

Technical Efficiency of the Kenyan Judiciary: A Case of the  
Magistrates' Courts

By

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**Declaration**

I here declare this paper as my original work presented primarily for the award of a Master’s Degree in Economics at the University of Nairobi’s School of Economics, it has not been presented elsewhere for any consideration.

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## **Abstract**

Efficiency is a performance measure: in production, it is concerned with how well resources are used in a firm. For that matter, it should be tracked within a firm or an organisation. This study set to do just that, that is; track the technical efficiency of the Kenyan Judiciary through its first instant court system, the Magistrates' Court. This was done for the period January 2014 to January 2016. It involved first, estimating monthly average technical efficiency of the courts and using the estimates in the second stage to establish the courts' efficiency trend for the period. The estimation was by FDH while the trend was established by simple Excel graphs. ANOVA was done as a statistical test for the trend.

The results pointed to an improving technical efficiency for the period January 2014 to January 2016. However, the improvement was found to be driven mainly by a few super-efficient courts. Analysis without these showed a declining Magistrates' Court technical efficiency. So, the said courts should be identified and used as a benchmark for the rest.

The study settled on the Magistrates' Court because of its size, it handles the bulk of Kenyan filed court cases and is found in most areas. For FDH, it was chosen because it has the ability to handle multiple outputs without limiting its efficient frontier to a convex shape. Also, FDH needs no prior specification of a decision making unit's production function. However, because of FDH's sensitivity to outliers, this study reports result both with and without outliers.

Key Words:

Judiciary, Courts, Frontier Estimation, Efficiency Measures, Data Envelopment, FDH

JEL Code:

D240, K4, K400

**Mentioned Abbreviations**

ANOVA-Analysis of Variance

ANCOVA-Analysis of Covariance

DEA-Data Envelopment Analysis

DMU-Decision Making Unit

FDH-Free Disposal Hull

ICT-Information Communication Technology

IMF-International Monetary Fund

OLS-Ordinary Least Squares

PMMSC- Performance Management and Measurement Steering Committee

SAPs-Structural Adjustment Programmes

SFA-Stochastic Frontier Analysis

T.E-Technical Efficiency



## CHAPTER 1: INTRODUCTION

### 1.1. Background Information

In production theory, the concept of efficiency implies optimal use of resources (Gravelle and Rees, 2004). As a measure, it shows how wasteful a firm is in using its resources. For that matter, the concept is popularly measured as a comparative index (Lovell, 1993 cited in Daraio and Simar, 2007). That is, comparing a production unit's observed value to its corresponding optimal value upon which any deviation indicates inefficiency. The optimal values are those on the unit's production possibility frontier (Daraio and Simar, 2007). In literature, this production unit is commonly called 'decision making unit' (DMU). This paper uses the terms 'DMU' and 'firm' interchangeably to refer to a production unit.

The Judiciary is the branch of government legally mandated to resolve all disputes in a country. It performs the above mandate through a system of courts and tribunals which can be viewed as independent production units with similar product, justice (Rosales-López, 2008). It is the production of this 'good' which makes the judiciary important in a country's economic prosperity. Theoretically, the connection has been made in two postulates (Messick, 1999). First, is an indirect connection; this emanates from the judiciary's role in maintaining the rule of law in addition to its role in curtailing government abuses. Second, the judiciary encourages business transactions necessary for economic growth; it does this by providing means to enforce contracts privately negotiated by businesses. It is therefore expected (in theory) that a country will benefit economically with the improvement of its judicial performance.

Such arguments have been supported at least in part by some empirical studies. Among them are those as reviewed in Dam (2006) which found positive link between judicial performance and: investment activities, credit availability, contract enforceability, firm size, among others. Similarly, Ippoliti, Melcarne and Romello (2015) in their study of the European countries' courts concluded that judicial efficiency affects a country's entrepreneurial activities; this reduces as the level of inefficiency increases. The same can be said of Giacomelli and Menon (2012) who in their study of Italian courts found that judicial system efficiency had influence on the country's firm size; regions with inefficient courts had smaller firms. Because of these, it is not implausible to speculate that a country's economic growth and in extension its economic development will improve with the improvement in its judicial system (World Bank, 2003).

It is because of the above arguments and others that campaigns for major judicial reforms have been on the rise (Botelo, la Porta, López-de-Salines, Shleifer, and Volokh, 2003). This followed a wider view that most of these institutions are currently inefficient. The campaign has been led by the World Bank (see the World Bank's 'Initiatives in Justice Reforms', 2002; 2004; 2009 editions) together with the governments of the affected countries (Rosales-López, 2008). Consequently, this has led to judicial reforms in: Georgia, Ecuador, and Bangladesh, in partnership with the World Bank (World Bank, 2003); and in Argentina, Italy, and Sweden among others globally. In Africa, the trend exists and was originally instigated among the economy wide reforms implemented under the World Bank and IMF funded Structural Adjustment Programmes (SAPs) (Elbialy and García-Rubio, 2011). African countries implementing or which have implemented some level of judicial reforms include South Africa, Tanzania, Cape Verde, and Egypt among others. Kenya surely is in this pack; it began the journey in 2003<sup>1</sup> and is currently implementing more reforms brought about by the promulgation of a new constitution in 2010.

Of the many reforms brought by the Constitution and its accompanying legislations to Kenya's Judiciary, those on its structure are the most evident. The law introduced another appellate court now on top of the system; the Supreme Court. Besides, it scrapped District Magistrates Courts and created other courts in the level of the High Court (see the Constitution of Kenya, 2010 Art. 162 (2)). Other reforms aimed at restructuring and reconstituting the Judicial Service Commission (JSC), simplifying judicial procedures, introducing judicial performance measurement programme, increasing the number of judicial officers and other staff, making the Judiciary financially independent (by creating the Judicial Fund), among others which are ongoing (see the Judicial Transformation Framework 2012-2016).

Expectedly, the performance of the Kenyan courts is to improve with time as more and more reforms are implemented. The question is whether such improvements have been witnessed in

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<sup>1</sup> In 2003, a tribunal was appointed by the then Kenyan Chief justice Evans Gicheru with aim of ridding the Judiciary of unsuitable judges. The tribunal recommended the removal of a number of judges. This was seen as the first instance in modern Kenya to transform the institution.

reality. This is why the efficiency (specifically, technical efficiency) of the institution should be studied; more so, given the general anecdotes<sup>2</sup> of such improvements since initiating the reforms. Such studies (on judicial technical efficiency) are not new. In the global scene, the studies have either been on single country judicial systems or a comparison of a number of judiciaries. Examples are those by Ippolitti et al. (2015) and Deyneli (2012) which estimated technical efficiency of a sample of European countries' judiciaries using the scores later to establish relationships between other variables and judicial efficiency. South American studies are mostly on Brazil; example include that by Yeung (2009), Yeung and Azevedo (2011) and that by De Sousa and Schwengber (2005) all of which focused on establishing technical efficiency as a basis to identify and make recommendations on less efficient courts. North America boasts one of the pioneering studies on a judicial system's technical efficiency; the work by Lewin, Morey and Cook (1982) on superior courts in North Carolina in the United States using Data Envelopment Analysis (DEA).

Research in this line is almost nonexistent on African countries; among the widely accessible publications, no paper on an African country's judiciary, saves for Egyptian system, could be located (Voigt, 2014). Elbially and Garcia-Rubio (2011) is one of the papers on the Egyptian Judiciary. Taking cognisance of reforms on Egyptian first instant courts, the authors used DEA to assess technical efficiency of the affected courts. Finally, other than qualitative studies one of which include that done by Machage (2014) on the role of ICT implementation on the performance of Mariakani Law Courts, the current author found no technical efficiency study on the Kenyan Judiciary. It is on this that this study was necessitated.

## **1.2. Problem Statement**

Every producer's aim is to eliminate wastes as much as possible. This even though inbuilt in the private sector, may not in the strict sense apply to a public institution like the judiciary. On their own, public institutions lack the incentives to operate efficiently which prone them to wastages. However, because these institutions are increasingly exposed to public scrutiny, such wastages can no longer be condoned, more so for the critical ones. So, a way must be advanced to keep such institutions in track with regard to their efficiency levels. This needs evidence. This

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<sup>2</sup> An example of such is an article titled "Mutunga built a strong Judiciary but failed to make the courts coherent" by lawyer Ahmednasir Adullahi in the *Daily Nation Newspaper* on 17<sup>th</sup> June, 2016 (p. 10)

evidence can be in form of measures of the judicial efficiency levels. Such measures are even more necessary during or after the implementation of some levels of judicial reforms in a country (Dakolias, 1999) as is the case in the post 2010 Constitution Kenya.

