

Measuring efficiency of Brazilian courts: one decade later*

Medindo a eficiência dos tribunais brasileiros: uma década depois

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ABSTRACT

The Judiciary is perhaps one of the most scrutinized political institutions in Brazil. Its credibility, independence and efficiency are considered to have crucial impacts on social, political and economic outcomes. This paper aims at measuring (in)efficiency of the Brazilian Judiciary and its dynamism in recent years (2009-2015). We use DEA (Data Envelopment Analysis) and the Malmquist index to evaluate efficiency and productivity change in Brazilian courts. Our results show that, more than a decade after the Conselho Nacional de Justiça's (CNJ) first attempts to publicize judicial statistics in the beginning of the year 2000, local courts have substantially improved the discipline and the quality of data production and collection. Yet, there is still much room for progress. In terms of productivity, the picture has not changed much; also, the Malmquist indexes showed little improvement throughout the years.

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KEYWORDS

Efficiency, productivity — Judiciary — Data Envelopment Analysis (DEA) — Conselho Nacional de Justiça (CNJ)

RESUMO

O Judiciário é, talvez, uma das instituições políticas mais escrutinadas no Brasil. Sua credibilidade, independência e eficiência têm impactos cruciais nos resultados sociais, políticos e econômicos. Este trabalho visa medir a (in)eficiência do Judiciário brasileiro e sua dinâmica nos últimos anos (2009-15). Utilizamos a Análise Envoltória de Dados — Data Envelopment Analysis (DEA) e o Índice de Malmquist para avaliar a eficiência e a mudança de produtividade nos tribunais. Nossos resultados mostram que, mais de uma década depois das primeiras divulgações de estatísticas pelo Conselho Nacional de Justiça (CNJ), os tribunais locais melhoraram substancialmente a disciplina e a qualidade da produção e coleta de dados. Mas há ainda muito espaço para progresso. Em termos de produtividade, a situação não mudou muito; também os Índices de Malmquist apresentaram pouca evolução ao longo dos anos.

PALAVRAS-CHAVE

Eficiência — produtividade — Judiciário — Análise Envoltória de Dados (DEA) — Conselho Nacional de Justiça (CNJ)

1. Introduction

It is common for developing countries to present weak institutions, which usually lack credibility, independence, transparency and/or, especially, efficiency. The prevalence of such institutions is, according to institutional scholars (e.g., North, 1991;¹ Acemoglu and Robinson, 2012),² one of the main reasons why countries remain underdeveloped.

The Judiciary is one of the most scrutinized of these institutions. A lengthy literature shows evidence of the nexus of judicial inefficiency on economic and

¹ North, Douglass C. Institutions. *Journal of Economic Perspectives*, v. 5, n. 1, p. 97-112, 1991.

² ACEMOGLU, Daron; ROBINSON, James A. *Why nations fail: the origins of power, prosperity, and poverty*. New York: Crown Business, 2012.

social outcomes. This paper aims to measure (in)efficiency of the Brazilian Judiciary and its dynamism in recent years (2009-15). It has been roughly one decade after the National Council of Justice (CNJ) first made available the data necessary for this kind of investigation. We use Data Envelopment Analysis (DEA), and more specifically, the Malmquist index approach, to analyze the efficiency and productivity change in Brazilian courts during this period. Results of this current article may help evaluate whether these recent efforts were useful (somehow) to improve judicial productivity in Brazil. The discussion may be fruitful for scholars, magistrates, lawyers, or anyone interested in better understanding the Brazilian Judiciary.

This paper is divided into five sections, including this introduction. Section 2 briefly reviews the literature on the impacts of judicial efficiency in the economy and also the DEA methodology applied to courts in Brazil. Section 3 is our section on methodology and data. We carefully describe this methodology, the data source employed, and the variable construction. In Section 4, we present the DEA results, the efficiency scores and the Malmquist Productivity Index. We close this section with a brief but important discussion relating judicial efficiency and judicial quality. Finally, in section 5 we conclude the paper with some final remarks.

2. Judicial efficiency applied to Judiciary and to Brazilian courts

A lengthy literature shows empirical evidence of the manner by which judicial inefficiency impact economic and social outcomes.

Weder (1995)³ focuses his analysis on Latin America. His results, based on data collected in interviews with entrepreneurs, show that 23% of the variation in per capita growth could be explained by the functioning of the Judiciary. It is clear that courts that are efficient and make decisions in a secure manner do bring higher level of economic growth.

In a comprehensive study on the literature of the determinants of judicial efficiency, Voigt (2016)⁴ made a summary of the empirical results found by

³ Weder, Beatrice. Legal systems and economic performance: the empirical evidence. In: ROWAT, M. et al. (Coord.). *Judicial reform in Latin America and the Caribbean — Proceedings of a World Bank Conference. World Bank Technical Paper Number 280*. Washington, DC: The World Bank, 1995.

⁴ Voigt, Stefan. Determinants of judicial efficiency: a survey. *European Journal of Law and Economics*, v. 42, n. 2, p. 183-208, 2016.

several studies, from all over the world. The author starts with a definition of what constitutes efficiency:

Efficiency prevails when a given output is realized with minimum input or a maximum output is produced with a given amount of inputs ... Evaluating the efficiency of the judiciary presupposes the measurability of judicial output. What are the relevant output dimensions? ... Landes and Posner (1979)⁵ pointed out that the judicial system produces two goods, namely a private and a public one. The private good is the decision concerning an individual case whereas the public good refers to the information contained in a decision that can be relied upon by anybody finding herself in a situation similar to the one decided upon by the courts. (p. 185)

These are the assumptions which the literature on judicial efficiency is usually build upon. Overall, empirical evidence from these works discussed by Voigt may be summarized into four groups of findings. First, average efficiency varies significantly within countries; interestingly, if efficiency is measured by court delay, it does not increase with the number of judges employed. Also, there seems to be some sort of outside pressure leading to higher judicial productivity. Moreover, the quality of procedural law is correlated with judicial efficiency: the more complex the procedures, the longer are court delays, and the less efficient are courts. Finally, there does not seem to be significant correlation between judicial efficiency and quality, as measured by reversal rates in higher courts.

