Explaining differences in efficiency. A meta-study on judicial literature

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- This research has been presented at the 30th Anniversary of the European Workshop on Efficiency and Productivity Analysis (EWEPA 2019, 11-13 June 2019, Senate House, London)

- It will be presented at the University of Salerno (26 June 2019), University of Naples (10 July 2019), Bank of Italy – Rome (16 July 2019) and at the MAER-net Colloquium 2019 (Greenwich University, London, 10-11 October 2019)

- The authors schedule to finalize the paper by 31 July 2019

Outline

- Why an MRA on judicial efficiency ?
  - Motivations (from judicial and efficiency literature)
  - Authors' pre-existing knowledge
- Metadata set: how is it created
- The MRA in a nutshell
- Fitted models and results
- Conclusions
- **Caveats and Insights for future work**

Motivations (from judicial literature)

- The institutional architecture of many countries has changed rapidly since the 1990s due to extensive deregulation aimed at **optimizing the use of public resources** in offering services of general interest at local level
- The institutional reforms accelerate over the last 15 years, thereby **increasing the interest on economists** and **public administration** to evaluate the **efficiency level** and the key-factors influencing the performance of the public sector (Lovell 2002)
- Importantly, the institutional framework on how courts work differs country-by-country and, therefore, it is reasonable to expect that the heterogeneity **in national norms translates into heterogeneity in judicial efficiency**

Motivations (from judicial literature)

- An effective justice system that interprets and applies the law fairly, impartially and without undue delay is fundamental to citizens' rights and a well-functioning economy (European Commission, 2017)
- Economists expect court delay to have important economic consequences: as fewer contracts are entered into, there will be a lower division of labor and, at the end of the day, less growth and income (Voigt, 2016)
- Judicial systems can be important to the economy for a variety of reasons. It is only with an effective judiciary that government promises to enforce private property rights stand a chance of being credible to potential investors (Ramello, Voigt 2012)

Motivations (from judicial literature)

- The judicial system, like many other sectors of the public administration, is an industry producing a specific good: justice and, accordingly, it can be studied by using the customary tools of production theory (Falavigna et al, 2017)
- Solving the problem associated with the measurement and assessment of court efficiency is one of the necessary elements of efficient management because of the relatively high amount of public expenditure on justice, in conjunction with the time which courts need for issuing judgements in cases (Major, 2015)
- Except for a few studies (the first one Lewin et al. (1982)) the problem of measuring the efficiency of courts has remained relatively unexplored

Motivations (from efficiency literature)

- Theory provides clear insights to define a unit-decision as efficient or not, but results are extremely different on empirical grounds
- There are several and different approaches to estimate efficiency with no consensus on the superiority of one method over the others (Coelli and Perelman 2000)

  Examples of choices to be made in empirics:

  - Parametric vs non-parametric
  - Stochastic vs deterministic
  - FDH or DEA
  - Number of inputs and outputs to be considered in the frontiers
  - Functional form to be assigned to the frontier
  - Distribution better fitting v_i and/or u_i (Normal, LogDagum, Gamma)
  - Econometrics used in estimating the frontiers
- **All this choices affect results, thereby causing heterogeneity**

Authors' Pre-existing knowledge

1. Aiello F., Bonanno G., (2019) Explaining differences in efficiency: a meta-study on local government literature, *Journal of Economic Survey*

2. Aiello F., Bonanno G., (2018) "On the sources of heterogeneity in banking efficiency literature" *Journal of Economic Survey*

3. Bonanno G, De Giovanni D., Domma F. (2017) «The wrong skewness problem: a re-specification of stochastic frontiers", *Journal of Productivity Analysis*

Meta-Analysis Regression

- MA evaluates the relationship between the dependent variable (that is the main result of the analyzed studies) and a lot of features of every paper. Here, the dependent variable is the efficiency score (in mean) of original papers
- Phrased differently, by modeling all the relevant differences across studies on a given subject, MA permits to understand the role of each varying factor in determining the heterogeneity of outcomes. In brief, it deals with the difficulty to compare results of empirical works

Meta Regression in Economics

- The use of MA is growing in economics and regards a very wide spectrum of subjects
- 1038 MA papers in Economics from 1980 to 2017, with an exponential growth in 2000s'. Many of them appeared in AER, JPE, RESTAT and JES
- Agricultural economics is the area of research with the highest proportion of MA papers, followed by industrial economics, labour economics and consumers economics.