The reforms were to improve the image of the institution then viewed by most to be highly inefficient and corrupt (Amollo, 2012; Hope, 2015). Before the reforms, cases took longer than usual to be resolved (Amollo, 2012); the result was a backlog of cases with the oldest dating back to 1968 (The Judiciary, Republic of Kenya, 2014). To be noted, as at August 2014; 31 % of all pending cases in Kenyan courts were more than 60 months old (ibid). With the reforms, the tone has generally changed. Some observers have even argued for a better judiciary than previous (Abdullahi, 2016; Amollo, 2012). The problem is that the arguments are scarcely data based.

It is for the above reasons that this study sets to estimate technical efficiency of the Kenyan Judiciary, tracking its trend over the reform period. Focus was on the lowest unspecialised court level<sup>3</sup>, the Magistrates' Courts, whose data were analysed under frontier method to technical efficiency measurement. The Magistrates' Courts were selected because they have the widest coverage and handle the bulk of cases filed in Kenya (The Judiciary, Republic of Kenya, 2014). Consequently, their performance is hugely expected to affect the overall performance of the country' judicial system. For the frontier method, it is the dominant technique believed more appropriate for efficiency studies (Daraio and Simar, 2007).

### **1.3. Research Questions**

Going forward, this study was guided by the following questions.

- a) For the period January 2014 to January 2016, what was the monthly average technical efficiency estimates for the Kenyan Magistrates' Courts?
- b) Has the Magistrates' Courts Technical efficiency estimates been improving?

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<sup>3</sup> Kenyan courts system has 4 levels, the Subordinate courts which are basically, but not for all matters, the first instant courts. Above these are 3 appeal levels, the High Court, Court of Appeal and the Supreme Court. The high court also serves as a first instant court for high level and certain special cases like those on environment. Among Subordinate courts are specialised courts like Kadhi's court based on Sharia law meant to handle family cases Islamic disputants in consent. See Constitution of Kenya Chap. 10 for details.

#### **1.4. Objectives**

The main objective of this study was to track the technical efficiency of the Kenyan Judiciary while focusing on the Magistrates' Courts. In specific, the study intended:

- a) To estimate the Kenyan Magistrates' Courts' post reform monthly average technical efficiencies
- b) To establish the trend of the efficiency estimates for the period.

#### **1.5. Justification**

This study intended to track Kenya's judicial technical efficiency for a period under its most recent major reformation. As shown by others (see introduction above), studying this area is important. The only thing is that few have been done in Africa in particular, and none (to the best of the current researcher's knowledge) in Kenya. Hopefully, this paper went along way in filling that gap. Also, the study employed FDH as opposed to the more popular DEA. With the information gathered, the belief is that such not only added to existing literature on judicial technical efficiency but, also may be used as a basis modifying the existing models.

The study was also justified on the relevance of its findings in guiding the general Kenyan judicial policy specifically the Magistrates' Courts. Since 2011, the country has been implementing a number of institutional reforms including those on its Judiciary. The reforms were generally meant to improve the institution's performance including its efficiency in handling cases. This paper, by showing the institution's performance through its largest courts system level in the reform period, hopefully provided data upon which further reform actions can be based. In particular, it found a trend whose further investigation may results in a better judicial system.

#### **1.6. Organisation of the Study**

Moving from this introductory chapter, the next discusses the relevant literature; it subdivides this in two sections: theoretical and empirical literature. This is followed by a discussion of the study's methodology in chapter three, the study's results and interpretations in chapter four and finalising with the study's conclusions and recommendations in chapter five. Other relevant materials are included in the appendix.

## CHAPTER 2: LITERATURE REVIEW

### 2.1. Theoretical Review

#### 2.1.1. Efficiency, Concept and Definition

In theory of production, assumption is that inputs are needed to produce outputs. Such are combined in ways aimed at optimising a firm's production. This combination of inputs and outputs in general is presented by a firm's production set and specifically by a production function or technology (Gravelle and Rees, 2004). A firm that operates on its technology such that no further improvement can be made is said to be efficient in producing output (ibid). However, in an industry, an efficient firm is that using an industry's best practices beyond which none can outperform (Daraio and Simar, 2007); in other words, efficiency becomes a comparative measure.

The two are the basis of two approaches to efficiency measurement in production; regression and frontier approaches. The former assumes firms always optimise hence focuses on estimating their production function (Daraio and Simar, 2007). The latter recognises failure by firms to optimise hence centred on establishing a best practice frontier used as a benchmark to gauge each firm's efficiency (ibid). This study followed the latter. It takes note of the many definitions of the concept as the basis of its various classes. Common of these are: technical efficiency, scale efficiency, structural efficiency, economic efficiency, etc. Because this study aimed at measuring technical efficiency, the others are not discussed. Technical efficiency is easier to study given the ease at which its necessary variables can be measured and accessed from readily available data. It only require information on the amount of inputs and outputs, these are not as troublesome to measure as price variables (Farrell, 1957).

Technical efficiency can be measured by taking the ratio of a firms' (DMU's) output to that of its input (Sengupta, 1995; Cooper, Sieford and Tone, 2000 cited in Daraio and Simar, 2007). However, this confuses with a measure of productivity. Therefore, it is better viewed as an index of observed input output set against their respective optimal values where the optimal values are those on a firm's production possibility frontier (Daraio and Simar, 2007). In this respect, technical efficiency is defined as the ratio of optimal (minimum) inputs to observed inputs or that of optimal (maximum) outputs to observed outputs *ceteris paribus* (Lovell, 1993 cited Daraio and Simar, 2007). This definition is the basis of frontier based models.

In these models, measuring involves two stages (Geys and Moesen, 2008). In the first stage, a set of input output combinations representing best practice are selected to construct the efficient frontier. After this, efficiency is measured by projecting every observed input-output set to the frontier. This depends on how each model treats the distance from the observed value to the frontier (ibid). Generally, the distance shows inefficiency. For nonparametric measures, this distance is calculated either as a radial measure (due to Debreu, 1951 and Farrell, 1957), hyperbolic distance (suggested by Färe, Grosskopf, and Lovell, 1985) or, a direct distance function (by Chambers, Chung, and Färe, 1996).

The popular frontier models are: Data Envelopment Analysis (DEA), Stochastic Frontier Analysis (SFA) and the Free Disposal Hull (FDH) models. These fall in two general categories of parametric (consisting of SFA) and nonparametric approaches (encompassing DEA and FDH)<sup>4</sup>. A brief discussion of each follows.

#### 2.1.3. Stochastic Frontier Analysis (SFA)

SFA models are founded on the works of Aigner, Lovell and Schmidt (1977) and that by Meeusen and van den Broeck (1977). They establish their efficient frontier by fitting data on a functional model assumed in advance. For that matter, they are parametric needing prior model specification. Secondly, they are stochastic; hence attribute deviations from a benchmark (efficient) frontier to inefficiency and an error term. Getting an efficiency score thus involve separating the distance from a frontier into two, that due to inefficiency and the other, due to error. The separation calls for further assumption regarding the distribution of the error term, this makes SFA the most restrictive among the three (Hampf, 2013).

#### 2.1.4. Data Envelopment Analysis (DEA)

DEA models are traced to the works of Farrell in 1957 that furthered those by Koopmans (1951) and Debreu (1951) to define an efficiency measure based on a convex technology. Basically, the model works by comparing every DMU to their efficient peers defined by a convex frontier. Farrell's model is a radial measure; it calculates efficiency by proportionately manipulating the relevant variable as one move towards an efficient frontier. The name DEA was given by Charnes, Cooper, and Rhodes (1978) who introduced a constant return to scale DEA. Banker,

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<sup>4</sup> Nonparametric methods are based on mathematical and economic assumptions on the production set requiring no functional form set by Shephard (1970 cited in Hampf, 2013)

Charnes, and Cooper (1984) later modified the model to allow for variable return to scale. DEA models are nonparametric: they need no prior model specification; assume convex frontier; and are deterministic in the sense that all deviation from their benchmark frontier are attributed to inefficiency. DEA models are based on mathematical programming techniques, specifically linear programming (Geys and Moesen, 2008).

#### 2.1.5. Free Disposal Hull (FDH)

These are based on the work of Deprins, Simar, and Tulkens (1984) and, like DEA are also nonparametric and deterministic. The only difference is that their benchmark frontiers are not restricted to a convex hull. They only rest on the assumption of strong disposability of variables implying monotonicity (Simar and Wilson, 2011). In that case, they construct a step-wise frontier tracing the best performing DMUs. Also, their efficiency values are computed by mixed integer programming under vector dominance reasoning suggested by Tulkens (1993).

#### 2.1.6. SFA, DEA, and FDH Compared

Because DEA and FDH are both nonparametric with similar assumptions except convexity assumption, they are hereby bunched and compared together with SFA models. On the positive side, nonparametric measures triumph SFA on the following: they can handle multiple inputs and outputs, and need no prior model specification. Because of no prior specification, DEA and FDH each avoid the problem of misspecification responsible for inconsistent estimates (Simar and Wilson, 2011).

