Using R for calculating efficiency in local governments

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Introduction

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- ✓ Economic situation.
- ✓ Expenditure containment politics.
- ✓ Non-fulfillment of electoral promises.
- ✓ Corruption scandals.

Reducing spending and improving service at the same time seems a difficult task to achieve. ***Efficiency*** is presented as a solution to this dichotomy.

Introduction

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This article focuses on:

- ✓ the methodology suitable to calculate efficiency,
- ✓ and its determinants.

The most significant contribution we make in this regard is the use of ***R*** software.

Used packages:

readxl

pastecs

psych

corrplot

deaR

truncreg

Literature

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The need to measure efficiency in municipal services is reflected in the growing literature:

- Lampe & Hilgers (2014).
- Emrouznejad & Yang (2017).
- Narbón-Perpiñá & De Witte (2018a, 2018b).

In the case of Spain, and with regard to specific services, the following works stand out:

- Benito et al. (2019), *water supply.*
- Pérez-López et al. (2016), *waste collection.*
- Lorenzo & Sánchez (2007), *public lighting.*
- Balaguer-Coll & Prior (2009), *street cleaning.*

Literature

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We focus our research on some exogenous factors that may improve efficiency levels:

- Population density.
- Tourist activity.
- The financial capacity of the local government.
- Ideological position.
- Fragmentation of municipal government.
- Management type.

Sample

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As an example to explain the methodological procedure, we selected the waste collection service, with the following data:

- 272 Spanish municipalities with more than 15,000 inhabitants.
- With information available in *CESEL*.
- The year 2017.

The sample is suitable for the following reasons:

- Is more reliable, complete and timely.
- These governments have top-level officials, improving the quality of information.
- Municipalities with more than 15,000 represent 73.71% of the total population, thus allowing an adequate generalization of the conclusions.

Econometric model

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- Variables of the model ***(package pastecs).***

Variable (Unit)	Min.	Mean	Median	Máx.	Std. Dev.
Inputs					
Cost (€)	4769.5600	3240567.1975	1467737.1400	183341657.8800	11534160.3005
Length (Km)	11.4200	86798.3363	286.0000	13485846.0000	824119.8235
Dumpster (units)	120.0000	2968.0551	1009.5000	359334.0000	21801.6715
Outputs					
Frequency	1.0000	5.7132	6.0000	6.0000	1.0302
Tons	9.9800	356672.8119	13908.0000	44164560.0000	3597008.8814
Variables					
Density	24.9570	1340.7383	498.9460	12372.8571	1971.5492
Tourism	0.0000	177.8489	20.6225	11649.6404	783.3687
Income	0.0000	1067.4003	995.7015	2958.1008	339.6502
Ideology	0.0000	0.0772	0.0000	1.0000	0.2674
Herfindahl	0.1552	0.3081	0.2980	0.6644	0.0846
Management	0.0000	0.6287	1.0000	1.0000	0.4840

Econometric model

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- ***Data Envelopment Analysis (package deaR) Coll-Serrano et al. 2018.***
  - Inputs
    - ✓ Effective cost
    - ✓ Length
    - ✓ Container
  - Outputs
    - ✓ Frequency
    - ✓ Tons

$$\hat{\delta}_i = \alpha + \beta_1 Density_i + \beta_2 Tourism_i + \beta_3 Income_i + \beta_4 Ideology_i + \beta_5 Herfindahl_i + \beta_6 Management_i + \varepsilon_i$$