Efficiency and MRA

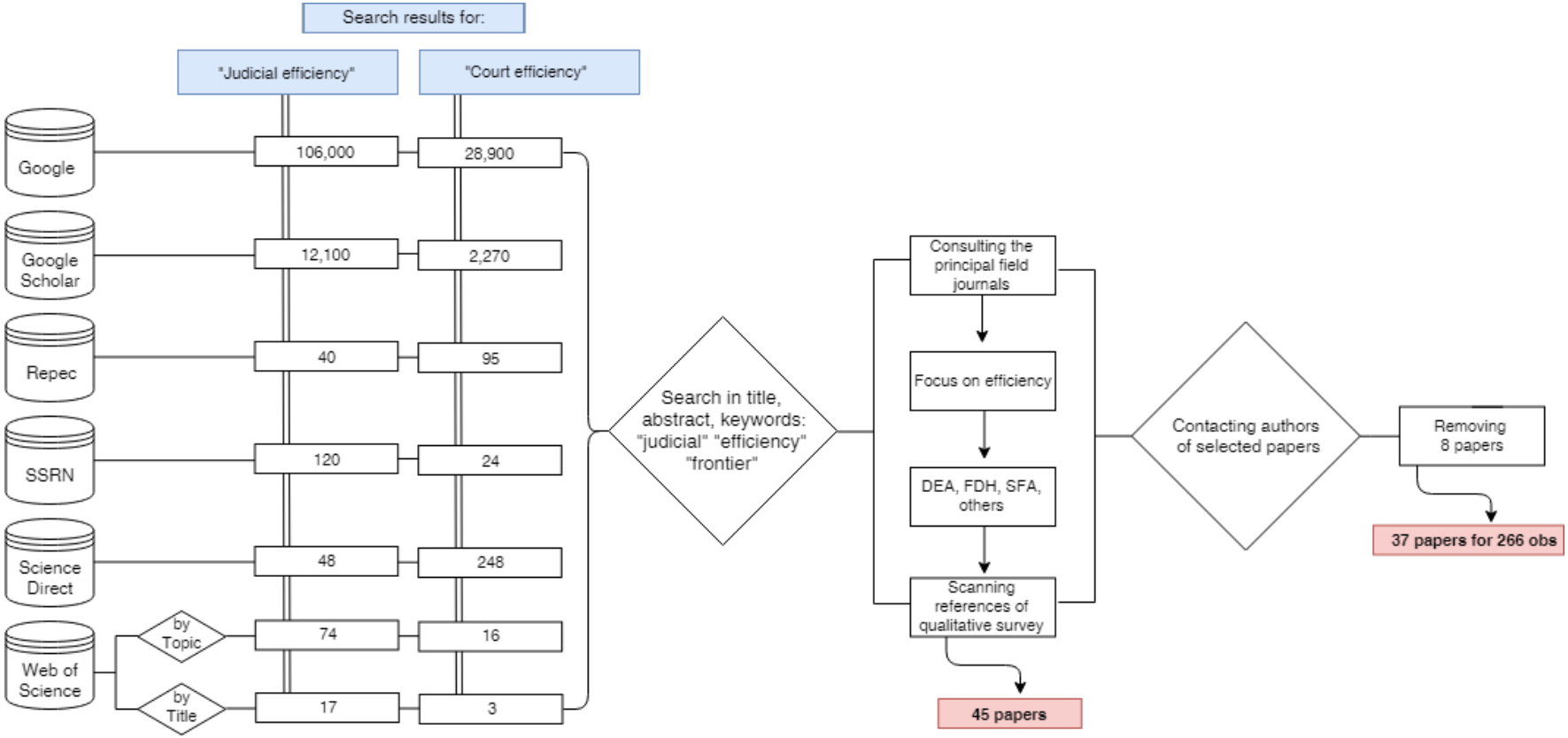
- **Few MRA papers dealt with the issue of efficiency. Some examples are**
- Bravo-Ureta et al. (2007) Thiam et al. (2001), Kolawole (2009) on agriculture
- Brons et al. (2005) focus on urban transport
- Iršová and Havránek (2010) focus just on US banks and consider 32 papers published over 1977-1997
- Aiello and Bonanno (2018) review 120 efficiency studies – with 1661 observations – on banking published over the period 2000–2014
- Aiello and Bonanno (2019) is on local government efficiency and meta-review 360 observations retrieved from 54 papers published from 1993 to 2016

Judicial literature: selected papers

- The search yields a sample of **37** papers published from 1982 to 2018

- Provided that many studies report multiple estimates of efficiency, the dataset under analysis comprises a total of **266** observations

Dataset assembling process



Source: Authors' elaboration, data extraction at May 23 , 2019

Average, Standard Deviaton and Number of Observations in Judicial Efficiency Literature (1/2)

ALL SAMPLE	Mean	**0.752**
	SD	0.195
	Obs	266
Estimation approach		
NON PARAMETRIC	Mean	0.731
	SD	0.193
	Obs	229
PARAMETRIC	Mean	0.885
	SD	0.153
	Obs	37
Data type		
CROSS SECTION	Mean	0.733
	SD	0.181
	Obs	161
PANEL	Mean	0.783
	SD	0.212
	Obs	105
Publication status		
UNPUBLISHED	Mean	0.643
	SD	0.171
	Obs	44
PUBLISHED	Mean	0.774
	SD	0.192
	Obs	222