In Brazil, there were some attempts to quantitatively measure judicial efficiency since the beginning of year 2000. For instances, Souza and Schwengber (2005)⁶ use the methodology of Nonparametric FDH (Free Disposal Hull) to estimate efficiency of local courts in the state of Rio Grande do Sul. By using a data set of 161 first-degree courts from the Southern state of Rio Grande do Sul, the authors analyze the number of new cases, settled cases, pending

⁵ LANDES, William; POSNER, Richard. Adjudication as a private good. *Journal of Legal Studies*, v. 8, p. 235-284, 1979.

⁶ Sousa, Maria C. S.; SCHWENGBER, Silvana B. Efficiency estimates for judicial services in Brazil: nonparametric FDH and the expected order-m efficiency scores for Rio Grande do Sul courts. In: ENCONTRO DA ASSOCIAÇÃO NACIONAL DE PESQUISAS EM ECONOMIA (ANPEC), XXXIII, Natal, 2005. *Anais do XXXIII Encontro Nacional de Economia*. Natal: Anpec, 2005. Disponível em: <<https://ideas.repec.org/p/anp/en2005/053.html>>.

cases and backlog in years 2002 and 2003. They find that small courts tend to be less efficient, as compared to larger courts, due to the economies of scale and of specialization. This result may be shown, according to the authors, by the higher average costs and higher reducible backlog characterizing smaller courts.

To our knowledge, the first attempts applying Data Envelopment Analysis (DEA) to courts in Brazil were Yeung and Azevedo (2011)⁷ and Fochezatto (2010).⁸ DEA methodology (as will be further explained in Section 3 below) is based on the construction of efficiency frontiers. An observer evaluates several units of production with respect to their relative efficiencies: the most efficient ones will, by definition, lay on the production frontier; all others lay away from the frontier. Both articles evaluate data on Brazilian State Courts: the former, of year 2006, and the latter, of years 2005 to 2008. Inputs and outputs used to measure efficiency vary slightly: while Yeung and Azevedo (2011) evaluates only number of magistrates and judicial staff — as inputs, and number of settled cases in the first-level and second-level courts — as outputs, Fochezatto (2010) includes four inputs and four outputs: per capita judicial expenditure, number of magistrates, total number of judicial staff, and number of personal computers — as inputs, and settled cases in the first level courts, published decisions in the second-level courts, total number of settled cases (first and second-degree) and, finally, settled cases in the small claims courts (*juizados especiais*) — as outputs. Both articles find similar results: a significant variation in the level of efficiency across the 27 Brazilian State Courts. Yeung and Azevedo (2011) highlights the importance of court management in the observed outcome. Fochezatto (2010), in his turn, observes a slight decline in the level of efficiency throughout the timeframe of his research.

Since then, several papers — published either nationally or abroad — employed the same approach, for instances: Nogueira et al (2012),⁹ Yeung

⁷ Yeung, Luciana L.; AZEVEDO, Paulo F. Measuring efficiency of Brazilian courts with data envelopment analysis (DEA). *IMA Journal of Management Mathematics*, v. 22, n. 4, p. 343-356, 2011.

⁸ Fochezatto, Adelar. Análise da eficiência relativa dos Tribunais da Justiça estadual brasileira utilizando o método DEA. In: Reunión de Estudios Regionales, AEER (International Meeting on Regional Science), XXXVI, 2010, Badajoz-Elvas, Spain. Disponível em: <<https://old.aeer.org/web/congresos/2010/htdocs/pdf/p50.pdf>>.

⁹ Nogueira, José M. M. et al. Estudo exploratório da eficiência dos Tribunais de Justiça estaduais brasileiros usando a Análise Envolvória de Dados (DEA). *Revista de Administração Pública*, v. 46, n. 5, p. 1317-340, set./out. 2012.

and Azevedo (2012),¹⁰ Botelho (2016).¹¹ The exponential growth in the DEA literature in Brazil reflects the same international trend, as shown by Emrouznejad and Yang (2018).¹²

As notable as this literature has been so far, there was little concern about linking the measurement of efficiency with policies adopted either by the Conselho Nacional de Justiça (CNJ) and/or by courts themselves to improve these results. Most of the work done so far has been descriptive in nature, with little evaluation of what has been implemented concretely in practice. Thus, it is not surprising that perhaps all this literature has impacted very little in the improvement of judicial efficiency in the real life. This is what we will try to show in the following sections of this paper.

3. Methodology, data and variables

3.1 Methodology

We use Data Envelopment Analysis (DEA) to evaluate efficiency of Brazilian courts. DEA is a methodology of calculation of production frontiers; it derives from the concepts of microeconomic theory, and is a non-parametric, non-statistic, and non-stochastic, being based on linear optimization calculations — which greatly differs from traditional econometric models based on parametric, statistic and stochastic assumptions.¹³

DEA differs from most parametric models in a significant manner, because it does not assume direct *a priori* knowledge of the production function. It identifies the best performers in a sample of observed units, creates a frontier based on the top performers, and then, evaluates the performance of all other

¹⁰ YEUNG, Luciana L.; AZEVEDO, Paulo F. Além dos “achismos” e das evidências anedóticas: medindo a eficiência dos tribunais brasileiros. *Economia Aplicada*, v. 16, n. 4, p. 643-663, 2012.