SFA wins on the following. Compared to DEA and FDH, SFA models are not that sensitive to outliers, they produce parameters with attractive economic interpretations (Daraio and Simar, 2007) and are rarely affected by ‘dimensionality curse’ (Simar and Wilson, 2011). A model is said to suffer from dimensionality curse if the rate of convergence of its estimators to the real value reduces with the number of dimension used (for this case, inputs and outputs) (Simar and Wilson, 2011; 2014). However, SFA is shielded from this curse only if correctly specified, correct specification is hard in practice. Going forward, this study solely focuses on nonparametric measures.

Turning on DEA vs. FDH, the following can be said. All are nonparametric with similar advantages and disadvantages except where the shape of a frontier is a concern. DEA assumes



convexity which is relaxed in FDH so, DEA will be better where a firms' actual production function is convex. However, assuming convexity where such cannot be proved is inappropriate given no economic theoretical basis of such (Cherchye, Kuosmanen, and Post, 2000) and its violation empirically by some firms (Geys and Moesen, 2008; Cherchye et al., 2000). This is more evident in public institutions whose behaviour cannot be generally modelled hence better analysed under FDH (de Borger, Kerstens, Moesen and Vanneste, 1994). For these reasons, this paper settled on FDH.

#### 2.1.7. Further Developments on Nonparametric Measures

A number of developments have been proposed to correct some of the initial weaknesses of nonparametric measures namely: their sensitivity to outliers, lack of a way to explain heterogeneity among firms, and lack of economic interpretation of the frontier (Simar and Wilson, 2011; 2014). The first weakness has been corrected by the development of partial frontier models such as the expected order-m and expected order  $\alpha$  models (ibid). To eliminate the sensitivity, these models use a sub-sample to establish their frontier. What separates the two is how they establish their sub-sample. Notably, this is the main problem of these models even though rule of thumbs exist to suggest ways of getting such subsample (see Simar and Wilson, 2011; 2014 for more).

Developments to explain heterogeneity among DMUs are the most widely used among those proposed to correct weaknesses of the basic models (Simar and Wilson, 2011; 2014). They involve introducing environmental factors into the basic models. Such have been done in two ways; putting the factors in the basic model as either inputs or outputs or in a second stage regression where the factors serve as regressors (ibid). The latter is the popular two stage nonparametric methods e.g. the 2-stage DEA. Though useful, Simar and Wilson (2011; 2014) warned against their use in situations where the 'external variables' affects a firms production function hence its efficient frontier. Such situations require other techniques more technical and mathematically demanding.

Other developments are those intended to parameterise nonparametric measures with an intention of making them more economically meaningful. Such are the result of nonparametric stochastic models and semi-parametric models (see Simar and Wilson, 2014). These models propose ways in which noise can be introduced into the nonparametric model, however, they are

computationally demanding (ibid). The most promising of the lot is a two stage parameterisation. Where basic nonparametric measures are used in the first stage to get efficiency scores later fitted in the second stage using OLS (Simar and Wilson, 2014). However, because the techniques are yet to be empirically applied, they are shunned in this study.

## **2.2. Review of Empirical Literature**

This section reviews studies with respect to what has been done in relation to measuring technical efficiency of a country's judicial system. This approach is to put more emphasis on choices as oppose to individual studies. Because of the specificity of such studies' results to the selected sample, the transferability of their findings is limited to the sample and to some extent to the respective population (Geys and Moesen, 2008). What can easily be transferred are the choices made with regard to the DMU, variables, methodology and data type. It is for these reasons that discussion of the results are by large omitted.

### **2.2.1. Studies by Region**

Until recently, few researchers have been interested in studying judiciaries in terms of technical efficiency (Voigt, 2014). This may have been due to lack of interest from quantitatively trained researchers like economists, a perception among legal scholars (familiar with judicial procedures) that such studies are less useful compared to those focusing on quality of judicial decisions (Rosales-López, 2008), and a general lack of data needed to perform such studies (Castro and Guccio, 2014; Rosales-López, 2008).

The last may be the reason more studies on developed country's judiciaries exist compared to those on developing countries. In Europe, Castro and Guccio (2014) used data on 27 Italian judicial districts to make conclusions on factors responsible for the Italian judicial inefficiencies. Hagstedt and Proos (2008) used 1998/1999 and 2006/7 data on Swedish district courts to establish a connection between judicial reform and judicial efficiency. While on a cross country level, Deyneli (2012) studied the effect of judges' salary on judicial efficiency by analysing data on 22 European countries. In the US, Ferrandino (2012) used data on 20 Florida circuit courts pooled for 15 years to investigate the performance of the circuits after a revision that changed their operations. The above are but a few, more studies exist.

Turning to developing countries, the following studies have looked at judicial system efficiencies. First is a study by Yeung and Azevedo (2011), dividing their unit of analysis in to first and second instant courts, they used data on 27 Brazilian state courts to make conclusions with respect to states needing improvement. Yeung (2009) had previously made such conclusion using Brazilian state courts' data from 2006-2008. On the Asian continent, is a study by Tsai and Tsai (2010) on 18 district courts in Taiwan.

Of all the continents, Africa is the least studied with regard to judicial technical efficiency (Voigt, 2014). This may be so due to data problem common in most developing countries and which is prominent in Africa (Center for Global Development, 2014; Dakolias, 1999; Elbially and Garcia-Rubio, 2011) and may have been made worse by the popular nonparametric techniques which demand large data (Simar and Wilson, 2011). The only visible study is that by Elbially and Garcia-Rubio (2011) on Egyptian first instant courts. Theirs was to investigate these courts' efficiency after a policy which altered their operations. They based this on an analysis of 22 first instant courts. Kenya is part of the existing dearth of studies on technical efficiency of African countries. This can no longer be justified given the much publicised reform the country's Judiciary is undergoing. By gauging the institution's technical efficiency, this study adds onto the current measures used by the institution to gauge its performance (PMMSC, 2015).

Proceeding, the next three sections look at the various choices made by researchers on judicial efficiency. The flow is from choices regarding unit of analysis, choices of inputs and outputs, and models used.

### 2.2.2. Unit of Analysis (Choice of DMU)

Depending on coverage, studies are either based on individual courts for within country studies or on national judiciaries in cross country studies. Except for a few cross country studies in Europe, most studies are on national judiciaries. Cross-country studies have mainly aimed at providing comparisons or testing influence of particular factors on judicial efficiency. For instance, using country data, Ippoliti et al. (2015) tested the effect of judicial performance on entrepreneurial behaviours in Europe. Deyneli (2012) used similar data to investigate the effect of judges' salaries on judicial efficiency.

In within country studies, the courts are further subdivided. This is motivated by the need to attain homogeneity necessary for frontier methods commonly used. Yet, most within country

papers have analysed first instant courts. Some of these include a study by Elbially and García-Rubio (2011) on Egyptian first instant courts, a study by Kittelsen and Førsund (1992) on Norwegian district courts, and that by Hagstedt and Proos (2008) on Swedish district courts. Yeung and Azevedo (2011) took this further by considering courts in two levels (1<sup>st</sup> and 2<sup>nd</sup> instant) in their study of Brazilian state courts' efficiency. The same applies to Castro and Guccio (2014) earlier mentioned.

### 2.2.3. Previously Considered Variables

The second choice is that of what to consider inputs and outputs. Choices of inputs so far in studies are in general measures of labour, capital, and judicial 'raw material', the cases. Some studies have considered measures of labour as their only input variables (see Deyneli, 2012; Kittelsen and Førsund, 1992; Yeung and Azevedo, 2011), this they did by arguing that courts are labour intensive (Deyneli, 2012). Specifically, they used the number of judges and/or that of non-judge staffs as their only inputs. Other studies have gone ahead and considered other measures besides those of labour. For example; Schneider (2005) used the number of judges and caseload per court in his analysis of the German courts, Ippoliti et al. (2015) added pending and incoming cases on top of judges and non-judge staffs, while Elbially and Garcia-Rubio's (2011) addition besides the two labour measures was computers per court. Some studies have used measures outside the classes discussed above. For example, wages and administrative cost were the only inputs in Hagstedt and Proos (2008) while Tsai and Tsai (2010) used a measure of time they named 'finished day' in their analysis of Taiwan courts.

Choice of judicial output has not been as diverse as that of inputs, for instant, all above mentioned papers considered decided cases as a single output or classified it into multi-outputs. Besides disposed cases, Schnieder (2005) considered published decisions while Deyneli (2012) added country population as extra outputs. Because the aim of any judicial system is to ensure justice thus the better output, all the above output measures can be viewed as 'intermediate outputs' (Rosales-López, 2008).

### 2.2.4. Efficiency Estimation Models

The three common models discussed above are also the most common on studies on judicial efficiencies. This section looks at such choices and their defences.