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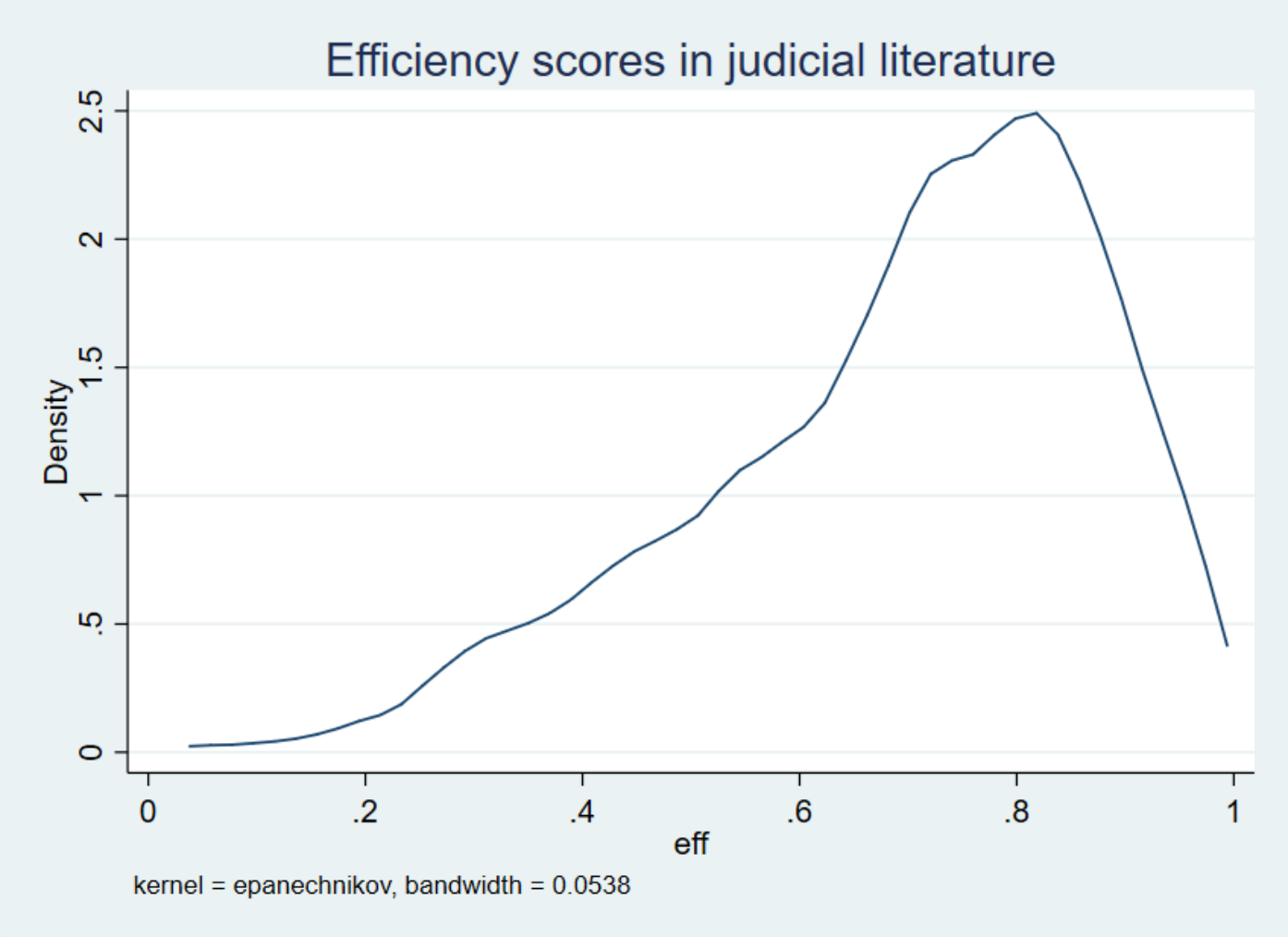
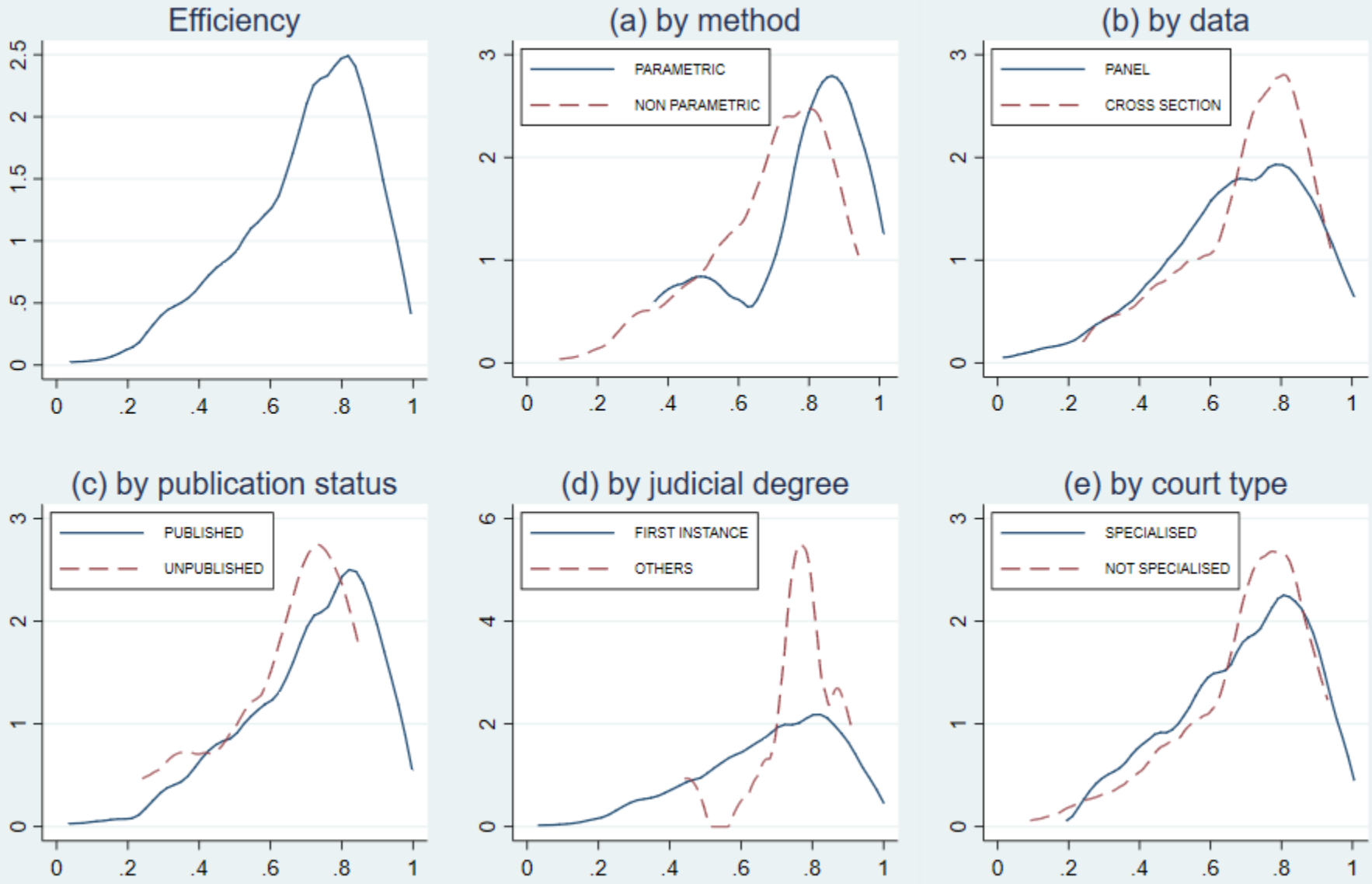
	Obs	105
Publication status		
UNPUBLISHED	Mean	0.643
	SD	0.171
	Obs	44
PUBLISHED	Mean	0.774
	SD	0.192