¹¹ BOTELHO, Martinho M. A eficiência judicial da justiça comum estadual no Brasil: uma análise jurimétrica pelo método DEA. *Revista de Processo, Jurisdição e Efetividade da Justiça*, v. 2, n. 1, p. 92-110, 2016.

¹² EMROUZNEJAD, Ali; YANG, Guo-liang. A survey and analysis of the first 40 years of scholarly literature in DEA: 1978-2016. *Socio-Economic Planning Sciences*, v. 61, n. 1, p. 1-5, 2018.

¹³ Parametric, statistic and stochastic assumptions derive from the classical statistical theories for large size sample observations. They may be summarized (but not limited) to normality of the data distribution, homogeneity in the data variance and independence of errors observed. These are fundamental assumptions for most of the traditional econometric work, based on the estimation of causality regressions. DEA, thus, is a methodology that relaxes most of these assumptions.

units by measuring their distance to the frontier. This is very different to what statistic regression models do, since these latter calculate an “average” behavior or a central tendency. As Cooper et al (2007)¹⁴ show, the difference of the DEA approach creates different efficiency evaluations and also generates different policy and management recommendations. Specifically, DEA highlights the best performers as potential benchmarks. Regression models, on the other hand, are not able to do so, since they lose information of individual units.

DEA has been commonly used to measure the efficiency in the production of non-traditional firms, such as those in public sector. In fact, the first paper introducing the DEA methodology was that of Charnes, Cooper and Rhodes, in 1978, in which the authors aimed at “evaluating activities of not-for-profits entities participating in public programs” (p. 429). Since then, scholars have used DEA for many different sectors, mainly due to some attractive features that make it very appropriate for analyzing non-traditional firms. First, it is difficult to accurately model the production function in these cases, and it is even harder to confidently assume knowledge of the distribution of the error term. This makes parametric methods, such as regression models and stochastic frontiers, unsuited for adequate analysis. Some studies (e.g., Souza, 2001)¹⁵ suggest that DEA has other advantages for the analysis of public and not-for-profit sectors, for instances, not needing to stipulate input and output market prices nor the assumption of profit maximization. Under such circumstances — which seem to be exactly the case of the Judiciary — DEA is the most appropriate methodology. It is not surprising that DEA has been commonly used for measuring court efficiency. A brief survey shows that many papers in the literature around the world employ DEA for the analysis of court efficiency (as shown in Appendix 5).¹⁶

Differences in the many DEA models may be summarized as related to: (i) assumptions of returns to scale (variable or constant returns to scale), (ii) input and/or output orientations, and, (iii) models of variable returns to scale, as being radial or non-radial metrics. Charnes et al (1994)¹⁷ point out

¹⁴ COOPER, William W.; SEIFORD, Lawrence M.; TONE, Kaoru. *Data Envelopment Analysis: a comprehensive text with models, applications, references and DEA-Solver software*. 2. ed. New York: Springer Science Business Media, LLC, 2007.

¹⁵ SOUZA, Geraldo S. Statistical properties of Data Envelopment Analysis estimators of production functions. *Brazilian Review of Econometrics*, v. 21, n. 2, p. 291-322, nov. 2001.

¹⁶ For an updated version of this survey, request is possible by e-mail to this author.

¹⁷ CHARNES, Abraham et al. (Ed.). *Data Envelopment Analysis — theory, methodology, and applications*. Norwell: Kluwer Academic Publishers, 1994.

that the envelopment frontier is identical in all cases, but the projection point, i.e., the basis of comparison for an inefficient unit (about which we will discuss later), is different across the models.

The DEA model employed here is the one originally developed by Charnes et al. (1978),¹⁸ known as the CCR model, which assumes constant returns to scale (CRS). Although there is no definitive consensus in the literature about this choice for judicial courts (Voigt, 2016),¹⁹ the assumption of constant returns to scale is not unfounded. Both Dalton and Singer (2014),²⁰ in the United States, and Kittelsen and Førsund (1992),²¹ in Norway, found that increasing returns to scale only appears in very small courts, those which handle less complex cases. In Spain (a civil law country, similarly to Brazil) Pedraja-Chaparro and Salinas-Jiménez (1996)²² regressed efficiency scores on size and found no significant results in the coefficients. Our base paper for Brazil, Yeung and Azevedo (2011),²³ did the same exercise, and also found no significant coefficients of the impact of size of courts to efficiency scores.

DEA employed here is, furthermore, output oriented; in other words, it analyses by how much a court can increase the level of output, while maintaining a constant level of inputs. The alternative choice would be an *input-oriented DEA*, which in turn analyses how much input the court could save, while maintaining a constant level of output. Due to the legal impossibility of Brazilian courts to freely adjust the level of inputs employed (judges, staff, etc.), the output-oriented model seems to be more adequate.

As for the dynamic analysis, of the productivity evolution throughout the time, we use the methodology of Malmquist Productivity Index (MPI), which enables us to analyze changes in the components of technical efficiency — i.e., pure efficiency and scale efficiency — and changes in technology.

¹⁸ CHARNES, Abraham; COOPER, William W.; RHODES, Edward. Measuring the efficiency of decision-making units. *European Journal of Operational Research*, v. 2, p. 429-444, 1978.