DEA leads in this and is cited for its ability to handle multiple inputs and outputs. Studies on DEA include: that by Yeung and Azevedo (2011), Schneider (2005), Ippoliti et al. (2015), Deyneli (2012), Elbially and Garcia-Rubio (2011), and Hagstedt and Proos (2011). Of the above, most used output oriented DEA. This is because of an understanding that courts' inputs are determined by factors beyond the courts control (Tsai and Tsai, 2010) like legal procedures (Yeung and Azevedo, 2011) which rules out input orientation. Less favoured is the input oriented DEA. For studies on this, the defence is that some courts limit court manager's control on outputs more than control on inputs. A good example is Deyneli (2012) who argued that the restrictive case disposition timeframe in his sampled European judiciaries limited judges' control on output, he therefore used input oriented DEA.

Notably, all the above studies (like most) ignored statistical properties of the DEA estimator. As Simar and Wilson (2011) observed, DEA estimates are like other estimates and must therefore be tested statistically. A study which tried this is that of Castro and Guccio (2014). They used a smoothed bootstrap procedure to correct DEA's bias and test the estimates.

FDH and econometric models have also been used but, in a lesser extent (see St Aubyn, 2008; Voigt, 2014 for a review). Tulkens (1993) opened the window on FDH with his study of the Belgium courts. This has been replicated by others, an example is the study by de Sousa and Schwengber (2005) on the Brazilian courts in the state of Rio Grande Do Sul. They used FDH together with another estimator, considered more robust (Simar and Wilson, 2011; 2014), the expected order-m estimator. For econometric models, an example is a study by Rosales-López (2008) on the performance of Spanish courts.

#### 2.2.5. Trend of Judicial Efficiency

While a number of quantitative studies have been done on performance of judicial systems, few have bothered to track such measures over time. This is strange given the recent reformation of these institutions especially in developing countries. As Dakolias (1999) argued, reforms will be better directed if gauged on their effectiveness in meeting their objective, improving judicial efficiency is one (World Bank, 2003). Only a handful of studies globally have attempted this, however, most have gauged efficiency after reforms without attempting to seek out the improvements or lack of it. This is what was done in the Brazilian study by Yeung and Azevedo (2011), Elbially and Garcia-Rubio's (2011) research on Egyptian courts among others.

The trend is however broken by Hagstedt and Proos (2008); in their study of the Swedish district courts, they used pre and post reform data (1998/9 and 2006/7 sets). They then compared the results from these two data sets to conclude that efficiency of the Swedish courts actually improved after reformation. Ferrandino (2012) improved on this further. This he did on his study of Florida circuit courts. The objective was to find out the effect of the courts reform which affected their funding. Using data on the courts from 1993-2008 and analysing it under pooled DEA complemented by two-way ANCOVA, the study concluded that the reform negatively affected the circuits technical efficiency with time. The current study to some extent followed this, but; with no intention of establishing causal relationships besides using ANOVA as oppose to ANCOVA.

### **2.3. Literature Overview**

Efficiency in production entails optimal use of resources. In analysing this, most authors have gone the frontier direction. That is, measuring a firm's efficiency based on a best practice frontier constructed on the best performing firms. Common frontier methods are DEA, FDH, and SFA. All have extensively been applied in empirical studies including those on judicial systems.

To use frontier methods, choices must be made on inputs and output measures. Number of judges, other staff, filed cases, pending cases, and computers are some of the common inputs in the studies. Settled cases dominate output measures. Based on this, the current study initially settled on three inputs; filed cases, number of court staff, and the number of courts rooms per station but; used only the first two due to lack of data on the last input. Labour was aggregated into one measure, court staff. On outputs, this paper divides them into civil and criminal decided cases; their procedures differ hence are seen as separate outputs.

With the above in mind, the following applied to the current paper. It adopted FDH in its analysis going output oriented as most past judicial efficiency papers. The choice is because of minimal control of judicial inputs by court managers which invalidates use of input saving FDH measure. Unlike most judicial efficiency studies save for a few like Castro and Guccio (2014), this study used bootstrap to correct FDH bias and construct confidence interval for the unbiased results. It also tested and eliminated serious outliers. Further, this study unlike others goes beyond point technical efficiency estimates and traces the trend of such over time.

## CHAPTER 3: METHODOLOGY

### 3.1. Introduction

This chapter expounds on the methodology used. It begins by discussing the theoretical model, follow this by an outline of the estimated model before giving a description of the study's data.

### 3.2. Theoretical model

This section outlines the theoretical model underlying the expected empirical model. Because the study settles on output oriented FDH efficiency estimator, this section will describe the logic behind output-oriented nonparametric models in general; the specifics on FDH are better distinguished under the section to follow on the intended empirical model. The discussion borrows heavily from Simar and Wilson (2014) in concepts and notations. To add, the notations are as commonly used in most technical efficiency based papers.

In production theory, a firm is modelled to use a set of inputs to produce output(s). This combination of inputs and outputs forms a firm production set and is the focus of efficiency analysis. The aim of such analysis is to theoretically define the set and thereafter use it to study a firm's efficiency. Following Koopmans (1951) and Debreu (1951), the production set is presented as follows.

Let  $x \in \mathbb{R}_+^p$  denote a vector of p inputs and  $y \in \mathbb{R}_+^q$  represent a vector of q outputs. A production set is the feasible combination of inputs and outputs and is given by:

$$\Psi = \{(x, y) \in \mathbb{R}_+^{p+q} | x \text{ can produce } y\} \quad (1)$$

Its boundary is given by equation (2) and forms the benchmark frontier of efficient input output combinations.

$$\Psi^\partial = \{(x, y) \in \Psi | (Y^{-1}x, Yy) \notin \Psi \text{ for any } Y > 1\}^5 \quad (2)$$

Where  $Y$  is an index identifying the efficient frontier.

Having established the frontier, the next step in efficiency measures is to measure the distance from an observed point to the frontier. In getting this, various measures can be used. The most

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<sup>5</sup> The production set boundary has various assumptions including: free disposability assumption, "no free lunch" assumption and the assumption of convexity. See Simar and Wilson (2014) for a brief on the three and Daraio and Simar (2007) for a discussion of the three plus others. The assumptions were set by Shephard (1970)

common (and which this study adopts) are the Farrell-Debreu (radial) measures. These are, input oriented approach or output oriented depending on a firm's control on either inputs or outputs (Daraio and Simar, 2007). Output orientation is more appropriate where greater control is on the amount of output(s). This is the chosen path for this study. Kenya's Magistrates' Courts' main input (filed cases) are demand based depending on factors beyond the courts' control such as legal procedures (Yeung and Azevedo, 2011). Since the main judicial input is not under courts' control, output orientation fit better. This output oriented efficiency score is given by the maximum radial expansion of outputs in  $(x, y)$  towards the efficient frontier  $\Psi^\theta$ . This is by solving equation (3):

$$\lambda(x, y) = \sup\{\lambda | (x, \lambda y) \in \Psi\} \quad (3)$$

For all  $(x, y) \in \Psi$ ,  $\lambda(x, y) \geq 1$ ; 1 = efficient

Where  $\lambda$  represents the output maximising efficiency score. It is the proportion by which output can be expanded with the existing input levels (Simar and Wilson 2011).

### 3.3. Empirical Model

The above section showed theoretically how output oriented efficiency measure is generally established under nonparametric methods. It was based on the existence of a feasible production set ( $\Psi$ ) with a boundary upon which observed input output combinations are projected to obtain efficiency scores. In reality, both the set and the subsequent efficiency values are unknown. These can only be estimated from an observed sample. This section discusses how the estimation is done using FDH.

Presenting the sample by  $\chi_n$  and observed inputs and outputs by respective capital letters, the sample consisting of n observed firms is here presented as:

$$\chi_n = \{(X_i, Y_i)\}_{i=1}^n \quad (4)$$

Further, under a nonparametric measure, the assumption is that all observations in the sample belong to the attainable set with a probability of one (Simar and Wilson, 2014), so:

$$Pr((X, Y) \in \Psi) = 1 \quad (5)$$



Using the observed data, the first aim is to estimate the unknown production set. Using FDH, this is as follows for a production plan  $(x, y)$ :

$$\hat{\Psi}_{FDH}(\chi_n) = \{(x, y) \in \mathbb{R}_+^{p+q} \mid y \leq Y_i, x \geq X_i, (X_i, Y_i) \in \chi_n\} \quad (6)$$

With the production set estimated, the next step is to use it to get each firm's efficiency estimate. The estimates are simply calculated by replacing  $\Psi$  with  $\hat{\Psi}_{FDH}(\chi_n)$  in the efficiency calculator  $\lambda(x, y)$  presented in equation 3. The result is the following FDH estimator.

$$\hat{\lambda}_{FDH}(x, y) = \sup\{\lambda \mid (x, \lambda y) \in \hat{\Psi}_{FDH}(\chi_n)\} \quad (7)$$

Solving the above is by vector dominance reasoning, a concept introduced by Tulkens (1993). A point  $(x_0, y_0) \in \Psi$  is said to dominate another point  $(x, y) \in \Psi$  if  $x_0 \leq x$  and  $y_0 \geq y$ . In this light, a set dominating  $(x, y)$  is given by:

$$D_{x,y} = \{i \mid (X_i, Y_i) \in \chi_n, X_i \leq x, Y_i \geq y\} \quad (8)$$

Incorporating this, the final FDH efficiency scores are given by solving the below for every observed input output set  $(x, y)$ .

$$\hat{\lambda}(x, y) = \max_{i \in D_{x,y}} \min_{j=1, \dots, q} \left( \frac{Y_i^j}{y^j} \right) \quad (9)$$

This model is the basis or results aimed at achieving this study's first objective which was; to estimate the monthly average Kenyan Magistrates' Courts technical efficiency for a period under judicial reforms. The average is deemed a good pointer at the general efficiency level of the entire Kenyan judicial system. The  $x$  and  $y$  in their variants as discussed will represent Kenya's judicial inputs and outputs respectively.