Average, Standard Deviaton and Number of Observations in Judicial Efficiency Literature (2/2)

Judicial degree		
OTHER INSTANCES	Mean	0.764
	SD	0.120
	Obs	39
FIRST DEGREE	Mean	0.751
	SD	0.205
	Obs	227
Type of courts		
NON SPECIALIZED	Mean	0.769
	SD	0.196
	Obs	160
SPECIALIZED	Mean	0.727
	SD	0.192
	Obs	106

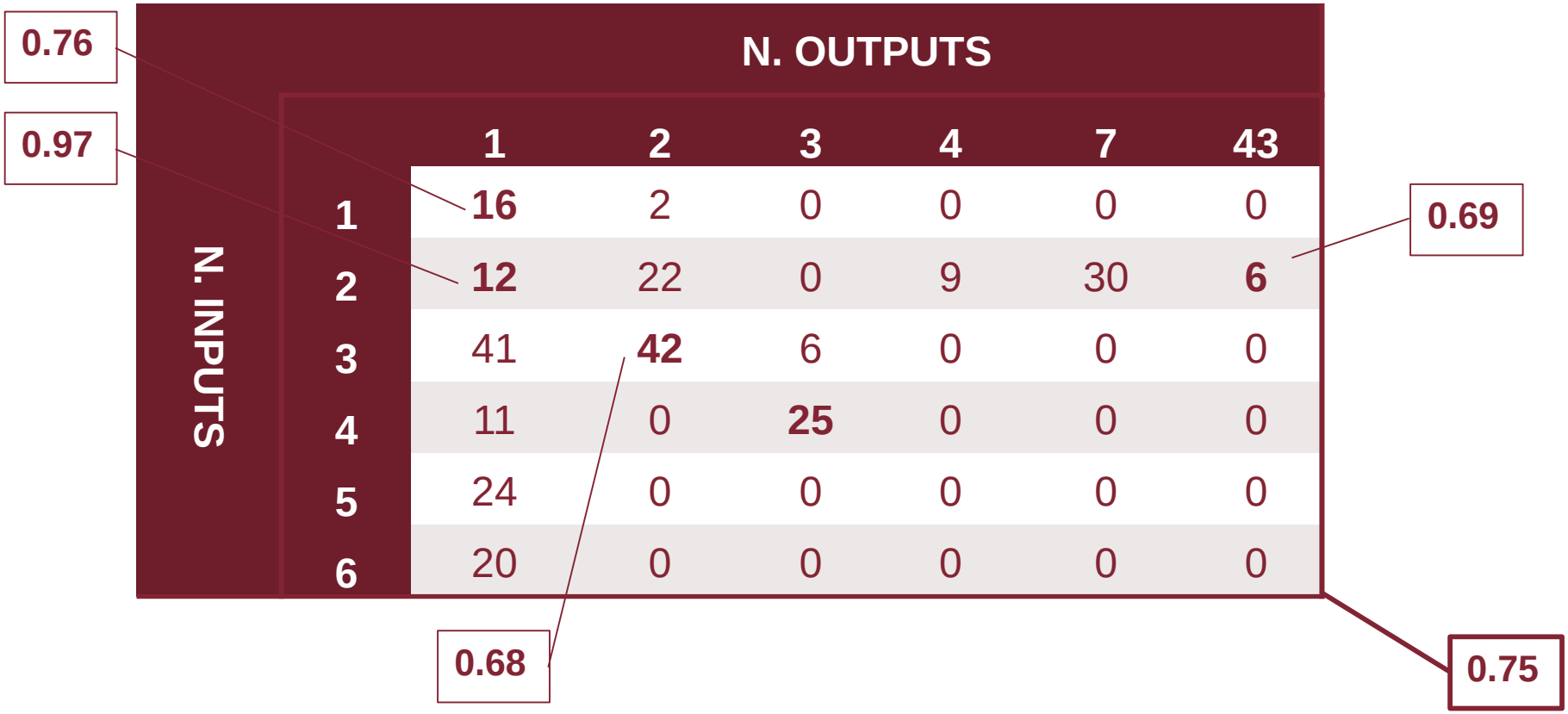
Heterogeneity in judicial efficiency literature




Efficiency
0
.5
1
1.5
2
2.5
0
.2
.4
.6
.8
1
(a) by method
PARAMETRIC
NON PARAMETRIC
0
1
2
3
0
.2
.4
.6
.8
1
(b) by data
PANEL
CROSS SECTION
0
1
2
3
0
.2
.4
.6
.8
1
(c) by publication status
PUBLISHED
UNPUBLISHED
0
1
2
3
0
.2
.4
.6
.8
1
(d) by judicial degree
FIRST INSTANCE
OTHERS
0
2
4
6
0
.2
.4
.6
.8
1
(e) by court type
SPECIALISED
NOT SPECIALISED
0
1
2
3
0
.2
.4
.6
.8
1