¹⁹ Stepan Voigt, *Determinants of judicial efficiency: a survey*, op. cit.

²⁰ DALTON, Teresa; SINGER, Jordan M. Bigger isn't always better: an analysis of court efficiency using hierarchical linear modeling. *Pace L. Rev.*, v. 34, p. 1169, 2014.

²¹ Kittelsen, Sverre A. V.; FØRSUND, Finn R. Efficiency analysis of Norwegian district courts. *The Journal of Productivity Analysis*, v. 3, p. 277-306, 1992.

²² PEDRAJA-CHAPARRO, Francisco; SALINAS-JIMÉNEZ, Javier. An assessment of the efficiency of Spanish Courts using DEA. *Applied Economics*, v. 28, p. 1391-1401, 1996.

²³ Luciana L. Yeung and Paulo F. Azevedo, Measuring efficiency of Brazilian courts with data envelopment analysis (DEA), op. cit.

3.2 Data and variables

Data for the DEA analysis comes from “Justiça em números”²⁴ (Justice in Numbers), the report annually published by the National Council of Justice (CNJ). This council was created in 2003, as part of a larger institutional reform of the Brazilian Judiciary, which aimed at improving efficiency. One of the tasks CNJ was to collect, monitor and publish statistics by all branches of the judicial system. Since the publication of the first “Justiça em números”, in 2004, several improvements have been made, mostly to make it more accessible to common citizens (not only scholars or law practitioners), and to present, in a more explicit manner, information related to efficiency, such as the duration of an average lawsuit, the percentage of appeals and amendments by the superior courts, etc.

We use data on state courts, both local level and second-level, appellate courts. According to “Justiça em números 2016”, these courts concentrated 69.4% of all new lawsuits in the country; they also hold 79.9% of all pending cases in the Brazilian Judiciary. There are 27 Federal Unities in the country, and therefore, 27 State Courts, which are the Decision Making Units (DMUs) in our study.

Two inputs were used: the number of judges and the number of judicial staff in each State Court. Output is the sum of the numbers of decisions held in the first- and second-level courts. Following Yeung and Azevedo (2011),²⁵ we also weighted the inputs and output of each State Court by its workload, i.e., divided inputs and outputs by the sum of new cases of the current year, and pending cases from the previous year. The main reason to do so is the high concentration of population, economic activity, and litigation in Brazil. As explained by those authors, not taking into account the striking differences between the Federal Unities could lead to bias,

since courts in which there is a heavier workload could automatically be identified as efficient units simply because they produce more absolute amount of outputs. Furthermore, the simplest concept of efficiency, given by the productivity ratio, also requires some sort of weighting... (p. 347)

²⁴ CONSELHO NACIONAL DA JUSTIÇA (CNJ). *Justiça em números*. Brasília, 2010 a 2016. Disponível em: <www.cnj.jus.br/publicacoes>.

²⁵ Ibid.

After weighting is done, to avoid very small decimal numbers, inputs were multiplied by 100,000 and output by 100. In Appendix 2, we present the data effectively used to run the DEA analysis for year 2015.

4. Results and discussions

4.1 DEA 2009 to 2015, as compared to previous results

a) Efficiency measures. First, let us look at the results on table 1, the efficiency scores from year 2009 to 2015:

Table 1
Efficiency Scores (2009-15)

STATE (DMU)	2009	2010	2011	2012	2013	2014	2015
Acre	0.400	0.451	0.526	0.320	0.381	0.307	0.313
Alagoas	0.527	0.418	0.323	0.502	0.524	0.360	0.622
Amapá	0.198	0.181	0.210	0.236	0.259	0.238	0.349
Amazonas	0.433	0.398	0.624	0.760	0.771	0.493	0.175
Bahia	0.214	0.263	0.295	0.298	0.261	0.255	0.228
Ceará	0.384	0.434	0.252	0.345	0.301	0.408	0.503
Distrito Federal	0.356	0.382	0.454	0.425	0.424	0.431	0.547
Espírito Santo	0.249	0.283	0.426	0.412	0.447	0.401	0.519
Goiás	0.606	0.434	0.564	0.769	0.694	0.663	0.539
Maranhão	0.206	0.164	0.290	0.380	0.277	0.271	0.600
Mato Grosso	0.353	0.274	0.379	0.406	0.417	0.538	0.558
Mato Grosso do Sul	0.956	0.849	0.665	0.670	0.567	0.555	0.643
Minas Gerais	0.491	0.476	0.551	0.625	0.548	0.529	0.689
Pará	1.000	0.991	0.614	0.472	0.734	0.752	0.333
Paraíba	0.319	0.302	0.436	0.315	0.275	0.317	0.302
Paraná	0.992	0.827	0.716	0.639	0.518	0.585	0.932
Pernambuco	0.365	0.378	0.448	0.400	0.589	0.429	0.350
Piauí	0.175	0.178	0.191	0.260	0.270	0.249	0.278
Rio de Janeiro	0.885	1.000	1.000	1.000	1.000	1.000	1.000
Rio Grande do Norte	0.290	0.292	0.276	0.293	0.286	0.317	0.287
Rio Grande do Sul	0.961	1.000	1.000	1.000	1.000	1.000	1.000
Rondônia	0.476	0.306	0.475	0.494	0.524	0.543	0.543
Roraima	0.276	0.224	0.262	0.265	0.299	0.434	0.732
Santa Catarina	0.659	0.697	0.743	0.759	0.671	0.566	0.657
São Paulo	1.000	0.613	0.860	0.776	0.664	0.717	0.873
Sergipe	0.504	0.583	0.458	0.555	0.710	0.685	0.362
Tocantins	0.092	0.257	0.307	0.299	0.343	0.441	0.350

Source: Author's own calculation.

