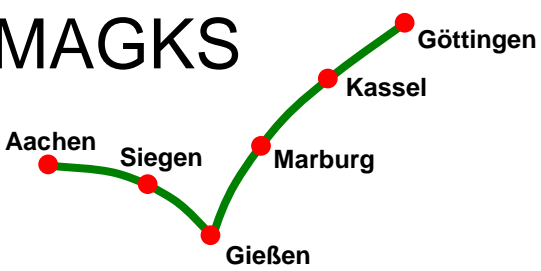


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Assessing Judicial Efficiency of Egyptian First Instance Courts

A DEA Analysis

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Abstract: *Egypt started a recent judicial reform program in 2007, which can be considered the first ever since the establishment of the National Egyptian Judicial System in 1952. It focuses mainly on solving organizational problems within First Instance Courts (FIC), as they form the active cell of the Egyptian judicial system. However the efficiency of FICs is still doubtful to a large extent. This paper provides for the first time an efficiency analysis of 22 FICs in Egypt using the technique of Data Envelop Analysis (DEA). The main strength of this study is to consider the number of computers per court, as none of the previous papers on court efficiency has included a capital variable when defining their court production function before. Our results show that there are no significant differences observed in terms of management efficiency between the civil and criminal FICs, however criminal FICs districts are superior with respect to their corresponding civil districts in terms of program efficiency.*

Keywords: Egyptian Judicial System; Efficiency; Data envelopment analysis.

Assessing Judicial Efficiency of Egyptian First Instance Courts

1. Introduction¹

First Instance Courts (FICs) are considered the active cell of the Egyptian judicial system. Accordingly, the Ministry of Justice (MOJ) has announced that the key to developing and achieving progress in the judicial system in Egypt requires building up efficient institutions for these courts and improving the quality of their judges, without losing sight regarding the rest of the judicial system. The idea behind focusing on FIC as a first attempt of the 2007 judicial reform program stems from the fact that these courts are the first to receive public prosecutors that are to become judges and court presidents of higher degrees after a while. Accordingly if they are best perceived and built up from the very beginning at this stage of their judicial career, they will be promoted as qualified efficient judicial councillors to the courts of Appeal and the court of Cassation after completing their required phase in the FIC. In other words, they started building up stable roots or ground to maintain a solid structure for the whole system on a long term basis. However, the absence of previously adopted accountable performance measures and studies within the Egyptian judicial system hinders the identification of important reform factors and leads to the inability to draw any conclusions about the significance of the current reform procedure. This fact becomes even more evident when referring to a quantitative assessment, due to the paucity of quantitative data describing judicial or court performance in developing countries in general.

As a first attempt to analyse the efficiency of individual FICs in Egypt, this study mainly depends on primary sourced data and statistics which were self-collected and have not been published or provided in this form before. We use Data Envelopment Analysis (DEA), instead of simple performance indicators (e.g. resolution rate) to measure court efficiency. The study is implemented over the civil criminal districts of 22 FICs. The objective is to answer the following questions: Are there significant efficiency differences between the civil and criminal courts when compared with the best observed practices in their own jurisdiction – management efficiency–? Can one jurisdiction be considered superior when compared to the other in terms of program efficiency?

¹ The authors would like to thank Councilor Ahmed Zaki (MOJ) for his excellent cooperation and provision of necessary data for this study, Professor Bernd Hayo for his support and constructive comments and last but not least Professor Stefan Voigt for his guidance, continuous advice and motivation.

Since the early 1990's analyzing the link between different aspects and characteristics of judicial reform and economic growth has become an important research area. North (1990:54) argues that the inability of societies to develop effective, low-cost enforcement of contracts is the most important source of both historical stagnation and contemporary underdevelopment in the third world. A well performing judiciary is considered a prerequisite for economic development, through enforcing property rights, controlling the abuse of government power, protecting the rule of law and last but not least securing the exchange of goods and services between private parties (Messick, 2002)². Weder (1995) explains that a weak legal system is considered one of the main obstacles to economic development in general. Some scholars have focused on individual institutional characteristics of the judiciary or certain judicial procedures in order to empirically test their impact on economic growth. Feld and Voigt (2003) on the one hand, called for achieving greater levels of judicial independence as they proved that it is a main determinant of economic growth. On the other hand, Hayo and Voigt (2008) showed that a number of judicial procedures positively affect economic growth, as they tend to increase the predictability of court decisions, which leads to more transactions and higher investment levels.

Accordingly, there were huge efforts done and a significant amount of grants given by international donor organizations, for example the World Bank (WB), the International Development Bank, and the Asian Development Bank to improve judicial performance in developing countries. These organizations have devoted a budget of over \$800 million in loans for judicial reform in developing countries (Messick, 2002). Moreover, the WB and the UNDP have provided great assistance to some Arab countries like Morocco, Egypt, West Bank and Gaza and Yemen to improve the institutional quality of their judicial system (Messick, 2002). However, little effort has been done till now to analyze judicial performance or measure the efficiency of the judicial system within the Arab region, especially in Egypt³.

Egypt, is considered one of the most durable authoritarian countries of the world, nevertheless it enjoys one of the oldest and most developed and influential judicial structures in the Arab region (Moustafa, 2008). The first modern judicial system in Egypt started in 1830. Until 1952, the Egyptian judicial system included in addition to Egyptian judges, also a number of French and English judges to ensure the fair treatment of foreign citizens in Egypt (Mixed Court System). In 1952, after the Egyptian revolution, the first Egyptian national judicial

² See also Messick (1999, 2004) and Posner (1998).