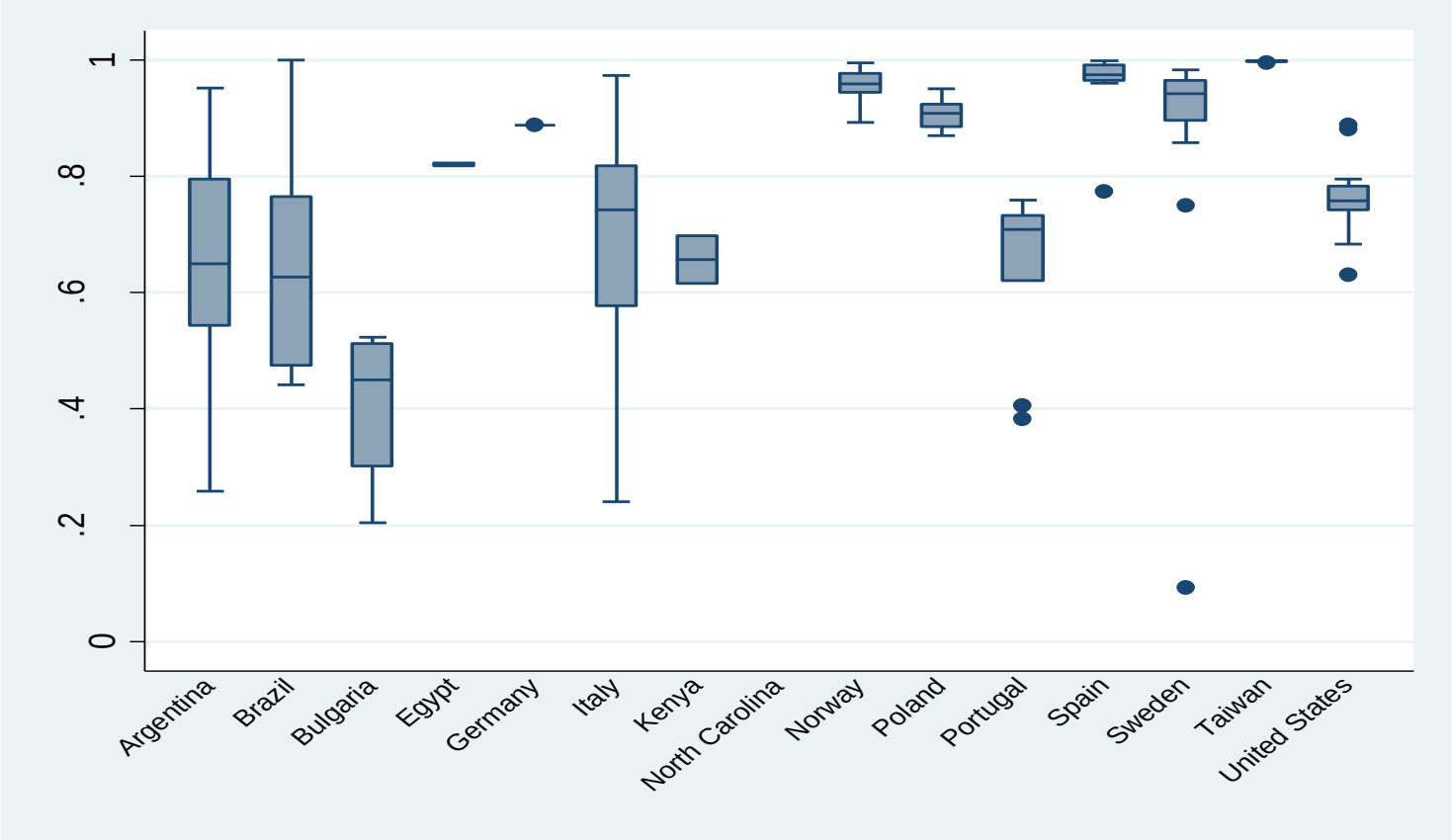
Efficiency in judicial courts
Does Heterogeneity exist?

Heterogeneity in Inputs and Outputs



N. INPUTS	N. OUTPUTS 1	2	3	4	7	43
1	**16**	2	0	0	0	0
2	**12**	22	0	9	30	**6**
3	41	**42**	6	0	0	0
4	11	0	**25**	0	0	0
5	24	0	0	0	0	0
6	20	0	0	0	0	0

Efficiency scores by country



Estimated models

$$E_i^* = \beta_0 + \beta_1 S_i^* + \sum_j \beta_j X_i^* + u_i + e_i$$

Random Effect framework

- The disturbance $e = \varepsilon/S$ is corrected for heteroscedasticity; all variables in the full model is weighted through the variance indicator S
- $e_i \sim N(0 , \sigma^2_i)$ is the disturbance and $u_i \sim N(0 , \tau^2)$ is the primary-study fixed-effect.
- The parameter τ^2 is the between-study variance, which must be estimated from the data as in Harbord and Higgins (2008).
- To provide some robustness of the results to clustering, we adopt a two-step procedure as in Gallet and Doucouliagos (2014) and adopted by Aiello and Bonanno (2018; 2019).
- An REML regression is run in the first step, while in the second step we run a WLS regression in which the weights also include the value of τ^2 retrieved from the first step. This ensures that the REML estimates will be robust to clustering at the study level.

Estimated models: Variables

- **D_param**: dummy equal to 1 for the parametric group of studies and 0 for the others (All the sample)
- **D_panel** is 1 if original works used panel data, 0 cross-section

Variables: Study design

- **Dimension**: given by the sum of the number of inputs and outputs of the frontier
- **Sample Size**: the number of observations used in primary papers when estimating the efficiency score
- **D_Europe** is 1 if the primary study used data from an European country (controlling group=efficiency scores from papers focusing on the RoW)
- **Time Effect**: *Year of publication (or Year of Estimation)*

Variables: Court type

- **D_first instance** is 1 for efficiency score observations related to sample of courts belonging to the first level of judgment.