Econometric model

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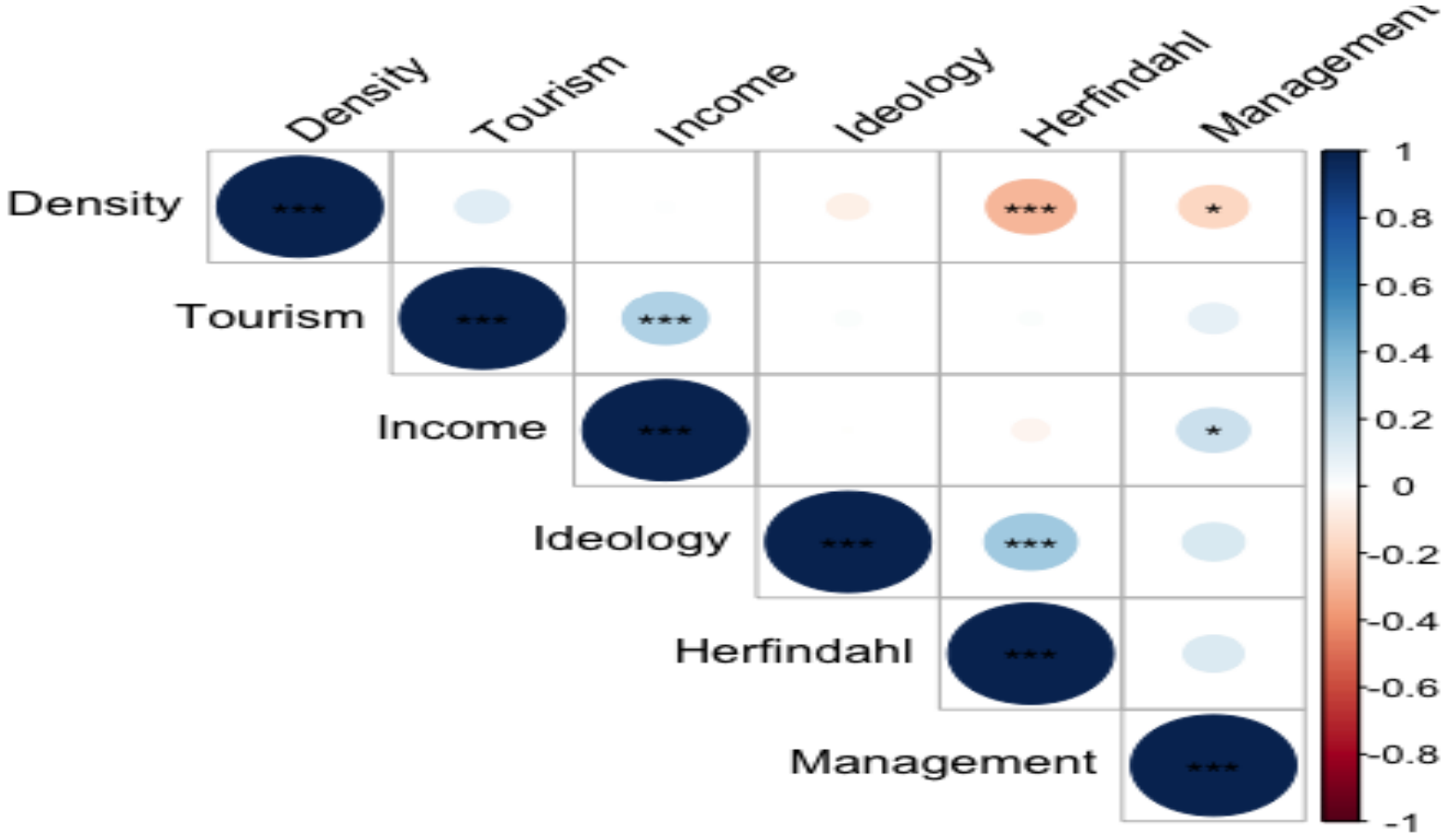
- Correlations between variables ***(package psych and corrplot).***



Econometric model

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- Variations in inputs/outputs to achieve efficiency ***(package deaR) Coll-Serrano et al. 2018.***

Orientation Inputs / Yields VRS	
Cost (€)	-88.99%
Length (Km)	-96.31%
Dumpster (units)	-89.37%
Frequency	5.02%
Tons	0.11%