³ There are a few studies e.g. Scott (1899) and Cannon (1972), who tried to assess the performance of the Egyptian judicial system before the 1952 revolution referring to the problems of mixed court systems.

system was formed and foreign judges were eliminated. Nasser's nationalization policy led to massive capital flight from the country at the time, the new government was attempting to utilize national resources to build up the economy. Citizens felt the danger of losing their property in the absence of a credible judicial system that can protect their property rights. The rate of capital flight reached \$2 billion per year which was approximately equivalent to three and a half times the rate of all domestic sources of investment of Egypt at that time. After Nasser's death in 1970, his successor Anwar Sadat who was faced with economic stagnation and escalating pressure from international lenders tried to restore the Egyptian economy through trying to attract Egyptian nationals to bring back their savings to Egypt, in addition to attracting foreign direct investment. Accordingly, he tried to win back their trust and ensure the provision of property right protection. Finally in 1979 and after a full decade of failed attempts to attract investment without implementing concrete institutional safeguards on property rights, the regime managed to establish the Supreme Constitutional Court. This Court is considered the first constitutional court in Egypt and in the Arab region and has the power of judicial review. The new court was designed mainly in order to win back the trust of investors and guarantee institutional constraints on executive actions (Moustafa, 2007). Hence it can be said that Egypt managed to discover the relation between economic development and judicial system ever since the establishment of its Supreme Constitutional Court.

The rest of the article is organised as follows: Section 2 describes the institutional structure of the Egyptian ordinary court system, as well as the embedded efficiency obstacles of FICs. Section 3 explains the methodology of the study. Section 4 describes the data, the model specification and the results. Last but not least section 5 summarises and concludes.

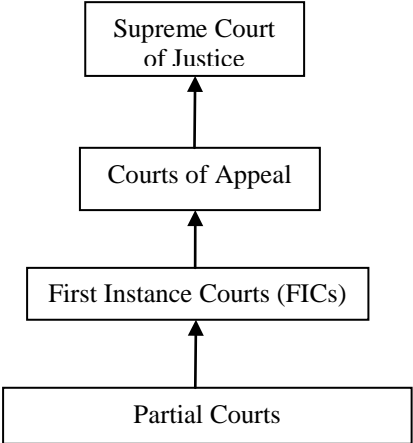
2. The Egyptian Court System

2.1 Hierarchical Structure of Ordinary Courts

According to Egypt's 1971 constitution, the Egyptian judicial system is an independent branch of the government. Since the establishment of the State Council (Maglis-Al-Dawla) according to law 112 of 1988, Egypt has adopted a dual judicial system: the administrative and the ordinary judiciary. The administrative judiciary has the jurisdiction to decide on administrative disputes in which any governmental entity is involved, while the ordinary courts are responsible for settling the regular criminal and civil cases among any two parties. Courts are organized according to the law of judicial power of 1972 and its several amendments in a hierarchical order according to their respective power (figure 1). The

Supreme Court is on top of this rank, followed by the Courts of Appeal, the FICs or Courts of First Instance and finally the Partial Courts.

Figure 1. Hierarchical Order of the Egyptian Court System



There exists only one Supreme Court which is based in Cairo and has exclusive superior power over all other lower degree courts. However the Courts of Appeal are distributed within the capital of the different Egyptian governorates. Hence there exist eight Courts of Appeal which are located in Cairo, Alexandria, Tanta, Mansura, Ismailia, Beni Suef, Asyut and Qena. FICs are usually established in the capital of each Egyptian governorate. There used to be 22 main FICs, but due to the large expansion of the population in new emerging governorates, the number of FICs is going to be extended to 27 till 2011⁴. In the domain of each FIC, small Partial Courts are formed to take care of less complicated cases that can be easily solved by one single judge. In total there exist about 337 Partial Courts. Decisions of a lower level court might be appealed against, at one of the higher level courts. In order to file a case in FIC, the minimum value of the case should exceed 6,800\$ after the reform program (since 2007), as before that time the critical value was 1,700 \$, otherwise the case should be filed in a Partial Court (Mokhtar, 2010). In addition a number of specialized courts like Family Courts (handling personal affairs cases) that were established according to law 10 of 2004 and recently Economic Courts (handling commercial and economic cases), established under law 120 of 2008 started to emerge in order to create judicial specialization within the system.

⁴The five additional courts (North Sinai, South Sinai, Helwan,6th of October and Red Sea) were parts of respective other larger courts (Ismailia, Suez, South Cairo, Giza, Qena). The main focus will be on the 22 First Instance Courts as most reports provided by the ministry of justice still include aggregated figures of the court to be able to compare the court output with previous years.

2.2 Obstacles of Judicial Efficiency

The deterrents of optimal judicial performance in Egypt can mainly be due financial and organizational factors (Elshahed, 2009).

- Financial obstacles: Despite the fact that a number of studies like Posner (2005), Buscaglia and Ulen (1997) have proved that increasing financial resources will not improve judicial performance; Egyptian judicial experts still link the weak performance of the judges to their levels of income. Judicial staff members still complain about their low income levels and put it as a main source of inefficiency of the system.

It can be said that the main problem of the judicial wage system in Egypt is that it is still functioning under law 46 of 1972 and its several extensions: law 17 of 1976, law 54 of 1978, law 143 of 1980, law 11, 114 and 138 of 1981, law 32 of 1983 and finally law 35 and 53 of 1984. This law implies giving judicial staff member a minimal fixed base salary while having an additional larger variable salary. This fixed base salary assigned for judicial staff members did not change since 1972; however law 32 of 1983 implied increasing each base category of the different wage categories by an annual amount of \$11 U.S⁵, to offset inflation. The sum of annual basic salaries of the Egyptian High Constitutional Court judges for example were estimated to be \$370,440 for the year 2007/2008, while the sum of the variable salaries in form of incentives and bonuses reached an amount of \$4,260,060 (Elgebaly, 2009:36). Table 1 below gives a picture of wages assigned to the different judicial career categories according to law 1972, compared to the net real wages including bonuses and other variable salary categories which are not registered in any formal decree. Hence the only way to observe them was through carrying different interviews with local prominent experts of the Ministry of Justice and different courts in Cairo who agreed all on the same observed net wages of the different categories.