  - Controlling group= observations from studies focused on appeal courts

- **D_specialized court** is 1 for efficiency score observations related to specific sample of courts (i.e. tax, civil, or criminal).
  - Controlling group= observations from primary-papers focusing on mixed sample of courts (i.e. tax &civil; civil & criminal) or on the national judicial system as a whole

Variables: Country Observables

- Log(GDP per capita)

Source: World Bank

- Legal system (average of several indicators)

Source: Global Competitiveness Report (World Economic Forum)

- Protection of property rights

This component is from the question: “Property rights, including over financial assets, are poorly defined and not protected by law (= 1) or are clearly defined and well protected by law (= 7).”

- Impartial courts

This component is the question: “The legal framework in your country for private businesses to settle disputes and challenge the legality of government actions and/or regulations is inefficient and subject to manipulation (= 1) or is efficient and follows a clear, neutral process (= 7).”

Controlling for publication bias

Variables	Model 1
Constant	0.8456***
1/S	0.0003***
Year of publication	
D_pub	
D_param	
D_panel	
D_Europe	
log(dim)	
log(size)	
Observations	241

There is publication bias

It's a robust result, whatever the MRA specification

1) RESULTS (STUDY DESIGN)

Variables	Model 1	Model 2
Constant	0.8456***	9.7768***
1/S	0.0003***	0.0003***
Year of publication		**-0.0045*** **
D_pub		**0.1617*** **
D_param		
D_panel		
D_Europe		
log(dim)		
log(size)		
Observations	241	241

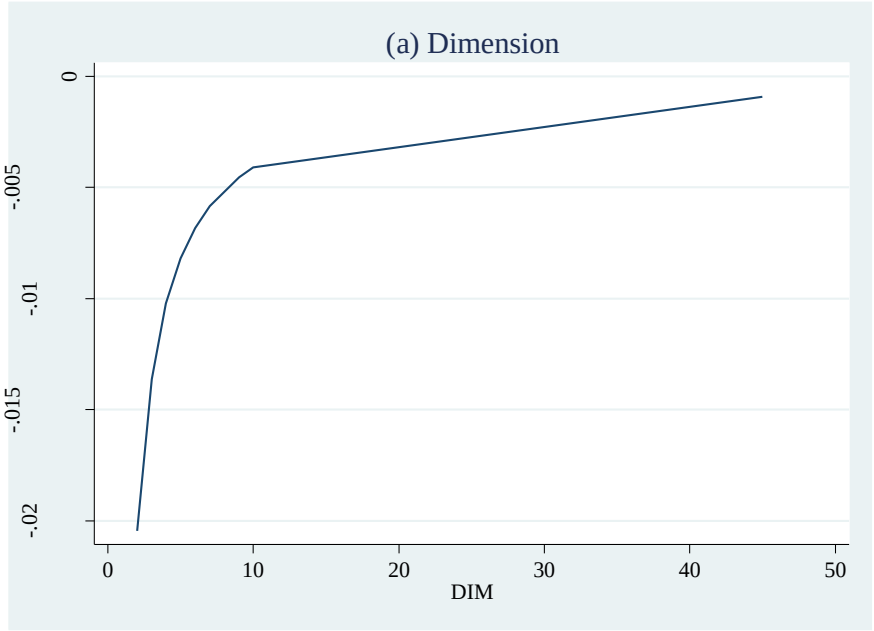
1) RESULTS (STUDY DESIGN)

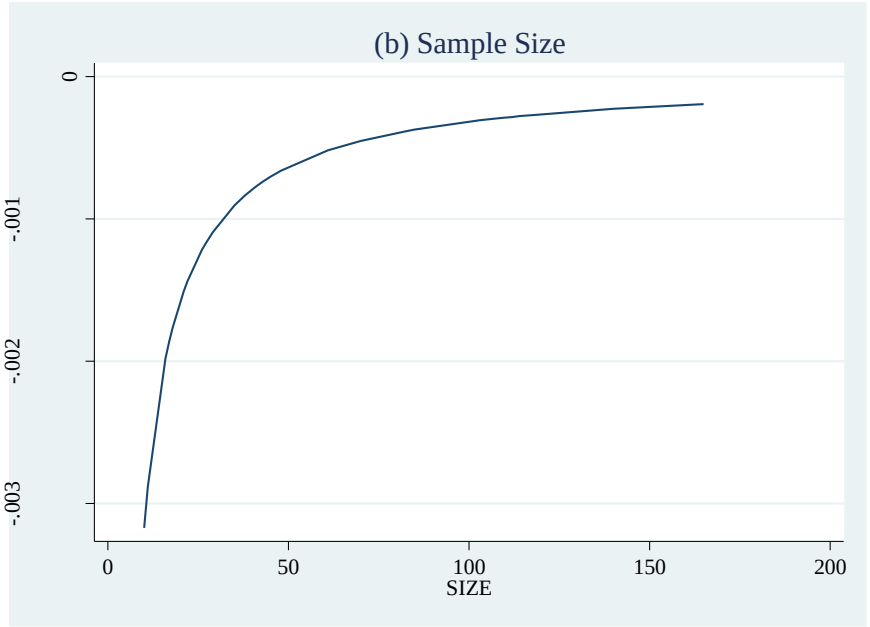
Variables	Model 1	Model 2	Model 3
Constant	0.8456***	9.7768***	13.1444***
1/S	0.0003***	0.0003***	0.0002***
Year of publication		-0.0045***	-0.0062***
D_pub		0.1617***	0.1377***
D_param			**0.1002*** **
D_panel			0.0040
D_Europe			0.0118
log(dim)			
log(size)			
Observations	241	241	241