To answer the second objective which was to establish whether the mean efficiency has been improving, ANOVA and simple Ms Excel graphs are used. The graphs were to establish the courts' monthly average efficiency trend over the period. On establishing the trend, one-way ANOVA followed to test the difference in the means. The months were the independent variable representing the categories while the courts' efficiency scores became the dependent variable.

### 3.3. Used Variables

For the above purpose, definition of variables for the study is in order. The variables representing inputs (X) and judicial outputs (Y) are as in the table. All these are guided by previous research as reviewed in chapter 2. They are limited to four most common variables; others were ignored given their absence in existing data and the problem more variables present on the rate of convergence of the estimates to its actual values (Castro and Guccio, 2014; Simar and Wilson, 2011; 2014).

**Table 1: Variables, their definitions and Measurements**

Variable		Measurement
Inputs (X)	Filed cases	Number per court station
	Court staff	Number per court station (both judicial and administration staff)
Outputs (Y)	Civil cases	No, per court station
	Criminal cases	No. Per station

### 3.4. Data, Type and Sources

The study used secondary data on Kenya's first instant courts, the Magistrates' Courts. This was collected from the Chief Registrar of the Judiciary through a formal request for the months January 2014 to January 2016. The data set had all the four variables in table 1.

## CHAPTER 4: FINDINGS, ANALYSIS AND INTERPRETATIONS

### 4.1. Introduction

This chapter presents the findings of this study. It begins by describing the data accessed and manipulations done to make it suitable for the analysis followed by the analysis. The analysis is in three parts. The first part deals with measuring the Kenyan Magistrates' Courts efficiency under FDH. This is done for all the months whose data were accessed. The means of the monthly scores are then used to construct a time series data graphed to establish the trend of the courts' efficiency. An ANOVA analysis is finally used as a mean of testing the trend, it is used to test if the plotted means are statistically different. The results answer this study's main objective which was to track the technical efficiency of Kenyan Judiciary through the Magistrates' Court system.

### 4.2. Preliminary Data Analysis

The study used monthly court data for the period January 2014 to January 2016 as collected and maintained by the Registrar's Office of the Kenyan Judiciary. In all the months, there was no instance of 100% submission; data on some court stations were missing while other stations reported incomplete data. Also, these were not reported in a similar format, this varied over the months. In short, the data needed some formatting which involved the following.

First; only courts with complete data were used, this was made simple since most of the data had them already identified. Where the distinction was not given, courts with blank spaces were deleted. This was on the assumption that such blanks signalled incomplete reporting as opposed to non-observation of a variable (assumed reported in zeros). In the end, fewer courts' observations than existing were used. The number of courts data used for every month against the systems' total is presented in table 2 below.

On the variables, the study used the four most consistent ones in all the monthly observations, some months had more variables which could have been useful but were dropped to ensure uniformity over the period. The inputs were, total court staff and the number of initiated cases while outputs were decided criminal and civil cases. Table 2 below give the summary statistics for the variables.

**Table 2: Summary Statistics**

Date	Obs.	Mean				Std. dev			
		Input		Outputs- Resolved		Inputs		Output-Resolved	
		Initiated	Staff	Criminal	Civil	Initiated	Staff	Criminal	Civil
2014									
Jan	80/115	175.31	26.69	148.75	96.73	150.31	20.62	145.40	398.16
Feb	93/115	191.46	27.73	194.94	117.56	196.44	23.97	410.51	593.41
Mar	61/115	197.07	29.93	199.36	46.82	152.09	23.72	213.03	121.87
Apr	68/115	191.93	27.35	185.54	57.46	167.05	24.11	183.57	266.05
May	64/115	255.58	26.34	234.25	53.57	259.78	22.99	225.59	223.81
Jun	64/115	255.58	26.34	234.25	53.57	259.78	22.99	225.59	223.81
Jul	86/115	231.14	26.50	209.62	119.11	259.24	22.05	229.73	517.60
Aug	88/115	285.77	28.86	277.28	170.26	374.23	25.78	356.19	769.40
Sep	99/115	300.37	31.08	275.12	44.48	320.13	28.11	316.00	84.14
Oct	67/115	237.37	27.13	247.77	153.67	233.15	21.92	260.00	714.56
Nov	81/115	207.22	25.20	189.81	113.12	282.01	21.93	264.40	583.33
Dec	56/116	141.68	29.64	89.04	13.70	144.29	26.56	98.65	28.91
2015									
Jan	69/118	122.81	29.20	64.41	5.67	126.88	24.58	73.28	8.29
Feb	66/118	121.00	24.26	72.30	6.08	108.18	18.25	71.03	8.18
Mar	84/118	145.17	26.55	85.60	10.82	123.58	19.68	84.94	18.93
Missing									
Jul	87/118	199.73	32.79	90.09	7.05	374.64	43.10	95.46	8.28
Aug	95/118	91.48	32.33	56.76	6.32	71.44	42.17	55.08	9.74
Sep	98/119	130.23	29.30	11.32	113.12	93.57	26.03	50.53	13.43
Oct	108/119	186.27	33.73	112.29	27.43	249.50	41.90	153.96	50.46
Nov	101/119	163.39	34.34	103.57	24.86	252.57	43.05	138.36	62.66
Dec	97/119	148.70	31.46	88.32	15.88	142.36	28.85	87.15	28.89
2016									
Jan	112/119	172.26	32.88	92.58	12.11	262.83	41.30	166.12	26.35

The following are notable from the table. First is that, as already explained, no month had 100% data submission so, observed courts number varied over the period. This ranged from 56 observations in December 2014 to a maximum of 112 in January 2016. Further, only 3 months had data for over 100 courts.

Over the months, cases filed varied largely, this is evidenced by the large difference between the minimum of 91.48 cases in August 2015 and the maximum of 300.37 in September 2014 reported in column 3. The latter appears to be the peak of what looks like a season of number of filed cases beginning in May 2014 and ending in November the same year. It is only in this season that (on average) more than 200 cases were filed.

Staff number has been maintained steadily per court station, the numbers are in high 20s and low 30s, however, most of the 30 are in the later months perhaps due to increased judicial hiring which has been part of the ongoing judicial reforms (see Judicial Transformation framework 2012-2016 and another). Initially, the staffing may not have affected the average as the new hires were for the new court stations created. For the period covered by accessed data, the number of court stations has increased from 115 in January 2014 to 119 in January 2016.

As expected, the Magistrate's Courts resolved more criminal cases than civil cases. However, this is not the case for September 2015, the month saw more civil than criminal cases being resolved. This peculiarity may be due to more pending civil cases not captured above or the enlisting of traffic offenses as civil cases, filed traffic offenses are known to rise with occasional police crackdown on such offenders.

The final point to be noted is that almost all courts had their observed variables' standard deviations almost equal to their respective means. This is an indication of the high variability possibly resulting from the different geographical and economical locality of the courts. Such will determine the number of cases filed which in turn determined the number of staff and cases resolved.

#### **4.3. Technical Efficiency of Kenyan Magistrates' Courts**

What follows is the discussion of the findings as set by the objectives. The first objective was to measure point technical efficiency of the Kenyan Magistrates' Courts. This was done under a nonparametric efficiency estimator, Free Disposal Hull (FDH) and implemented under Frontier Efficiency Analysis with R (FEAR) package in R as described by Wilson (2008); bootstrap method was used to obtain the unbiased values besides constructing the confidence intervals. The respective efficiency scores are presented here without including their constructed confidence interval; this is shown in appendix 1. Even there, only a single table for the month of April 2014 is given due to the many months involved (22).

Generally, the analysis followed this format. Data used was monthly each containing information on the relevant variables for a number of Magistrate Courts stations. Each month's data was subjected to a FDH technical efficiency estimator thereby obtaining scores for the affected

courts. This was averaged into the monthly mean technical efficiency scores presented in table 3 below. The average is the approximate technical efficiency of the Kenyan Magistrate Court and a pointer to that of the country's entire judicial system.