No DMU was on the efficiency frontier during all seven years of the period analyzed; yet, two units were very close to it: the State Courts of Rio de Janeiro and of Rio Grande do Sul. Both were away from the efficiency frontier only in the first year of the period analyzed (2009), and their distance was not far from it. Rio de Janeiro scored 0.885, and Rio Grande do Sul was even closer, 0.961. Yeung and Azevedo (2011),²⁶ analyzing data of 2008, the year immediately before the first observation in our panel, found that the only DMUs lying on the efficiency frontier were exactly these two units, the State Courts of Rio Grande do Sul and of Rio de Janeiro.

Some DMUs have consistently low scores throughout the period, most of them belonging to the poorer northern regions, such as Acre, Amapá, Bahia, Ceará, Maranhão, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, and Tocantins. Others, such as Espírito Santo (in the richer Southeast region) also have a long way towards the efficiency frontier. On the other hand, most of the richer southern states did perform well throughout the period: Rio de Janeiro, São Paulo, Paraná, Santa Catarina and Rio Grande do Sul. Future research should try to address whether judicial efficiency is correlated with per capita income. Voigt and El-Bialy (2016)²⁷ did not find this relationship for European countries.

(b) Peer groups and efficient units

DEA theory shows that, for each inefficient DMU, it is possible to derive an efficient projection onto the production frontier. This projection is not necessarily empirically observed but is constituted by a convex combination of efficient units effectively observed. Cooper et al. (2007)²⁸ warns that, if an efficient DMU does not appear many times as peer for others (as k), the result might not be reliable. Pedraja-Chaparro and Salinas-Jiménez (1996)²⁹ also affirm that only those efficient DMUs that appear many times in peer groups should be considered “genuinely efficient units”. For this reason, we present table 2, which examines how many times each efficient DMU shows up as peer for others, during this 7 year time period:

²⁶ Ibid.

²⁷ VOIGT, Stefan; EL-BIALY, Nora. Identifying the determinants of aggregate judicial performance: taxpayers’ money well spent? *European Journal of Law and Economics*, v. 41, n. 2, p. 283-319, 2016.

²⁸ William W. Cooper et al. *Data Envelopment Analysis*, op. cit.

²⁹ Francisco Pedraja-Chaparro and Javier Salinas-Jiménez, An assessment of the efficiency of Spanish Courts using DEA, op. cit.

Table 2
N. of times an efficient DMUs is peer to inefficient ones

	2009	2010	2011	2012	2013	2014	2015
Pará	23	***	***	***	***	***	***
São Paulo	23	***	***	***	***	***	***
Rio de Janeiro	***	20	20	21	21	21	15
Rio Grande do Sul	***	25	25	25	25	25	24

Source: Author's own calculation.

For each year during this time period, there were 25 inefficient DMUs. Except for the first year observed, during which it did not lay on the efficient frontier, the State Court of Rio Grande do Sul presents itself as peer for all inefficient units, but one, in 2015. Rio de Janeiro also did not appear as an efficient unit on 2009, from 2010 on, it always showed up as peer for the vast majority of inefficient units. This means that each of the 25 inefficient DMUs, from years 2010 to 2015, has an efficient projection composed by a convex combination of the data of Rio Grande do Sul and Rio de Janeiro. We may, with strong certitude, be sure about the DEA scores of this time period, especially for the case of these two DMU's.

It is still not sure why São Paulo and Pará appears only once as efficient units, during this 7-year time period. The State Court of São Paulo is, by far, the largest court in the country. According to the report "Justiça em números 2016", during year 2015, it encompassed more than 25 million cases, either new or pending ones. It is almost twice the size of the second largest court, the one of Rio de Janeiro, that had 13.6 million cases in that same year. With some degree of internal management, São Paulo could reach the efficient frontier, and the scores on table 1 show that: except for two years, its efficiency score was over 0.7. On the other hand, Pará seems to be an unexpected odd case. As for year 2015, it ranked 14th largest State Court (total = 27). As one can see from table 1, efficiency scores are not consistent. One may explain this fact after some in-depth analysis of the quality of the data, and/or of the qualitative descriptions about the situation in 2009, the year in which it appears as efficient. One need more research to explain this all.

(c) Actual versus target outputs, actual versus target inputs

One interesting feature of DEA is the possibility of getting target outputs and inputs and comparing them to the real values observed.

Let us make an exercise with one DMU, the State Court of São Paulo, the largest in the country, which, in year 2015, had a DEA score of 0.873. DEA results indicate that target output for this DMU is 19.47. Yet, because we have weighted all inputs and outputs before running DEA, we must now multiply target values by the respective weight of each state, i.e., the number of new and pending cases in each year. From table A2, one can see that, for the State Court of São Paulo, in year 2015, weight equals 24,771,652. Thus, multiplying 19.47 by 24,771,652 and subsequently dividing by 100 (reversing the operation described in section 3.2 above), one gets roughly 4,823,041. Again from table A2, effective output by this DMU was of 4,223,467. This means that, taking into account inputs effectively employed, the State Court of São Paulo lagged behind in approximately 599,574 decisions, as compared to its DEA target, or 14.2% of the total produced. In fact, this is a relatively positive result. The same exercise may be carried out for other inefficient DMUs.