⁵ Given that the per capita income of Egypt is equivalent to 5.460 US dollars (World Development Indicators database, World Bank, 7 October 2009)

Table 1. *Formal and Informal Wages of different Judicial Career Levels according to Law 46 of 1972 in US \$.*

<i>Judicial Career Category</i>	<i>Annual Basic Wage (according to Law 46, 1972)</i>	<i>Annual Actual Wage (US\$)</i>
Head of the Supreme Court	2,876	22,226
Head of Court of Appeal	2,320-2,868	17,582.4
Head of First Instance Court degree (Judge A)	1,548-2,364	11,113
Head of First Instance Court degree (Judge B)	1,308-2,064	8,890-11,113
Regular Judge	1,080-1,868	8,791.2
Attorney	780-1,464	6,593.4

Source: Law of Judicial Power number 46, 1972, p. 71-72; interviews at the Egyptian MOJ and the Economic Court of North Cairo.

From the previous table it can be seen that despite the fact that judicial salary has been raised to a large extent due to the addition of a larger amount of variable salary (bonuses extra working hours, travel expenses and some other subsidies) most judges still can not consider it as being fair to reward a judge and motivate his incentives. Table 2 below shows a comparison between the judicial salaries of a regular judge (starting salary) in 10 Mediterranean countries⁶ including Egypt. In order to be able to observe a better comparison regarding a fair level of judicial salary among countries, the net salary is divided by the corresponding GDP per capita of each country.

⁶ Only this group of countries could have been chosen, due to the paucity of published data regarding the judicial salaries in other Arab or African countries.

Table 2. Comparing Judicial Salary in some Mediterranean Countries

<i>County</i>	<i>Net (starting) income of a regular judge</i>	<i>GDP per capita^b (PPP)</i>	<i>Judicial income/GDP per capita income level</i>
Bosnia	21,671	6,400	3.39
Turkey	24,983	11,400	2.19
Monaco	56,368	30,000	1.88
Egypt ^a	8,791	6,000	1.47
Spain	49,127	33,600	1.46
Montenegro	14,085	9,800	1.44
France	44,348	32,600	1.36
Greece	40,550	31,000	1.31
Italy	36,261	29,900	1.21
Croatia	20,250	17,500	1.16

Sources:

^a Law of Judicial Power number 46, 1972, p. 71-72; interviews at the Egyptian ministry of Justice and the Economic Court of North Cairo, as for the rest of the countries, data were obtained from the European Commission for the Efficiency of Justice CEPEG 2008 evaluation report.

^b CIA (2009): <https://www.cia.gov/library/publications/the-worldfactbook/rankorder/2004rank.html?countryName=Tokelau&countryCode=tl®ionCode=au&rank=214#tl>.

It seems that Egypt ranks 4th among the chosen 10 Mediterranean countries. Hence although judicial salary in Egypt might look low in absolute terms, it turns out to be in line with, if not better than other Mediterranean countries when taking the GDP per capita of the country into consideration. However it must be mentioned that income was calculated through taking the respective GDP per capita of each country into consideration. In other words, we considered income in real terms instead of using the nominal values. Using the nominal values Egypt occupies the least rank.

- Organizational Obstacles: the organizational obstacles surrounding the Egyptian

Judicial system can be simply summarized by referring to the following factors:

- i. *The judges' qualification and employment system.* As mentioned before there is no specific agreed upon performance criteria for appointing judges in Egypt. A grade of at least good is currently required to apply for a judicial career job, however real life examples show that students with lower grades were preferred over students with higher grades without providing any interpretation for their evaluation criteria. Hence it can be said that the appointment criteria is still

vague and does not necessarily reflect a certain performance. Law school graduates are appointed as attorneys without any formal training. They used to spend a training duration for 4 months before they are nominated to serve as judges. Aleslambuly (2009: 58) refers to the fact that a minimum of one year training should be put as a requirement for an attorney to be appointed as a judge. Moreover he states that for a law school student to enter the judicial career, he must first go through a probation phase of one year, during which he attends intensive preparatory courses. Afterwards each student shall receive an evaluation and only those who perform well may be appointed as judges, the rest can be assigned some other judiciary related administrative jobs. There has been already a law drafted to support this idea in 2008. It concerned establishing a so called “Judicial Academy” where judicial candidates can attend a probation phase before being assigned a formal judicial position. It involves judicial training and additional qualifying courses to ensure high judicial quality among those who are going to occupy judicial positions. This law however is not being approved by the parliament yet. There exists an essential need for such qualifying courses as the judicial system of FICs lacks high qualified judiciary. The only qualification they have is their bachelor certificate from law school. Table 3 shows that during 2009, only 16.7% of total judicial staff of FICs in Egypt enjoys a higher qualifying degree, like PhD, Masters or even a certified diploma with a minimal number of PhD holders (1%).

Table 3. *Qualified Judges as a percentage of total number of judges in Egyptian FICs (2009)*

<i>Court</i>	<i>PhD</i>	<i>Master</i>	<i>Diploma</i>	<i>Total</i>
North Cairo	2.0	6.9	16.2	25.1
South Cairo	1.8	10.0	15.4	27.1
Giza	0.8	4.6	10.8	16.3
Banha	1.6	11.1	17.5	30.2
Alexandria	0.0	4.0	6.7	10.7
Tanta	0.5	3.3	7.6	11.4
Shebin El Kom	1.4	5.1	8.7	15.2
Mansurah	1.4	6.2	10.5	18.1
Zakazik	0.5	4.3	9.2	14.0
Damanhour	0.5	3.2	7.4	11.1
Kafr El Sheikh	1.3	6.9	4.4	12.5
Damietta	0.0	11.8	5.9	17.6
Ismailia	0.0	5.7	7.5	13.2
Port-Said	2.3	9.3	11.6	23.3
Suez	2.2	19.6	17.4	39.1
Fayum	0.0	11.7	7.4	19.1
Beni Suef	2.1	9.5	13.7	25.3
Menia	0.8	5.3	8.3	14.4
Asyut	0.0	7.9	9.2	17.1
Sohag	1.4	2.2	4.3	8.0
Qena	0.6	2.4	4.3	7.3
Aswan	1.6	3.2	7.9	12.7
All FICs	1.0	6.1	9.6	16.7

Source: MOJ (2009).