Using different FDH estimators and manipulated data, four groups of results were found. With regard to the type of estimator, basic and bootstrapped FDH estimators<sup>6</sup> were used mainly for comparison purposes. Also, the bootstrap was to aid statistical inference hard under basic FDH considered biased (Simar and Wilson, 2011; 2014). The two estimators were used on data subdivided into two; that with outliers and that corrected for outliers. The corrected version was based on a test described by Wilson (1993 cited in Simar and Wilson, 2011) and implemented by `ap` and `ap.plot` command in FEAR (Wilson, 2008).<sup>7</sup> These results are presented in table 3. The column on basic FDH are labelled Biased T.E while those on bootstrapped FDH are under Unbiased T.E label. The two major sub-groups are results of differing data.

**Table 3: Mean Monthly Technical Efficiency Estimates**

Month	Original data (Mean Scores)		Outlier Minimised Data (Mean Scores)	
	Biased T.E $[\hat{\lambda}_B^1]$	Unbiased T.E $[\hat{\lambda}_U^1]$	Biased T.E $[\hat{\lambda}_B^2]$	Unbiased T.E $[\hat{\lambda}_U^2]$
2014				
Jan	1.936	0.9177	1.585	0.4688
Feb	2.314	-0.0463	1.346	0.7029
Mar	2.375	2.2030	1.517	1.2450
Apr	1.761	1.2530	1.730	1.2070
May	1.376	0.7554	1.222	0.9083
Jun	1.376	0.7557	1.222	0.9083
Jul	1.281	0.6014	1.261	0.8720
Aug	1.347	0.6842	1.348	0.8064
Sep	1.321	0.4833	1.363	0.7299
Oct	1.897	0.2724	1.515	0.8978
Nov	1.619	1.0740	1.619	1.0740
Dec	1.703	1.0340	1.703	1.0340
2015				
Jan	1.744	1.4220	1.492	1.2500

<sup>6</sup> The bootstrapped based on 10000 reps.

<sup>7</sup> `Ap` command identifies outlier observations which it presents in a matrix for the range of observations a researcher is willing to delete as outliers. `Ap.plot` command plots the log-ratio identifying those observations considered serious outliers. The plots were used, outliers identified and deleted and the process repeated until a smooth plot was found.

Feb	2.679	2.3490	1.443	0.9959
Mar	1.525	1.1670	1.224	0.9915
Missing				
Jul	1.850	1.3540	1.850	1.3540
Aug	1.357	1.0660	1.360	1.0730
Sep	1.437	0.7918	1.378	0.9324
Oct	1.392	0.8341	1.392	0.8341
Nov	1.511	1.0700	1.388	1.0130
Dec	1.618	1.1470	1.406	1.2610
2016				
Jan	1.780	0.5958	1.546	0.9687
Mean	1.691		1.450	

In interpreting the above, it must be noted that all the above scores were based on Farrell-Debreu output oriented efficiency measure ( $\lambda$ ). Such measures show the scale a DMU can improve its output without increasing its level of inputs (Simar and Wilson, 2011; 2014). In this respect, a value of 2 means the possibility of doubling a firm's output should the firm operate efficiently, 1 shows an efficient firm<sup>8</sup>. This interpretation may not strictly apply to the unbiased values. The unbiased values are a result of the difference between an estimated technical efficiency score and its corresponding bias hence may have a value less than 1 or a negative value depending on the size of the estimated bias. For this reason, the unbiased estimates are here not interpreted with respect to their magnitude but are used in comparison with the biased estimates, to establish the trend of the Kenyan Magistrates' Court technical efficiency. To add, all the unbiased values presented are significant at 5% interval level, the results for the month of April 2014 are given in appendix 1 as evidence.

Beginning with the values got without testing and eliminating outliers (column 2), the following can be said. Compared to the best performing courts; in general, the Kenyan Magistrate Court is inefficient. With the existing resources, the courts settled fewer cases than what they could had they performed as the best court among them. This varied with time. July 2014 was the best performing month, it could have resolved more cases by a factor of 1.281. On the contrary, February 2015 had the worst efficiency mean score, had the courts been efficient, they could

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<sup>8</sup> It should be noted that the inverse of the Farrell-Debreu measures are the Shephard distance functions. Under output orientation, the Shephard results are bounded from above by 1 and below by 0; they measure the proportion of a dmU's output relative to the optimal. Shephard measures for the above result are given in appendix 2 for those interested in such interpretations.

have resolved cases equivalent to 2.679 times the number they did. Such more than double improvements could have been possible also in the months of February and March, 2014.

However, the double possible improvements ceases the moment the data is rid of serious outlier observations. For instance, February 2015's mean technical efficiency improves from 2.679 to 1.443 while that for the October 2014 improves from 1.897 to 1.515. In fact, save for a few months (August, September, November and December 2014 and July, August and November of 2015), all the courts mean efficiency scores for the months improved when outliers were reduced. Because FDH identifies its frontier from extreme observations, data with outliers definitely results in overstated inefficiency scores. Such observations are usually removed since they could be a result of recording error (not accounted for in FDH), or belong to a different population (Khezrimotlagh, 2013; Wooldridge, 2012). On the other hand, an observation at times (especially from a small population) may outly simply because it differs from others even if this is in a relevant aspect (Wooldridge, 2012). In FDH, super-efficient observation falls in such category. This is because the basic FDH does not allow for such superefficient DMUs. Because measures were taken to eliminate any error in data used, this study attributes basic FDH outliers to superefficient courts.

#### **4.4. The Trend of Kenya's Magistrates' Court Technical Efficiency**

Besides getting the technical efficiency scores, this study also set to establish its trend with regard to the Kenyan Magistrates' Court while aiming to gauge whether the trend is upward given the ongoing judicial reforms. This was done using data for January 2014 to January 2016. In interpreting the results, the following are considered. First is that the period considered is not long enough to establish a long term trend so, the trend given should be considered an indicator. Second, within the range, some data were missing (April, May, and June, 2015).

The process involved plotting the estimated mean monthly technical efficiency score against time, fitting the plots with short and long term trend lines, obtaining an equation and respective  $R^2$  for the short run trend line before testing the trend under ANOVA. The assumption is that, so long as the plots show an evidence of a trend, then proof of unequal monthly means is enough (DeCosta, 2006). For comparison, all the four technical efficiency estimates presented in table 3 were plotted against time. This was accomplished under Ms Excel. To test for the strength of this



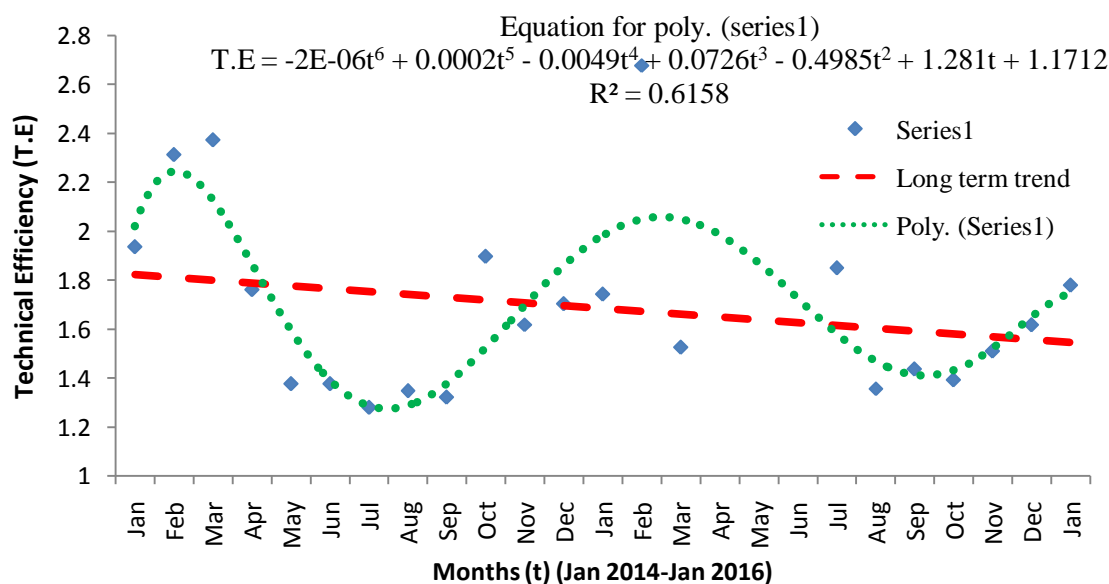
however, ANOVA was used only for the efficiency estimates presented in column 2 and 3 of table 3; the two were deemed enough to establish difference in the monthly mean efficiencies.

In the following discussion, the plots and their respective trends and equations are presented first followed by the results of the ANOVA analysis. For all the plots, two fitting lines are shown; a straight line to predict the long term trend and a more fitting line. The latter was to capture the short term cycles in the trend.

Beginning with the biased scores presented in column 2 of table 3, it can be said that in the long term, Kenyan Magistrates' Court technical efficiency has been improving. In Fig. 1 below, the long term trend line (the broken line) appears to approach 1 albeit at a slow rate. Recall, a score of 1 indicates an efficient DMU with higher values indicating inefficiency.