One may do another similar exercise considering target inputs. We may do that for the State Court of Amazonas, the least efficient DMU in year 2015, with a score of only 0.175. Target inputs, calculated by DEA, is 56.77 for judges and 667.00 for judicial staff. Doing the reversal operation as described above (i.e., multiplying by its respective year 2015 weight, and then dividing by 100,000) one gets targets of 129.8 judges and 1,526.58 judicial employees. The effective numbers were, according to table A2, 178 judges and 1,526 employees. Therefore, taking into account the output produced, the State Court of Amazonas could have employed 48 judges less than it did effectively; judicial staff, on the other hand, was exactly on target. Unfortunately, for judicial courts in Brazil, the exercise of evaluating target inputs is merely theoretical, since as explained before, the definition of the numbers of judges and judicial employees are determined by law.

4.2 Malmquist indexes

Now, we may turn to a dynamic analysis of judicial efficiency in Brazilian State Courts, i.e., the evolution their productivity, as measured by the Malmquist Productivity Index (MPI). From the 27 units, only two presented all round productivity growth during the period of 2009-15: the State Court of Amapá, and that of Tocantins. Rio de Janeiro presented growth in all changes, except for pure efficiency change (PECH), which remained constant throughout the period. Yet, one should remember that we are, in this analysis,

employing the Constant Returns to Scale (CRS) perspective, therefore, the PECH indicator is not applicable here. In this sense, Rio de Janeiro can also be considered a unit that presented positive changes in all indicators.

As for the other units that were DEA efficient, Pará and São Paulo, presented decrease in *all* measures of the MPI. This means that, if these two units were efficient somehow and sometime in the past, they are quickly losing their positions, being surpassed by other units (for instances, Rio de Janeiro). Rio Grande do Sul, on the other hand, which was on the efficiency frontier from 2010 to 2015 alongside with Rio de Janeiro, presented growth in technical efficiency (EFFCH) and scale efficiency (SECH), but negative technical change (TECHCH), and more importantly, also negative total factor productivity change (TFPCH). Regress was low (of 1.2%), but if this trend continues, it may, sometime in the future, lose its position on the efficiency frontier, something it has granted throughout the last decade.

Table 3
Average productivity change, selected unities (2009-15)

STATE (DMU)	EFFCH	TECHCH	PECH	SECH	TFPCH
Amapá	1.099	1.009	1.096	1.003	1.109
Pará	0.833	0.962	0.858	0.970	0.801
Rio de Janeiro	1.021	1.001	1.000	1.021	1.022
Rio Grande do Sul	1.007	0.981	1.000	1.007	0.988
São Paulo	0.978	0.999	0.983	0.994	0.977
Tocantins	1.249	1.004	1.238	1.009	1.254

Source: Author's own calculation.

On table A3 (appendix), one might see the overall evolution during this 7 year-period. Average TFPCH was of 1.017, or 1.7% growth, with Pará presenting the largest regress (0.801) and Tocantins the largest progress. In fact, 15 units (out of 27) showed positive growth.

However, both TECHCH and SECH showed average negative growth during this period. TECHCH ranged from 0.954 in Paraná to 1.012 in Acre, with an average national score of 0.993. This aspect should be carefully dealt by court managers in Brazil. In recent years, much attention was given to initiatives that aimed at equipping courts with computers and at transforming all paper documents into electronic files. It seems, though, that this effort has not been translated into concrete technical changes, and thus,

has not effectively improved judicial efficiency. It is clear that Brazilian courts are still unable to achieve productivity growth by means of technological improvements, or by means of the better scale management. SECH, in its turn, ranged from 0.853 in the State Court of Amazonas, to 1.176 in Maranhão. These results indicate evidence that most State Courts in the country are showing decreases in returns to scale; thus, perhaps these units are facing decreasing returns to scale. Due to the many implications that the change of this perspective (from one of constant returns to scale) might cause, we will let future works to address this matter.

5. Conclusions

When the CNJ was created in 2003, one of its main goals was to boost efficiency of the Brazilian Judiciary. For this purpose, it mandated the collection and creation of several statistics by local courts, which were compiled in annual reports. More than one decade after the publication of the first report (2004), and several years after the first publications employing DEA to the Judiciary, there does not seem to be much concrete improvement in day-to-day efficiency in courts.

Most of the inefficient State Courts found by Yeung and Azevedo (2011)³⁰ remain so, several years later. The same two efficient units found by those authors remain on the efficiency frontier, except for the first year analyzed in this paper. The structure of high performers and low performers remained basically unchanged throughout most of the ten-year period.

Malmquist Productivity Index (MPI) shows even less exciting evidence: there were very modest changes during this time. Only two units presented productivity growth for the entire period analyzed. Average TFPCH was 1.017, or 1.7% growth; this is a small rate, but 15 units (out of 27) showed some positive change. On the other hand, TECHCH and SECH presented average negative growth. TECHCH across the 27 State Courts showed very small variations, an average of 0.993, or 0.7% negative growth per annum throughout the period. The problem of judicial inefficiency has been increasingly debated in the country, and the National Council of Justice (CNJ) has even chosen

³⁰ Luciana L. Yeung and Paulo F. Azevedo, *Measuring efficiency of Brazilian courts with data envelopment analysis (DEA)*, op. cit.

its improvement as one of the highest priorities for the Brazilian Judiciary; thus, this negative growth at the TECHCH is very worrisome. It seems that most efforts and resources dedicated to the modernization of Information Technology at judicial courts have not resulted in any concrete results. Productivity, as measured by changes in scale efficiency, have also been negative: SECH during this period averaged 0.996.