1) RESULTS (STUDY DESIGN)

Variables	Model 1	Model 2	Model 3	Model 4
Constant	0.8456***	9.7768***	13.1444***	13.6029***
1/S	0.0003***	0.0003***	0.0002***	0.0001***
Year of publication		-0.0045***	-0.0062***	-0.0063***
D_pub		0.1617***	0.1377***	0.1582***
D_param			0.1002***	0.1155***
D_panel			0.0040	0.0075
D_Europe			0.0118	0.0123
log(dim)				**-0.0309***
log(size)				**-0.0389****
Observations	241	241	241	241

Marginal effect DIMENSION and SIZE (Model 4)





2) RESULTS (JUDICIALS' SPECIFIC VARIABLES)

Variables	Model 4	Model 5
Constant	13.6029***	16.5522***
1/S	0.0001***	0.0001***
Year of publication	-0.0063***	-0.0078***
D_pub	0.1582***	0.1444***
D_param	0.1155***	0.1247***
D_panel	0.0075	-0.0215
D_Europe	0.0123	-0.0003
log(dim)	-0.0309*	-0.0231
log(size)	-0.0389***	-0.0399***
D_specialized court		**0.0527*** **
D_first Instance		
Observations	241	241

2) RESULTS (JUDICIALS' SPECIFIC VARIABLES)

Variables	Model 4	Model 5	Model 6
Constant	13.6029***	16.5522***	14.8513***
1/S	0.0001***	0.0001***	0.0001***
Year of publication	-0.0063***	-0.0078***	-0.0070***
D_pub	0.1582***	0.1444***	0.1683***
D_param	0.1155***	0.1247***	0.1145***
D_panel	0.0075	-0.0215	-0.0071
D_Europe	0.0123	-0.0003	-0.0070
log(dim)	-0.0309*	-0.0231	-0.0494**
log(size)	-0.0389***	-0.0399***	-0.0309***
D_specialized court		0.0527***	
D_first Instance			0.0706**
Observations	241	241	241

2) RESULTS (JUDICIALS' SPECIFIC VARIABLES)

Variables	Model 4	Model 5	Model 6
Constant	13.6029***	16.5522***	14.8513***
1/S	0.0001***	0.0001***	0.0001***
Year of publication	-0.0063***	-0.0078***	-0.0070***
D_pub	0.1582***	0.1444***	0.1683***
D_param	0.1155***	0.1247***	0.1145***
D_panel	0.0075	-0.0215	-0.0071
D_Europe	0.0123	-0.0003	-0.0070
log(dim)	-0.0309*	-0.0231	-0.0494**
log(size)	-0.0389***	-0.0399***	-0.0309***
D_specialized court		0.0527***	
D_first Instance			**0.0706****
Observations	241	241	241

2) RESULTS (JUDICIALS' SPECIFIC VARIABLES)

Variables	Model 4	Model 5	Model 6	Model 7
Constant	13.6029***	16.5522***	14.8513***	17.8455***
1/S	0.0001***	0.0001***	0.0001***	0.0001***
Year of publication	-0.0063***	-0.0078***	-0.0070***	-0.0085***
D_pub	0.1582***	0.1444***	0.1683***	0.1542***
D_param	0.1155***	0.1247***	0.1145***	0.1237***
D_panel	0.0075	-0.0215	-0.0071	-0.0370*
D_Europe	0.0123	-0.0003	-0.0070	-0.0204
log(dim)	-0.0309*	-0.0231	-0.0494**	-0.0409**
log(size)	-0.0389***	-0.0399***	-0.0309***	-0.0317***
D_specialized court		0.0527***		**0.0531*** **
D_first Instance			0.0706**	**0.0719** **
Observations	241	241	241	241

3) RESULTS (COUNTRIES OBSERVABLES)

Variables	Model 8
Constant	12.5962***
1/S	0.00003***
Year of publication	-0.0061***
D_pub	0.1714***
D_param	0.1032***
D_panel	-0.0339*
D_Europe	0.0089
log(dim)	-0.0356*
log(size)	-0.0190***
D_specialized court	0.0460***
D_first Instance	0.1202***
log(GDP per capita)	**0.0361****
Legal system quality	
Prot. of property rights	
Impartial courts	
Observations	230

3) RESULTS (COUNTRIES OBSERVABLES)

Variables	Model 8	Model 9
Constant	12.5962***	13.3418***
1/S	0.00003***	0.00002***
Year of publication	-0.0061***	-0.0065***
D_pub	0.1714***	0.1818***
D_param	0.1032***	0.1229***
D_panel	-0.0339*	-0.0394**
D_Europe	0.0089	0.0039
log(dim)	-0.0356*	-0.0345*
log(size)	-0.0190***	-0.0181***
D_specialized court	0.0460***	0.0375**
D_first Instance	0.1202***	0.1092***
log(GDP per capita)	0.0361**	**0.0481*** **
Legal system quality		**-0.0135***
Prot. of property rights		
Impartial courts		
Observations	230	228

3) RESULTS (COUNTRIES OBSERVABLES)

Variables	Model 8	Model 9	Model 10
Constant	12.5962***	13.3418***	12.8226***
1/S	0.00003***	0.00002***	0.00002***
Year of publication	-0.0061***	-0.0065***	-0.0062***
D_pub	0.1714***	0.1818***	0.1780***
D_param	0.1032***	0.1229***	0.1180***
D_panel	-0.0339*	-0.0394**	-0.0373**
D_Europe	0.0089	0.0039	0.0028
log(dim)	-0.0356*	-0.0345*	-0.0332*
log(size)	-0.0190***	-0.0181***	-0.0182***
D_specialized court	0.0460***	0.0375**	0.0377**
D_first Instance	0.1202***	0.1092***	0.1107***
log(GDP per capita)	0.0361**	0.0481***	0.0449***
Legal system quality		-0.0135*	
Prot. of property rights			**-0.0081***
Impartial courts			
Observations	230	228	230

