
- Efficiency shows a ciclical behaviour and, on average, has remained stable in the period 2006 - 2017.

Regression analysis

> This paper offers empirical **evidence of a negative relationship between inequality and efficiency**, that is, a reduction of income inequality (or an increase in equality) could have positive effects on economic efficiency, at least at the level of local governments.

Limitations and Future Research

Limitations

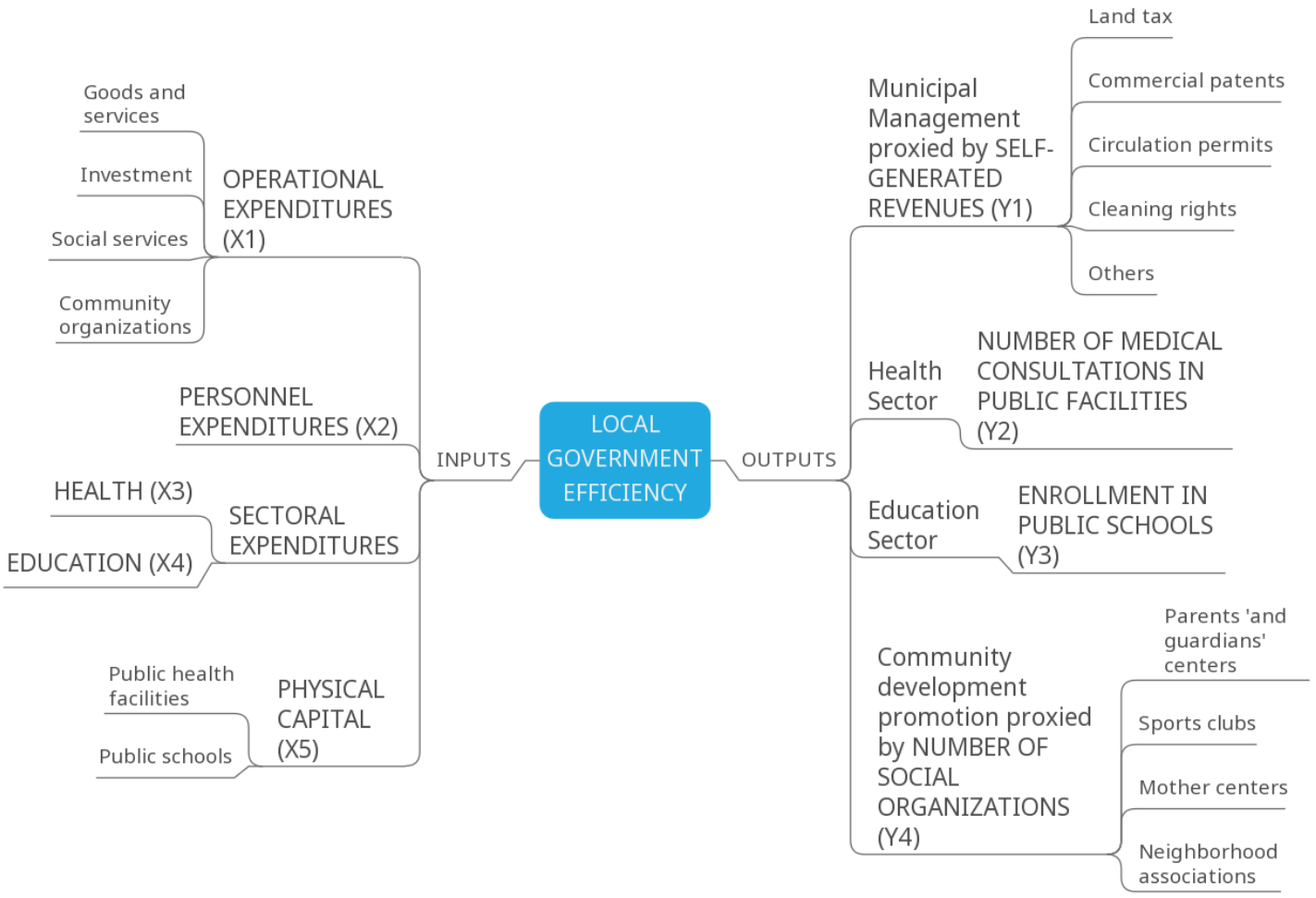
- Results sensitive to the selection and number of inputs and outputs (External validity)
- Associated with observational data and causal inference

Future research

- Program evaluation in Chilean municipalities (for instance, assigning municipalities to "treatment" using as running variable county population or the level of income percapita)
- Given the current situation of the country: What about the issue of **reverse causality?**

Thanks for Listening!

Appendix 1: Inputs and Outputs for DEA



Appendix 2: Contextual factors