- ii. *Judicial inspection procedures that are carried out in FICs.* The judicial inspection department is the authority responsible for evaluating the performance of FICs. They gather reports on the rate of case resolution, filed cases and pending cases from each court. Hence their main job is to collect data and present statistics about the performance of each court and each judge within the court. Before the implementation of the new 2007 judicial reform program, the judicial inspection department used to issue evaluation reports mainly based on information submitted by individual courts including the number of accomplished cases per judge. This evaluation method led to observing a kind of misleading performance measure as data and information were to a large extent biased and manipulated by individual courts. Accordingly, judges tended to

handle easy and simple cases rather than long complicated ones to achieve a high record on the one hand. On the other hand, judges stopped spending too much time on each individual case to carefully analyze its components and evidence which might lead to misjudging the case or neglecting an important part of the evidence. The first fact can be used to explain the reason behind the increasing number of pending cases, while the second fact may be considered a main determinant of the huge number of appealed cases in Egyptian FICs.

- iii. *Promotion procedure and the selection of the highest ranking judicial positions in ordinary judiciary.* This procedure is usually done in a systematic way according to the nature of the judicial career system and the final decision is then to be taken by the judicial council and approved by the president of Egypt. To take the final decision, official performance reports about the number of finished cases are used⁷, without referring to the degree of difficulty of the case, nor the quality of decisions taken by each judge. Accordingly the system embeds a weak relation between performance and promotion, as it is rather built on a strong relation between age; connections and promotion. Such a system creates weak incentives to observe special skills along the career and inhibits competitive performance among judges.
- iv. *Outsourcing judges.* This is a widespread phenomenon among the judicial system in Egypt, due to its judicial leadership position among different Arab and African countries in the region. Most Judges prefer to participate in this program to obtain a greater salary, as outsourced judges are paid according to the salary scheme of the host country, which indeed has a higher per capita income level. As it is difficult to obtain clear estimates of judicial salaries in other Arab and African host countries, one can look at the different per capita income levels of the different Arab host countries to observe an estimate of how much more a judge would be paid compared to his original salary in Egypt (see table 4 below). Moreover outsourced judges are offered free housing as well as transportation facilities, in addition to free flight tickets for him and for his family. Hence they are able to save a huge amount of their salary. Outsourcing judges negatively affects the Egyptian judicial system as it links judges away from their original goals in their own country. Moreover the type of cases judges handle during their

⁷ The judicial inspection department for example carries such reports for the FICs. Court performance data are collected on a monthly basis, including the workload per judge.

stay outside the country may differ to some degree from the nature of cases in Egypt which would not add to their experience in solving cases when they return to Egypt (Aleslambuly, 2009: 61).

Table 4. *GDP per capita in some Arab Countries in 2009*

<i>Country</i>	<i>GDP per capita (PPP) (in US\$)</i>
Qatar	119,500
Kuwait	52,800
UAE	38,900
Bahrain	38,800
Oman	25,000
Saudi Arabia	20,600
Egypt	6,000

Source: CIA (2009)⁸

- v. *Number of judges.* Most judicial staff members agree that Egyptian Courts are understaffed, which is the main reason behind court inefficiencies. The number of judges must steadily increase to match the steady increase in population and number of filed cases (Aleslambuly, 2009; Elshahed, 2009). However, recent statistical analysis by the MOJ found out that the existing number of judicial staff members is sufficient to handle the existing cases available in the Egyptian FICs (Egyptian Ministry of Justice, 2009).
- vi. *The absence of judicial specialization.* Till October 2008 and before the establishment of separate economic courts, commercial as well as economic cases were handled by ordinary unspecialized courts. Judges were spending some time tackling commercial cases, then a second period tackling criminal or civil cases and so on. Hence the structure of the system was not providing a persistent field of specialization for judges to improve their performance through experience and knowledge accumulation.
- vii. *Unfair Distribution of Caseload.* One of the main backlogs of the Egyptian judicial system was the unfair distribution of case load among judges and/or among the different districts of one court. Judges who finish their work promptly were given higher workload to improve the overall performance of the court.

⁸<https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html?countryName=Tokelau&countryCode=tl®ionCode=au&rank=214#tl>.

Even the degree of case difficulty varied a lot from some judges to others: good, efficient judges were given the most difficult cases. Hence judges who were performing well became reluctant to finish their cases in order to avoid additional workload and more complex cases. As for those who were lazy and slow, they didn't find any motive to change their attitude as they are always backed up by others. Accordingly, when asking judges about the timeliness of their cases, they might blame the degree of difficulty or the number of their assigned cases. In order to avoid this conflict and to achieve a fair distribution of case load, the ministry of justice has used the so called Case Difficulty Coefficient (CDC) to ensure a fair distribution of case load among judges. This new statistical technique is developed in 1.10.2007 and is considered a main factor of the judicial reform program in FICs. It is calculated by assigning to each type of case (criminal, civil,...) a certain weight according to its degree of difficulty (average time spent to settle the case). Afterwards they divide (the number of available cases weighted by their corresponding CDC) by (the available number of judges) to be able to decide upon the required judicial force to settle the cases. The MOJ then determines a predefined so called warm zone with a maximum, minimum and an average case load per judge and expects all FIC Districts to operate within this zone. It can be said that the CDC is a tool used to draw conclusions on the assigned case load per judge or per district court within the same FIC in a fair manner. It is also used to project future needs of workforce, which led to the fact that there has not been a great change in the number of judicial staff members for the year 2008/2009. Implementing this case load distribution criterion in all Egyptian FICs shall encourage judges to finish their cases in the assigned time or even before without fearing additional unappreciated workload of others. As a result, it is expected that the number of assigned cases per judge decrease, while the number of resolved cases increase. The impact of using CDC on court efficiency is however unknown, due to the paucity of court level data before 2010.