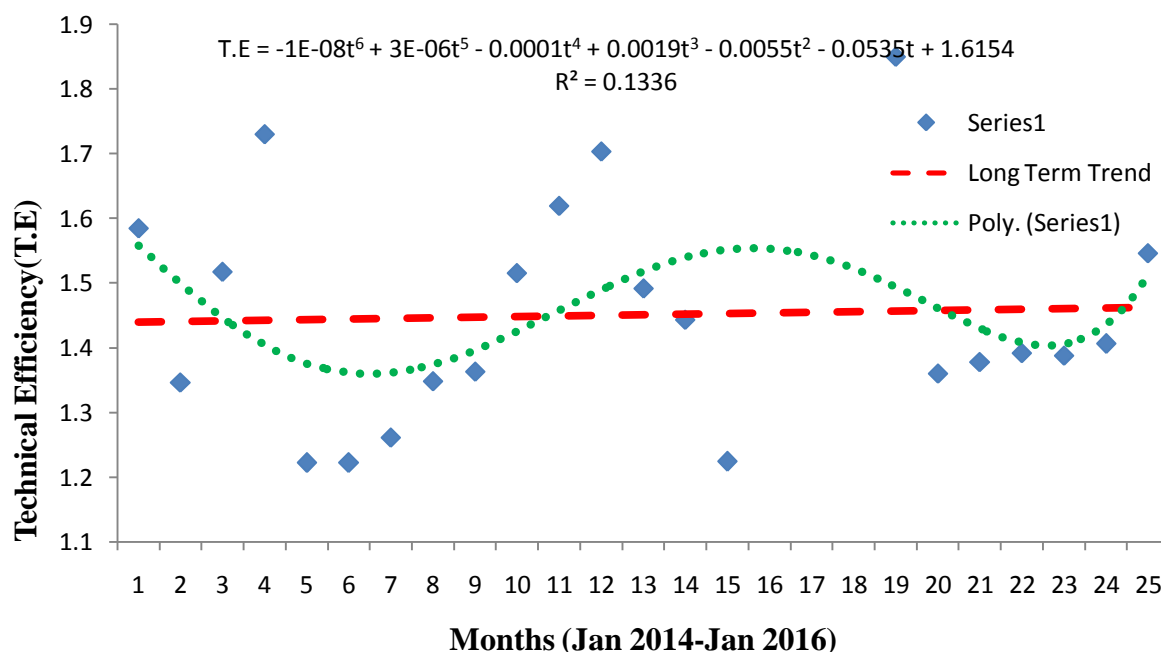
In the short-run, Kenyan Magistrates Courts seem to have a cyclical trend as is shown by the wavy dotted line in Fig. 1. Specifically, the institution exhibits a polynomial trend of order 6. In the figure, an Excel generated equation and its  $R^2$  are also given. Using the equation, it can be seen that the trend depends more on the recent period with the influence diminishing as time passes. Specific to the case of the study, the model show that a court's current efficiency will on a diminishing strength depend on its previous month's efficiency and those immediately before. Because the model explains 61.58% of a courts technical efficiency, it is strong enough.

**Fig. 1: Magistrate Courts' Technical Efficiency Trend, Biased Estimates with Outliers ( $\hat{\lambda}_P^1$ )**



On elimination of outliers from the data and still using the biased measures, the above trend changes. In the long term, the Magistrates' Courts seem to be less efficient with time, a broken line labelled long term trend in Fig. 2 below traces this.

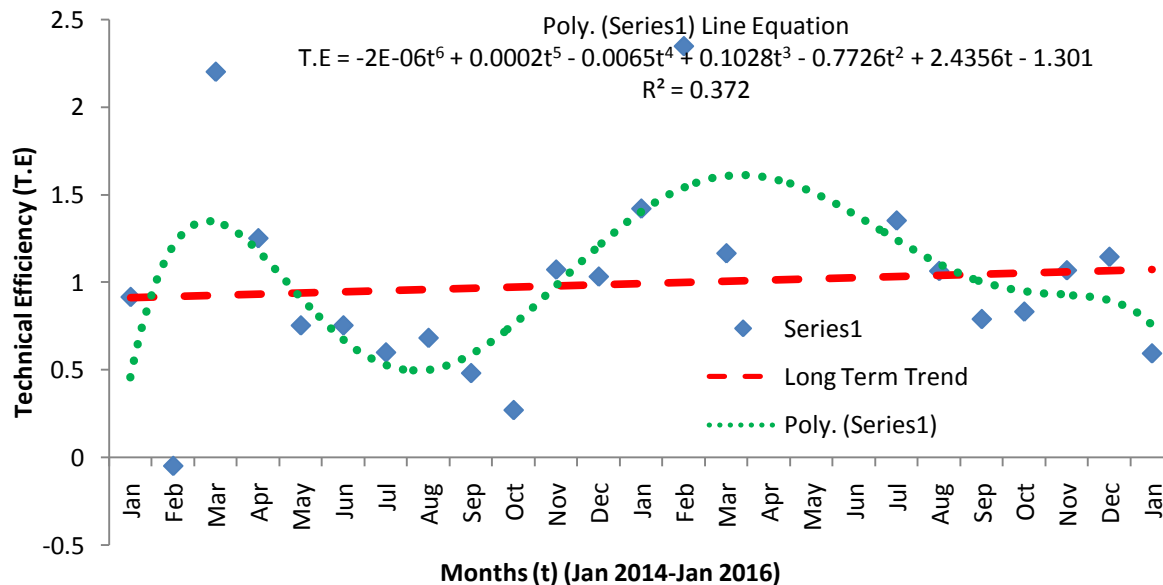
**Fig. 2: Magistrates' Courts Technical Efficiency Trend, Biased Estimates Without Outliers ( $\hat{\lambda}_p^2$ )**



The line can be seen to move away from 1 as time passes. Thus comparing the two trends so far, it seems the Magistrates' Courts general performance depends on a few superefficient court stations. When they are considered, the system appears to get better with time; however, their exclusion bares a possible decline in the courts' performance. The short-run trend is still represented by a wavy line showing the systems' ups and downs. However, while Fig.1 showed a positive relation with the immediate month's performance, Fig. 2 reverses the pattern while still indicating the strong influence of the immediate past performance. This model though polynomial of order six as that on Fig. 1, it is not as strong ( $R^2=13.36\%$ ).

The above results are almost replicated when the bootstrapped FDH estimator is used on the data without eliminating any outlier. Like in the above case, the courts' technical efficiency seemed to be worsening with time in the long-run. The long run line rises with time; the line is the broken one named long term trend in Fig. 3 below.

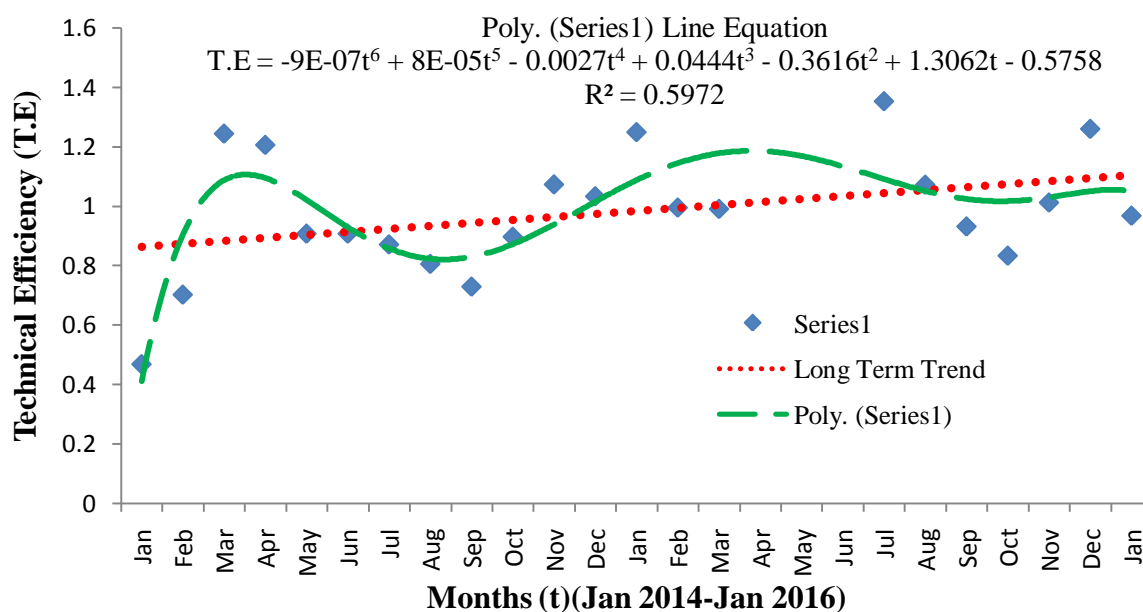
**Fig. 3: Magistrates' Courts Technical Efficiency Trend, Unbiased Estimates with Outliers ( $\hat{\lambda}_U^1$ )**



In the short run, it shows the now familiar wavy (polynomial of order 6) trend but, which unlike the above two, falls out of the pattern with the most recent data. Like all the curves, the immediate month's performance is the most important in predicting a month's efficiency. The respective model is relatively strong; its  $R^2$  is 37.2%. Compared to the trends in Fig. 1, correcting for bias reverses the trend of judicial efficiency from a bettering one (in Fig. 1) to that worsening with time (Fig. 3). Outliers affect an estimator's bias. So, for the same estimator, correcting for its bias will likely have similar trends as correcting for outliers. In this case, it diminished the influence of super-efficient courts which seem to be getting better with time.