Was any of CNJ's efforts useful for improving efficiency in Brazilian courts? There seems to be so, in qualitative terms: as one may observe by looking at the "Justiça em números" reports year after year, local courts seem to have "learned" how to collect and organize their data. It is certain that the quality of data produced is much better than of ten years ago, when the first editions of the report (2004 to 2008) were published. However, there is still room for improvements. Even for the latest years of the time period covered in this paper, there were still some State Courts which did not present data on very basic statistics. Neither Amazonas nor Paraná presented official data on judicial outputs (decisions made at 2nd degree courts) for the year 2015; for the purposes of this paper, we had to estimate these variables in order to "fill the blanks" for the DEA analysis.³¹ Caution in the interpretation of the results for these two courts is advised.

Our final conclusion is that, although the literature on judicial efficiency, and very specifically on DEA measures, has blossomed in the last decade in Brazil, public managers, judges, and even CNJ itself, do not seem to have grasped the true value of efficiency analysis. Although the agenda for "efficiency boosting" seems to permeate throughout the entire Judiciary in the country, actions and policies have been taken by "trials and errors", without deep analysis of the real roots for the overall inefficiency. Efforts to implement Information Technology throughout the courts are examples of such actions. This is a dangerous path, because if practitioners feel that such initiatives are useless, they will be less and less convinced about the importance of improving efficiency in their daily routines. One positive example stands out, the same

³¹ These estimates were done by taking the average annual percentage increase from the previous year, and then applying it to the year before the one in which data was missing. For example: annual increase in the number of second-degree decisions in State Court of Amazonas, from year 2009 to 2014, was on average +45%. In year 2014, total number of second-degree decisions was 14,426, which summed with 45% resulted in an estimate of 20,882 cases for year 2015. This, summed with 19,825 cases decided in the first-degree, made up a total of 40,707 cases, which is exactly the number of outputs used for the State Court of Amazonas in 2015 (see Appendix 2).

one since the first study by Yeung and Azevedo (2011):³² the State Court of Rio de Janeiro, that since the beginning of the year 2000's has implemented a certification of ISO 9001, demonstrating its full commitment to efficiency in a very broad and deep manner. It is the only State Court in the country that, besides presenting perfect efficiency scores in six years of the panel, also showed positive productivity changes in every aspect, except PECH (in which it remained constant): its Total Factor Productivity Change in the seven-year time period was 1.022, or +2.2% annual increase. Certainly, this is a case for benchmark to other Brazilian courts.

We hope that, in the next 10 years, the literature on judicial efficiency keeps improving. However, it would be much more important to see all this academic research translated into real impacts on the daily functioning of judicial courts in Brazil.

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³² Luciana L. Yeung and Paulo F. Azevedo, Measuring efficiency of Brazilian courts with data envelopment analysis (DEA), op. cit.

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Appendix 1

Details of the variables analyzed

“Justiça em Números” provides a full range of variables and measures in a very detailed manner. Sometimes it was not straightforward which variable was the most suited for our analysis. Keeping our original goal in mind — to have a broad temporal analysis — we kept as closely as possible those variables analyzed by Yeung and Azevedo (2011), with some minor adjustments (due to changes brought by CNJ itself). The exact CNJ data we used for this paper was:

Inputs:

- “Servidores da Área Judicial”: the number of staff in the judicial area, as defined by CNJ.
- “Magistrados”: the number of judges officially allocated to that State Court, both at the first and the second degree.

Outputs:

- “Sentenças do 1º Grau”: Decisions granted at first degree courts.
- “Decisões Terminativas do 2º Grau”: Closing decisions granted at second degree courts. These are decisions to which no more appeals are possible at the second degree; any appeal, if allowed, is directed to 3rd degree (higher courts).

Weighting:

- “Casos Novos”: All new cases entering the State Court in a particular year.
- “Casos Pendentes”: The number of pending cases from the previous year, as appeared on December 31st.

Appendix 2

Table A2
Inputs and outputs (raw data) — Year 2015

UF	Input 1: N. Judges	Input 2: N. Staff	Outputs: Decisions from 1st and 2nd degree	Weights: New and Pending Cases
Acre	72	1,049	44,511	169,339
Alagoas	127	1,419	136,113	646,713
Amapá	69	865	43,729	201,235
Amazonas	178	1,526	40,707	228,873
Bahia	586	6,364	229,285	2,809,253
Ceará	385	3,747	290,934	1,527,443
Distrito Federal	328	5,142	358,935	959,704
Espírito Santo	343	3,419	270,434	1,707,994
Goiás	368	4,674	372,085	2,163,514
Maranhão	149	4,076	179,732	1,473,132
Mato Grosso	233	3,204	245,760	1,379,274
Mato Grosso do Sul	180	2,211	211,035	1,103,861
Minas Gerais	967	13,199	1,273,704	5,943,441
Pará	320	3,321	165,031	1,315,189
Paraíba	253	2,768	128,380	758,549
Paraná	819	6,836	996,306	4,093,071
Pernambuco	473	6,042	315,007	2,365,103
Piauí	158	1,830	80,344	604,601
Rio de Janeiro	782	12,758	1,658,856	13,325,954
Rio Grande do Norte	187	2,264	101,516	890,014
Rio Grande do Sul	729	8,441	1,311,035	4,499,102
Rondônia	139	1,917	140,134	509,427
Roraima	38	479	50,819	135,114
Santa Catarina	465	5,063	506,346	3,421,153
São Paulo	2,415	36,664	4,223,467	24,771,652
Sergipe	161	1,996	106,506	533,868
Tocantins	115	1,401	72,679	405,263

Appendix 3

Table A3
Average productivity change, Brazilian state courts (2009-15)