3. Methodology

3.1 Court Efficiency versus Court Performance

To analyze court performance previous scholars used to depend on court output related data. For example Schneider (2005) used an output index which comprises two variables, namely court output in terms of dispute resolution (finished cases either by trial, settlement, or withdrawal) and the number of published decisions. Dalton and Singer (2009) used the number of adjudications controlled by workload (filed plus pending cases) and in another attempt they used case duration or length (the total time from case filing to final disposition) as an indicator for court performance. Lopez (2008) however defined court's output as being only composed of sentences and warrants, without controlling for the number of filed and pending cases. Comparing the clearance rate of FICs in Egypt, one should first differentiate between the clearance rate of civil and criminal cases within the judicial system. In the circuit of each FIC there are a number of civil and criminal District Courts. Each type of court registers its case data independent from the other type. At the end the data of each type of District Courts is collected and summed up to represent the performance of each FIC. To measure court performance the MOJ usually depend on calculating the resolution rate of each court by dividing the number of finished or resolved cases by the total number of filed cases:

$$\text{Resolution Rate} = \frac{\text{Resolved Cases}}{\text{Filed Cases}} \cdot 100$$

This measure however might be misleading, as it does not account for the available resources or factor inputs used in the case resolution process of each court. This is why we should differentiate between court performance or output and court efficiency, as the latter one requires considering the court inputs used (judges, other staff members, available computers,...) in the production of the court's output (cases resolved). Technical Efficiency (TE) is widely used instead of the more general concept of economic efficiency because the latter one is quite difficult to determine, as it requires additional information on the quality of case resolution. TE can be measured by examining whether a production unit (in our case: court) produces the maximum output given the level of inputs employed. Green (1993) defines the level of technical efficiency by the relationship between observed actual production and some ideal or potential production. We can think in this case of a production possibility frontier (PPF) with perfectly efficient courts lying on this frontier (technically efficient) and others lying inside this frontier (technically inefficient) with the ratio of actual

to potential production defining the level of efficiency of the individual court. There exist different approaches to estimate the technical efficiency of a court. Seiford and Thrall (1990) generally categorize them into two main groups: parametric (stochastic) versus non-parametric (non-stochastic) methods.

Most studies conducted to measure judicial efficiency implement a non-parametric technique, e.g. Data Envelopment Analysis (DEA) using the size of the judiciary as a main if not the sole input factor for court output to measure court efficiency. The DEA technique provides an efficiency rank for each court within the whole judicial system; however it does not impose any assumptions on the functional form and the distribution assumption of the data which might be considered a disadvantage. However this technique is very useful when considering more than one output per production unit, as all other parametric or stochastic techniques only allow for one output per model.

3.2. Assessing technical efficiency with data envelopment analysis

DEA techniques were introduced by Charnes et al. (1978) using mathematical programming to pursue Farrell's approach to technical efficiency measurement (Farrell, 1957). DEA is a non-parametric approach to measure efficiency. It evaluates the performance of peer units allowing the construction of a surface over the data, the so-called technological frontier, which permits the observed behaviour of a decision-making unit (DMU) to be compared with best observed practices. DEA has been used in a large number of industries, including banking, airlines, railroads, schools, hospitals, farms and courts (Emrouznejad et al. 2008). Further details on DEA can be found in Cooper et al. (2007).

Let us start by considering that we observe a sample of n DMUs, each DMU _{j} ($j=1, \dots, n$) uses a set of m inputs x_{ij} ($i=1, \dots, m$) in order to obtain a set of s outputs y_{rj} ($r=1, \dots, s$). The technology used to transform inputs into output is assumed to fulfill the standard properties suggested by Shephard (1970). Assuming variable returns to scale –a less restrictive approach–, the output-oriented technical efficiency of DMU₀ can be assessed with the BCC model (Banker et al. 1984). As a result, the efficiency scores obtained are net of any scale effect. The BCC model measures the maximum feasible proportional increase in all outputs that the DMU₀ could achieve without increasing its use of inputs. Thus, it assesses Farrell-Debreu-type technical efficiency, which is also called weak efficiency.

However, once Farrell-Debreu efficiency has been reached, additional increases might still be possible in some outputs, as well as further reductions in some inputs, bringing DMU₀ into a

Pareto-Koopmans or stringly efficient status (Koopmans, 1951). In line with Ali and Seiford (1993), the output-oriented envelopment model of variable returns to scale makes it possible to obtain the efficiency of DMU_0 ϕ_0 and identify any slacks in both inputs and outputs by solving the following mathematical problem:

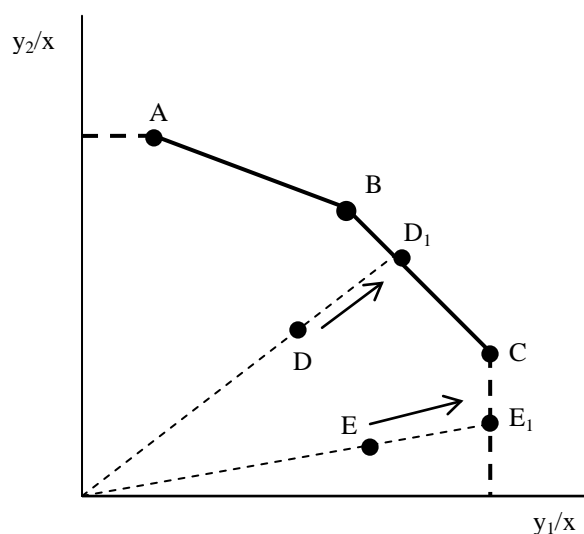
$$\begin{aligned} & \max_{\lambda, \phi_0, s_{i0}^-, s_{r0}^+} \phi_0 \cdot \left(\sum_{i=1}^m \lambda_j \cdot x_{ij}^- + s_{i0}^- \right) \cdot \left(\sum_{r=1}^s \lambda_j \cdot y_{rj}^+ - s_{r0}^+ \right) \\ & \text{subject to :} \\ & \sum_{j=1}^n \lambda_j \cdot x_{ij}^- + s_{i0}^- = x_{i0}^- \quad i = 1, 2, \dots, m \quad \text{(i)} \\ & \sum_{j=1}^n \lambda_j \cdot y_{rj}^+ - s_{r0}^+ = \phi_0 \cdot y_{r0}^+ \quad r = 1, 2, \dots, s \quad \text{(ii)} \\ & \lambda_j \geq 0 \quad j = 1, 2, \dots, n \quad \text{(iii)} \\ & \sum_{j=1}^n \lambda_j = 1 \quad \text{(iv)} \end{aligned} \tag{1}$$

x_{i0} and y_{r0} representing, respectively, the observed values of productive resource i and output r on DMU_0 . In addition, λ_j is a variable representing the weight of DMU_j in the composition of the reference representing best observed practices; s_{i0}^- and s_{r0}^+ being the slacks in input i and output r of DMU_0 , respectively.

In Figure 2, $DMUs$ A , B and C form an efficient frontier and hence $DMUs$ D and E are considered inefficient, as they lie inside the frontier. The efficiency target of DMU D will be D_I , that is, its radial projection onto the efficient frontier. In addition, the radial efficiency target of DMU E will be E_I and the distance CE_I represents the slack.

The solution to program (1) for DMU_0 provides a measure of its efficiency. It is restricted to being equal to or greater than one, and measures the maximum feasible proportional increase of all outputs that could be achieved by DMU_0 without increasing its use of inputs. A score equal to one indicates best performance. The more the score deviates from one, the more inefficient the DMU is. For instance, a score of 1.1 would, for a given DMU_0 , mean that its outputs could be proportionally increased by 10% without consuming additional inputs.

Figure 2. *Farrell-Debreu efficiency and Pareto-Koopmans efficiency*



3.3. *Estimating inter-programme efficiency*

The methodological approach to evaluating programme efficiency was developed in one of the first empirical papers on DEA by Charnes et al. (1981). This paper suggests that groups of DMUs belonging to different programmes might have different technological frontiers due to programme differences. The technical efficiency of DMUs operating under different programmes is assessed by distinguishing between intra-program efficiency and inter-program efficiency. While the former assesses the performance of DMUs when they are compared to the frontier of their own group or programme (within group efficiency), inter-programme efficiency identifies differences in performance between the different programme types (among groups). Testing for the significance of differences in intra-program efficiency between the different programs allows us to identify whether efficiency differences between both types of programs (according to case type) is due to managerial and institutional characteristics of each program or whether prevailing inefficiencies can be attributed to random factors beyond the control of managers. This however does not allow us to draw any conclusion regarding the impact of belonging to a different program on court efficiency and that is why inter-program efficiency becomes necessary.

Computing inter-programme efficiency requires four steps to be followed. In the first step, the sample is divided into two subsamples or groups, one for each of the different programmes (i our case: civil vs. criminal district courts) considered. Then, mathematical program (1) needs to be applied to each subsample in order to compute its intra-program efficiency. This enables

us to assess the performance of each DMU when it is compared to the best practices within its own programme. In the second step, the inefficient DMUs in each group must be projected onto the technological frontier of their own group. The objective is to eliminate intra-program inefficiency by making all the units of the same programme appear as strongly or Pareto-Koopmans efficient. As a result, the potential improvement in DMU₀ would be the result of an increase in its outputs and a specific decrease in each of its inputs. Formally, the values for inputs and outputs projected onto the efficient frontier are:

$$\hat{x}_{i0} = x_{i0} - s_{i0}^-, \quad i = 1, \dots, m, \text{ and} \quad (2)$$

$$\hat{y}_{r0} = \phi_0 \cdot y_{r0} - s_{r0}^+, \quad r = 1, \dots, s, \quad (3)$$

Where ϕ_0 is as already noted, the efficiency obtained for DMU₀, while s_{i0}^- and s_{r0}^+ are, respectively, the optimal slacks in input i and output r of this unit obtained from program (1).

The third step consists of solving the mathematical program (1) for all the DMUs in the sample regardless of the group they belong to, using the adjusted data obtained in the previous step; that is, the values of inputs and outputs that are derived from expressions (2) and (3). Therefore, inter-program efficiency is estimated, allowing us to assess the difference in efficiency between programmes, once intra-program inefficiencies have been eliminated. The fourth and final step requires the use of a test aimed at evaluating the statistical significance of the differences in efficiency among programmes. We use the non-parametric tests by Mann-Whitney (MW test). More details can be found in Conover (1999).

4. Data, model specification and results

4.1. Data and model specification

Kittelsen and Førsund (1992) and Pedraja and Salinas (1995) measure court efficiency focusing mainly on the number of judges and office staff as important input factors. In a similar attempt, Gorman and Ruggiero (2009) analyze efficiency of US judicial district prosecution offices by considering the number of prosecutors, in addition to other staff members. Other studies managed to collect data on a wider range of input variables to measure court efficiency. Lewin et al. (1982), considered the number of district attorneys and assistants, working days of courts (proxy for the number of judges), caseload and the size of white population as input factors to measure court efficiency. Moreover, Schneider (2005),

managed to collect data on judicial qualification and age to test their impact on the efficiency of German labour courts.