RESULTS

Variables	Model 8	Model 9	Model 10	Model 11
Constant	**12.5962*** **	**13.3418*** **	**12.8226*** **	**3.1118**
1/S	0.00003***	0.00002***	0.00002***	0.00001*
Year of publication	-0.0061***	-0.0065***	-0.0062***	-0.0014
D_pub	0.1714***	0.1818***	0.1780***	0.1956***
D_param	0.1032***	0.1229***	0.1180***	0.1468***
D_panel	-0.0339*	-0.0394**	-0.0373**	-0.0611***
D_Europe	0.0089	0.0039	0.0028	-0.0163
log(dim)	-0.0356*	-0.0345*	-0.0332*	-0.0439**
log(size)	-0.0190***	-0.0181***	-0.0182***	-0.0174**
D_specialized court	0.0460***	0.0375**	0.0377**	0.0419*
D_first Instance	0.1202***	0.1092***	0.1107***	0.0886*
log(GDP per capita)	0.0361**	0.0481***	0.0449***	0.0376**
Legal system quality		-0.0135*		
Prot. of property rights			-0.0081*	
Impartial courts				**-0.0122*** **
Observations	230	228	230	199

RESULTS

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Constant	12.5962***	13.3418***	12.8226***	3.1118
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Year of publication	-0.0061***	-0.0065***	-0.0062***	-0.0014
D_pub	**0.1714*** **	**0.1818*** **	**0.1780*** **	**0.1956*** **
D_param	**0.1032*** **	**0.1229*** **	**0.1180*** **	**0.1468*** **
D_panel	**-0.0339***	**-0.0394****	**-0.0373****	**-0.0611*** **
D_Europe	0.0089	0.0039	0.0028	-0.0163
log(dim)	-0.0356*	-0.0345*	-0.0332*	-0.0439**
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log(dim)	**-0.0356***	**-0.0345***	**-0.0332***	**-0.0439****
log(size)	**-0.0190*****	**-0.0181*****	**-0.0182*****	**-0.0174****
D_specialized court	0.0460***	0.0375**	0.0377**	0.0419*
D_first Instance	0.1202***	0.1092***	0.1107***	0.0886*
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Legal system quality		-0.0135*		
Prot. of property rights			-0.0081*	
Impartial courts				**-0.0122*****
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Year of publication	-0.0061***	-0.0065***	-0.0062***	-0.0014
D_pub	0.1714***	0.1818***	0.1780***	0.1956***
D_param	0.1032***	0.1229***	0.1180***	0.1468***
D_panel	-0.0339*	-0.0394**	-0.0373**	-0.0611***
D_Europe	0.0089	0.0039	0.0028	-0.0163
log(dim)	-0.0356*	-0.0345*	-0.0332*	-0.0439**
log(size)	-0.0190***	-0.0181***	-0.0182***	-0.0174**
D_specialized court	**0.0460*** **	**0.0375** **	**0.0377** **	**0.0419***
D_first Instance	**0.1202*** **	**0.1092*** **	**0.1107*** **	**0.0886***
log(GDP per capita)	0.0361**	0.0481***	0.0449***	0.0376**
Legal system quality		-0.0135*		
Prot. of property rights			-0.0081*	
Impartial courts				**-0.0122*** **
Observations	230	228	230	199

RESULTS

Variables	Model 8	Model 9	Model 10	Model 11
Constant	12.5962***	13.3418***	12.8226***	3.1118
1/S	0.00003***	0.00002***	0.00002***	0.00001*
Year of publication	-0.0061***	-0.0065***	-0.0062***	-0.0014
D_pub	0.1714***	0.1818***	0.1780***	0.1956***
D_param	0.1032***	0.1229***	0.1180***	0.1468***
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Results in brief

- Parametric methods yield higher levels of efficiency than nonparametric studies
- Published papers yield higher levels of efficiency than nonpublished studies
- Efficiency in paper using panel data is lower than papers based on cross sectional data
- Efficiency decreases with the number of inputs and outputs (the marginal effect decreases as the dimension increases)
- The heterogeneity in results is significantly dependent on the sample size used in primary papers
- When focusing on a given court-type, the results are, on average, higher than those from papers analysing the judicial system as a whole or combining different types of courts (civil&criminal; civil & tax)
- Papers on first instance judgment yield on average higher efficiency scores focusing on appeal courts

Caveats and Insights for future work

- While results are robust to different samples of observations, the study has some limitations depending on data quality. Many primary papers do not report any detail regarding their empirical setting. There is much hidden information, thereby impeding replicability
- A lesson that we have learnt is that it is a good practice for primary papers to provide full explanations, not only so that readers are informed concerning each single study, but also because it would help the understanding of some key issues in the efficiency literature
- For instance, it would be valuable for academics to know if heterogeneity in judicial efficiency might be explained by orientation in technology (input- *vs* output-oriented models)

Caveats and Insights for future work

- Similarly, the data available from published papers signal that there has been a predominance of nonparametric techniques (DEA in particular), whereas the parametric approach is disregarded by scholars
- There is also a need for more variability in the geographical distribution of efficiency papers. Despite the importance of judicial system, only 37 studies were identified in 3 decades of research. This does not reflect the relevance of the matter over the world. A recommendation of this MRA is that future studies focus more on estimating frontiers of courts in other countries that have so far received little attention in the literature (Japan, USA, Germany, UK)
- Researchers might address these issues in future work by performing a new MRA. However, this is feasible only if primary papers provide more detailed information than those used in this meta-study

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