STATE (DMU)	EFFCH	TECHCH	PECH	SECH	TFPCH
Acre	0.960	1.012	0.966	0.994	0.971
Alagoas	1.028	1.002	1.044	0.984	1.029
Amapá	1.099	1.009	1.096	1.003	1.109
Amazonas	0.860	0.957	1.008	0.853	0.823
Bahia	1.011	0.991	0.994	1.017	1.002
Ceará	1.046	0.963	1.068	0.979	1.007
Distrito Federal	1.074	0.999	1.113	0.965	1.073
Espírito Santo	1.130	0.977	1.120	1.009	1.104
Goiás	0.981	1.003	0.989	0.992	0.983
Maranhão	1.195	0.999	1.017	1.176	1.195
Mato Grosso	1.079	1.000	1.094	0.987	1.079
Mato Grosso do Sul	0.936	1.002	0.932	1.005	0.938
Minas Gerais	1.058	0.999	1.057	1.001	1.057
Pará	0.833	0.962	0.858	0.970	0.801
Paraíba	0.991	0.995	1.029	0.964	0.986
Paraná	0.990	0.954	0.992	0.997	0.944
Pernambuco	0.993	1.011	1.015	0.978	1.004
Piauí	1.081	0.983	1.071	1.009	1.063
Rio de Janeiro	1.021	1.001	1.000	1.021	1.022
Rio Grande do Norte	0.998	1.000	0.940	1.062	0.998
Rio Grande do Sul	1.007	0.981	1.000	1.007	0.988
Rondônia	1.022	1.004	1.026	0.996	1.027
Roraima	1.177	1.011	1.188	0.990	1.190
Santa Catarina	1.000	0.997	1.009	0.991	0.996
São Paulo	0.978	0.999	0.983	0.994	0.977
Sergipe	0.946	1.006	0.967	0.979	0.951
Tocantins	1.249	1.004	1.238	1.009	1.254
MEAN	1.024	0.993	1.027	0.996	1.017

Appendix 4

List of acronyms

CCR Model:	Charnes, Cooper and Rhodes (DEA) Model
CNJ:	Conselho Nacional de Justiça
CRS:	Constant Returns to Scale
DEA:	Data Envelopment Analysis
DMU:	Decision-Making Unit
EFFCH:	Technical Efficiency Change
FDH:	Free Disposal Hull
MPI:	Malmquist Productivity Index
SECH:	Scale Efficiency Change
SFA:	Stochastic Frontier
STJ:	Superior Tribunal de Justiça
TECHCH:	Technical Change
TFP:	Total Factor Productivity
TFPCH:	Total Factor Productivity Change

Appendix 5

Brief survey of articles on judicial efficiency (the first 30 years of this literature, from 1980s to 2000s)

Author, Title	Methodology	Country/State of Analysis
BEENSTOCK, M.; HAITOVSKY, Y. Does the appointment of judges increase the output of the judiciary? <i>International Review of Law and Economics</i> , v. 24, p. 351-369, 2004.	Econometric regression	Israel
BLANK, J. et al. <i>Bench marking in an international perspective – an international comparison of the mechanism and performance of judiciary systems</i> . Commissioned by the Netherlands Council for the Judiciary. Rotterdam, 2004.	Descriptive statistics, correlation analysis	11 European countries
DALTON, T.; SINGER, J. M. A matter of size: an analysis of court efficiency using hierarchical linear modeling. 2009.	Linear hierarquical models	District courts, USA
DJANKOV, S. et al. Court: the Lexis Mundi Project. <i>NBER Working Paper Series, Working Paper 8890</i> , 2002.	Econometric regression	109 countries
HAGSTEDT, K.; PROOS, J. <i>Has the recent restructuring of the Swedish district courts improved efficiency? A DEA analysis</i> . Uppsala University, Department of Economics; Spring 2008.	DEA	Sweden
KITTELSEN, Sverre A. V.; FØRSUND, Finn R. Efficiency analysis of Norwegian district courts. <i>The Journal of Productivity Analysis</i> , v. 3, p. 277-306, 1992.	DEA	Norway
LEWIN, A. L.; MOREY, R. C.; COOK, T. C. Evaluating the administrative efficiency of courts. <i>Omega</i> , v. 10, p. 401-411, 1982.	DEA	North Carolina, USA
OSTROM, B.; HANSON, R. Efficiency, timeliness, and quality: a new perspective from nine state criminal trial courts. <i>Research in Brief</i> , National Institute of Justice, U.S. Department of Justice, June 2000.	Frontier analysis	Criminal courts, USA
PEDRAJA-CHAPARRO, Francisco; SALINAS-JIMÉNEZ, Javier. An assessment of the efficiency of Spanish Courts using DEA. <i>Applied Economics</i> , v. 28, p. 1391-1401, 1996.	DEA	Spain
SCHNEIDER, M. Judicial career incentives and court performance: an empirical study of the German Labour Courts of Appeal. <i>European Journal of Law and Economics</i> , v. 20, p. 127-144, 2005.	DEA	Labor courts, Germany
SOUZA, Maria da Conceição Sampaio; SCHWENGBER, Silvane Battaglin. Efficiency estimates for judicial services in Brazil: nonparametric FDH and the expected ordem-m efficiency scores for Rio Grande do Sul courts. In: ENCONTRO DA ANPEC 2005, 2005.	FDH (Free Disposal Hull)	Rio Grande do Sul, Brazil
TULKENS, H. On FDH efficiency analysis: some methodological issues and applications to retail banking, courts, and urban transit. <i>The Journal of Productivity Analysis</i> , v. 4, p. 183-210, 1993.	FDH (Free Disposal Hull)	Belgium