Accordingly, this study uses DEA with a sample 22 FICs differentiating between civil and criminal jurisdictions. Table 5 shows the descriptive statistics of the sample for both jurisdictions. The productive process of the courts is described using three inputs: number of judges (*judges*), number of administrative staff members (*admin*) and number of computers per court (*computers*) as a proxy variable of the capital. And an output: the number of resolved cases (*resol*). The used data set is obtained from the unpublished annual judicial reports available at the Egyptian MOJ, however some data are collected by the authors via the MOJ for the purpose of this study (e.g. the number of computers, the number of administrative staff for each jurisdiction within each court).

Table 5. *Sample Description*

		<i>inputs</i>			<i>output</i>
		<i>Computers</i>	<i>admin</i>	<i>judges</i>	<i>resol</i>
Civil Courts	Mean	91.227	1,211.227	58.000	30,504.409
	S.D.	45.472	615.098	38.065	18,269.490
	Minimum	24	325	12	4,869
	Maximum	166	2,593	162	66,032
Criminal courts	Mean	61.500	193.864	44.773	304,504.409
	S.D.	30.230	88.078	23.735	169,996.044
	Minimum	17	65	11	65,365
	Maximum	111	351	97	667,230

4.2. Results

Model (1) is once implemented to carry an efficiency analysis regarding the civil case resolution procedure in the first place. Secondly, a similar analysis regarding the efficiency of criminal case resolution procedure is performed. Therefore, the values of the intra-program efficiency are obtained. The FICs of the civil jurisdiction are compared with the best practices observed among the civil courts and the same process is made for the criminal courts. In table 6 the descriptive statistics of the efficiency results for both jurisdictions are depicted.

Table 6. *Estimates of Efficiency*

		<i>civil</i>	<i>criminal</i>
Intra-program efficiency	Mean	1.298541	1.33647
	S.D.	0.37568	0.56213
	Minimum	1	1
	Maximum	2.29994	3.61108
Inter-program efficiency	Mean	13.96861	1
	S.D.	6.23700	0
	Minimum	7.5414	1
	Maximum	35.92010	1

The efficiency results of civil district courts are more assembled around their average; hence enjoy lower deviations from their mean when compared to their corresponding criminal districts of each court. On average, courts could increase their number of solved civil cases by 25.85% and criminal cases by 33.65%.

Tables 7 and 8 present efficiency rankings and input slacks for the criminal and civil districts of each court respectively. To order the efficient FICs in both jurisdictions the sum of the weights (λ_j) that correspond to the efficient FIC in all the reference sets –best observed practices– that they belong (benchmarks) has been used. Additionally, although the efficiency rankings notably vary among both jurisdictions (see tables 7 and 8), the most inefficient FIC is Kena+Red Sea in both cases. An efficient behaviour would lead it to solve 133% more cases than in the civil jurisdiction, and a 261% in the penal jurisdiction.

Table 7. *Civil Case Ranking and input slack for 22 FICs in 2010*

	<i>Efficiency</i>	<i>Benchmark</i>	<i>Input slacks</i>		
			<i>computers</i>	<i>admin</i>	<i>judges</i>
Giza	1.00000	2.71744	0.00000	0.00000	0.00000
North Cairo	1.00000	2.65495	0.00000	0.00000	0.00000
Sohag	1.00000	1.88939	0.00000	0.00000	0.00000
Fayum	1.00000	1.20702	0.00000	0.00000	0.00000
Asyut	1.00000	1.10125	0.00000	0.00000	0.00000
Damietta	1.00000	1.02562	0.00000	0.00000	0.00000
Aswan	1.00000	0.46558	0.00000	0.00000	0.00000
Damanhour	1.00000	0.39460	0.00000	0.00000	0.00000
Port-Said	1.00000	0.27471	0.00000	0.00000	0.00000
Suez	1.00000	0.26944	0.00000	0.00000	0.00000
Ismalia	1.08462	-	0.00000	0.00000	0.00000
Menia	1.15178	-	0.00000	571.20000	0.00000
South Cairo	1.28682	-	0.00000	710.40046	0.00000
Beni Suef	1.35111	-	0.00000	70.50000	0.00000
Alexandria	1.40435	-	44.83103	0.00000	0.00000
Tanta	1.42549	-	0.00000	96.68070	0.00000
Zakazik	1.57592	-	0.00000	0.00000	0.00000
Shebin El Kom	1.57962	-	0.00000	2.40426	0.00000
Mansurah	1.65547	-	0.00000	196.52397	0.00000
Banha	1.77376	-	14.93722	0.00000	0.00000
Kafr El Sheikh	1.97909	-	0.00000	0.00000	0.00000
Qena	2.29994	-	0.00000	0.00000	0.00000

Table 8. *Criminal Case Ranking and input slacks for 22 FICs in 2010*

	Efficiency	Benchmark	Input slacks		
			computers	admin	judges
Alexandria	1.00000	8.66186	0.00000	0.00000	0.00000
Fayum	1.00000	5.73897	0.00000	0.00000	0.00000
Damietta	1.00000	1.04103	0.00000	0.00000	0.00000
Suez	1.00000	0.39535	0.00000	0.00000	0.00000
Port-Said	1.00000	0.16279	0.00000	0.00000	0.00000
Aswan	1.00000	0.00000	0.00000	0.00000	0.00000
Ismalia	1.00973	-	0.00000	7.95349	0.00000
Damanhour	1.03739	-	0.00000	36.02128	53.44681
Sohag	1.05600	-	0.00000	117.46556	0.00000
Mansurah	1.09063	-	0.00000	152.14894	15.12766
Zakazik	1.20043	-	0.00000	217.36170	43.59574
Beni Suef	1.22400	-	0.00000	56.76596	1.08511
North Cairo	1.29484	-	0.00000	30.98072	0.00000
South Cairo	1.30520	-	0.00000	4.80851	10.97872
Giza	1.31832	-	0.00000	113.51064	10.72340
Tanta	1.31987	-	0.00000	127.42553	18.93617
Kafr El Sheikh	1.41199	-	0.00000	161.31915	10.70213
Banha	1.46211	-	0.00000	56.10213	2.74468
Menia	1.60216	-	0.00000	151.31915	43.70213
Asyut	1.65099	-	0.00000	147.46809	16.82979
Shebin El Kom	1.80758	-	0.00000	94.21277	6.46809
Qena	3.61108	-	0.00000	126.42553	21.93617

Is it possible to affirm that criminal FICs present in average a better performance than civil FICs? Or in other words, are the intra-program efficiency differences statistically significant? In order to estimate the statistical significance of these differences the non-parametrical Kruskal-Wallis (KW) test is implemented. The results are presented in table 9 and indicate that there are no significant differences in efficiency between both jurisdictions if every court is compared with the best practices in its own jurisdiction. In other words, there are no differences in the managerial efficiency.