Results

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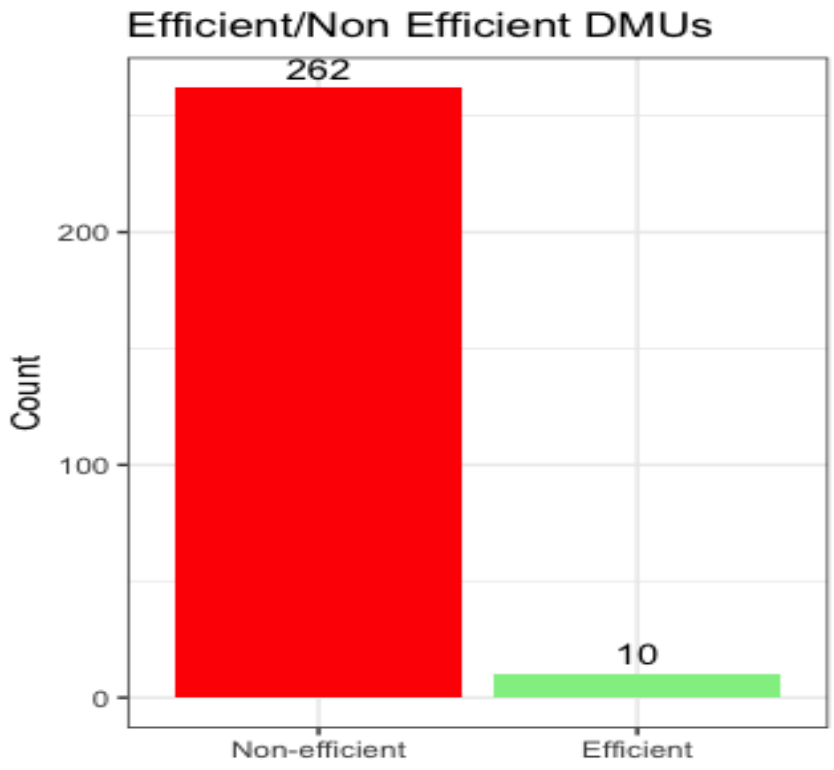
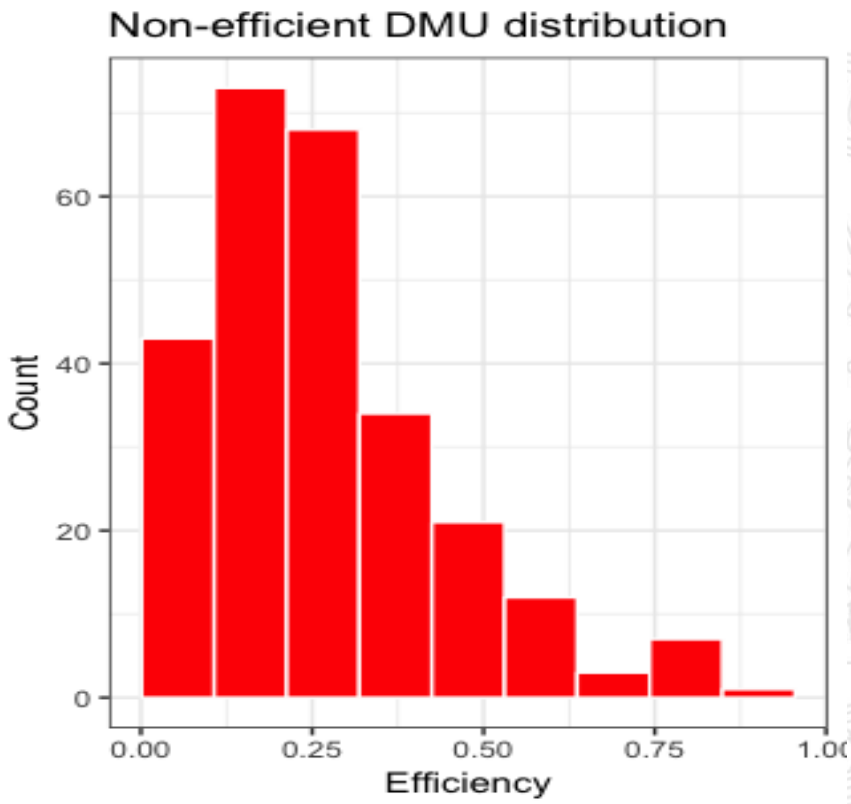
- Efficiency results ***(package deaR) Coll-Serrano et al. 2018.***





Results

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- Robust regression of the efficiency index VRS on the exogenous factors ***(package* truncreg*).***

	Estimate	Std. Error	t-value	Pr(>|t|)
Intercept	3.2571e-01	7.4208e-02	4.3892	***1.138e-05
Density	5.0889e-06	7.2296e-06	0.7039	0.48149
Tourism	-4.1003e-05	1.7792e-05	-2.3046	*0.02119
Income	-7.0819e-05	4.1501e-05	-1.7065	*0.08792
Ideology	-2.9949e-02	5.2855e-02	-0.5666	0.57097
Herfindahl	1.2533e-01	1.7392e-01	0.7206	0.47115
Management	1.2533e-01	2.8908e-02	0.3498	0.72652

Significant : ***1%, **5% and *10%, coefficient, (t-statistic).

Conclusions

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For the waste collection service:

- ✓ Tourist activity reduces efficiency due to seasonal population growth.
- ✓ Local governments with more budgetary revenues are less efficient, as they have more resources and not establish a rational use of them.

Future lines of research

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- ✓ Facilitate research work in the framework of local public sector auditing and accounting.
- ✓ Continue improving package and their applications, according to the spirit of the community *R-Hispano*.
- ✓ Update the available packages for the creation of more flexible, fast and dynamic databases.

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Thank you for your attention

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Fuente: http://img2.rtve.es/v/5211543?w=1600&preview=1557930419095.jpg