Table 9. Results for Mann-Whitney tests

		<i>civil</i>	<i>criminal</i>
Intra-program efficiency ^a	Average range	21.86	23.14
	Z-statistic (p-value)	-0.337 (0.736)	
Inter-program efficiency ^a	Average range	33.5	11.5
	Z-statistic (p-value)	-6.072* (0.000)	

^a The null hypothesis is that the two samples are drawn from the same population.

* Significant at 99%.

The absence of difference in managerial efficiency however does not necessarily imply the absence of differences in program efficiency among both types of court jurisdictions, as explained before. Accordingly, it becomes interesting to analyse whether one of the two programs –civil and criminal– present superiority in its inter-program efficiency.

In order to respond to this question again our data results of our model explained in section 3.3 is used. As explained before, table 6 shows the descriptive statistics of the results in the inter-program efficiency and table 9 depicts the results of the KW test for both programs. In this case, the inter-program efficiency differences are statistically significant. In fact, every criminal court is in the frontier of best practices, while civil courts appear as inefficient (see table 6). However, this difference in the inter-program efficiency is not related to managerial inefficiency within each court. Hence, it becomes important to search for the causes of criminal program superiority against its corresponding civil one within each court, which is due to the paucity of data beyond the objective of this study.

5. Conclusions and Policy Implications

It can be said that the Egyptian MOJ has cut the first round of its judicial reform program. However depending on court resolution rates to measure court efficiency might hinder the ministry to discover lots of valuable information regarding the efficient use of resources available in each court. In order to draw adequate policy recommendations, further empirical analysis is required to test the impact of each input variable on the case resolution rate before and after the reform program in order to identify the most important obstacles of judicial efficiency. When designing further reform policies, the performance of individual courts must be compared and ranked by the ministry using more reliable techniques (e.g. the Data

Envelopment Analysis), to observe a clearer view of each courts performance, taking all input factors into consideration.

Regarding the efficiency of the civil courts, our results show that North Cairo, Giza, Damanhour, Damietta, Port-Said, Suez, Fayum, Asyut, Sohag and Aswan are efficient, although altogether show a volume of 111,234 pending cases.

On the contrary, Banha, Zakazik, Mansurah, Shebin El Kom, Kafr El Sheikh and Qena are inefficient. In those FICs, the promotion of an efficient behaviour would permit to solve all the pending cases with the available inputs. Capital input *computers* could be even reduced in Banha, while it is advised to reduce *admin* in Mansurah and Shebin El Kom (see slacks in table 7).

South Cairo, Alexandria, Tanta, Ismalia, Beni Suef and Menia are also inefficient, showing a total of 138,019 pending cases. However, in those FICs, a better performance would still maintain a total volume of 84,265 pending cases. In other words, the resolution of a greater volume of cases in those 6 civil courts requires greater amounts of inputs. In this regard, it would be necessary to hire a greater amount of *judges* in all 6 courts. Moreover *computers* should be increased in all the FICs except for Alexandria, and finally *administrative staff* should be increased only in Alexandria and Ismalia (see slacks in table 7).

As for the criminal courts, Alexandria, Damietta, Port-Said, Suez, Fayum and Aswan are efficient, although together they show a volume of 110,839 pending cases.

On the contrary, North Cairo, South Cairo, Giza, Banha, Tanta, Zakazik, Mansurah, Shebin El Kom, Kafr El Sheikh, Beni Suef, Menia, Asyut, Sohag and Qena are inefficient. For those FICs the promotion of an efficient behaviour would permit to solve all pending cases with the available inputs. It is even recommended to reduce *admin* input in North Cairo and Sohag, and *admin* and *judges* in within the remaining inefficient courts (see slacks in table 8).

Damanhour and Ismalia are also inefficient, showing together 85,507 pending cases, but in those FICs better performance would still maintain a total volume of 63,342 pending cases. Therefore, the resolution of a greater volume of cases would require greater input volume. In particular, it would be necessary to increase the level of *judges* solely in Ismalia and *computers* in both courts (see slacks in table 8).

Nevertheless, there are not statistically significant differences in the managerial efficiency in both jurisdictions. However, the differences of inter-program efficiency between both jurisdictions are quite large. In fact, from a joint frontier between civil and criminal courts,

members of the first group appear all to be relatively inefficient while the members of the latter one are all efficient. One of the possible reasons could be that the civil cases require generally greater qualifications and experience from a judge than the one obtained by a degree in law school. Moreover, most judges interviewed during the data collection phase of the study agreed upon, that civil cases are complex in nature rather than criminal cases, especially when involving a case where both conflicting parties hide evidence from court or try to use unethical lawyers to postpone the case resolution process. However, the most plausible reason might be that the Egyptian government gives more attention to the penal causes, since it shows the degree of juridical stability of the country. In other words, a great crime index represents lower stability degrees which in turn might destroy the external image of the country.

Finally, it must be mentioned that the absence of reliable data hinders a lot of progress in the field of analyzing court performance in Egypt. The process of data collection and data presentation within the MOJ still suffer from lots of draw backs, which can be considered a main drawback of the system, even after the reform program.

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