Correcting for outliers for the bootstrapped model does not change very much the results in Fig. 3. Like in the figure, the courts seem to get less efficient with time while their short-run efficiency trend is better fitted by a polynomial trend of order six. The only different is that this model is stronger than that in Fig. 3; its  $R^2$  is 59.72%. All these are presented in Fig. 4 below.

**Fig. 4: Magistrates' Courts Technical Efficiency Trend, Unbiased Estimates without Outliers  $\hat{\lambda}_U^2$**



#### 4.5. ANOVA Results

Having established Kenyan magistrates' Court technical efficiency trend, the next step was to test the trend. One-way ANOVA was done to make conclusion with regard to this. Unlike other trend test, ANOVA gives significant results even for smaller  $n$  (DeCosta, 2006), an  $n$  of 22 used here is considered small hence the choice of ANOVA. The test was under a null hypothesis of equal monthly means against an alternative hypothesis of differing monthly means. The two are given below.

$$H_0 = \mu_1 = \mu_2 = \mu_3 = \dots = \mu_n$$

$$H_1 = \mu_1 \neq \mu_2 \neq \mu_3 \neq \dots \neq \mu_n$$

Where the means ( $\mu_i$ ) were the monthly courts' technical efficiency means for  $i$  to  $n$  months. Since the above plots showed a trend, rejection of the null hypothesis was considered enough evidence for statistical significance of the said trend. Further, because ANOVA only test difference in means, the author deemed it unnecessary to test the difference in all the four scores. Biased and unbiased estimates uncorrected for outliers were the only ones tested. Time was the

groupings factor (the independent variable) with the mean monthly efficiency estimates being the dependent variable. This was done under Stata statistical software. The Stata outputs are presented below.

**Table 4: One-way Analysis of Variance for  $\lambda_B^1$**

Source	SS	df	MS	F	Prob. > F
Between month	228.75141	21	10.892924	1.83	0.0118
Within month	10674.294	1798	5.9367597		
Total	10903.045	1819	5.9939776		
Number of obs. =1820		R <sup>2</sup> =0.0210			
Evaluated at n=82.57					

**Table 5: One-way Analysis of variance for  $\lambda_U^1$**

Source	SS	df	MS	F	Prob. > F
Between month	450.26692	21	21.441282	2.04	0.0035
Within month	18857.395	1798	10.487984		
Total	19307.662	1819	10.614438		
Number of obs. =1820		R <sup>2</sup> =0.0233			
Evaluated at n=82.57					

ANOVA works by calculating an F value it compares with the critical F value, a value greater than the critical is enough to reject the null hypothesis. This can also be interpreted with regard to the p-value. For the above results, evidence exists to reject the null hypothesis for both at 5% significance level. The first has a p-value of 0.0118 while the second's group value is 0.0035. Hence; the affected technical efficiency means are statistically different at 5% significance level. The second set of means is significantly different at 1% too. Based on these ANOVA results, the trend established above can indirectly be trusted at 5% significant level.

## CHAPTER 5: CONCLUSIONS AND RECOMMENDATION

### 5.1. Conclusions

On the onset, this study set to investigate the efficiency of the Kenyan Judiciary while focusing on the Magistrates' Courts. Using judicial data accessed from the Judiciary for the months January 2014 to January 2016, the study subjected the data to a FDH efficiency estimator. Because of outlier problem in FDH, both results with and without outliers were reported. In addition and to aid inference, bootstrapped FDH was also used. These results were then averaged per month, and investigated for trend.

In summary, these were the results. On average, the Magistrates Court could have done better with the resources they had. All the months had a mean efficiency of more than 1. This is an indication of resource underutilisation; optimisation of such would have produced more resolved cases. When this was corrected for outliers, the magnitudes of the scores seem to reduce for the months with very high inefficiency estimates. This was attributed to few superefficient courts in the system. Their performance was camouflaging the actual performance of the system.

Turning to the trend of the Kenyan Magistrates' Court technical efficiency, the following are the results. In the short run, the institution has a cyclical polynomial trend of order 6. This was evidenced both in present of and absence of superefficient courts. In the long run, the trend depends on inclusion or exclusion of the said superefficient courts. When included, the courts appear to get better with time. But, the system assumes a declining performance trend with their exclusion. Therefore in general, it can be said that in the face of judicial reforms, Kenya's judicial efficiency has been improving. However, the trend has been driven mainly by a few superefficient courts.

### 5.2. Recommendations

#### 5.2.1 Policy Recommendations

The ongoing judicial reforms in Kenya have been accompanied by the injection of more resources into the institution. New court stations have been established, existing ones upgraded and more judicial staff employed among others. To aid this, the system for the first time was by

the Constitution assigned its on Fund (the Judicial Fund) it manages independently. All these were initiated with an aim of bettering the institution.

From the analysis of January 2014 to January 26 data, this study found evidence pointing toward an institution bettering with time. However, the trend has been dominated by few over-performing courts the absence of which negates the trend. Also, the courts' mean efficiency over the months was below the optimal level. For these, the following may help the judiciary get better results

- Allocate court resources on a need base. This will counter resource under utilisation which may be the reason for the inefficiency still experienced in a majority of the courts. A survey should be done with an aim of documenting resources in existing courts, gauging their level of utilisation and using this as the basis of reallocation and allocation of more resources.
- The few over-performing courts should be identified, their best practise documented and promoted as a benchmark for the nonperforming courts. At the same time, such courts should be feted; their staff awarded and encouraged to perform even better. This should be done in a manner than is sustainable and eliminate unfair practices.
- Further investigations should be done as to the major causes of the cyclical short term efficiency trend. It is only on such information that the long term trend can be influenced and made to improve faster. With the knowledge, 'efficiency booms' can be made longer while measures can be placed to shorten judicial 'efficiency slumps'.
- The best practices so far in place should be implemented going forward with the same or more intensity. Courts behind should be facilitated and supported in the process. This should be based on an evaluation of reforms so far implemented by the courts.

### **5.2.2** Limitations of the Study and Recommendations for Further Studies

This study has two major limitations. First, it is based on FDH estimator which is sensitive to outliers, lacks direct economic interpretations, and suffers from 'dimensionality curse' (Simar and Wilson, 2011). Models have been proposed<sup>9</sup> and some applied which address some of these,

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<sup>9</sup> See Simar and Wilson (2011, 2014) for a discussion on recent development in nonparametric approaches

however, because of the high level of programming needed to execute them, this study left them for future studies.

Second, the study is limited by the number of its observations in time and DMUs; it used data on about 115 Magistrates' Courts. This is considered small under nonparametric approach (see table 2.1 in Simar and Wilson (2011) for some recommendations) even though use of such numbers is not uncommon (*ibid*). Also, given that the reforms were initiated in 2011, the reform period is not long enough. The fact that the current researcher only managed to obtain data for a period of 22 months made the situation even worse, such short period is inadequate for gauging long term trend. So, what is provided here is a preliminary indication which should be investigated with a longer time frame.

With the above in mind, the following are recommended for further studies

- Use of data covering longer than the two years covered here. It is on such that a better longer term trend can be established and even tested.
- Obtain information on more variables and select only those found relevant after performing variable relevance test. Because nonparametric efficiency estimators are sensitive to outliers, measures should be taken to ensure only relevant variables are used. This is because variables used determine observations considered outliers (Khezrimotlagh, 2013).
- Use estimators developed to counter the weaknesses of basic FDH e.g. the robust order-m and order-a estimators, stochastic FDH, semi-parametric measures among others. Alternatively, more than two estimators can be used and their results compared.
- Cover the other courts besides the Magistrate Court, while Magistrates courts are the largest, contribution of the other levels are also important.

Besides the above, future researchers can try and identify the superefficient magistrates' courts in Kenya and investigate the source of their efficiency. In the same breath, the source of inefficiency in the other courts may also present a new study area



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## APPENDICES

### Appendix 1: Magistrates' Court Technical Efficiency Estimates (April, 2014)

Court	Biased	unbiased	bias	Variance	Confidence Interval	
					Lower limit	Upper limit
[1]	1.0000	-0.267	1.26704	0.0949	-0.812	0.377
[2]	2.0166	2.0729	-0.0563	0.0153	1.8335	2.3219
[3]	2.4222	1.8356	0.5866	0.0802	1.3216	2.4233
[4]	3.8928	3.8299	0.06293	0.2237	3.0335	4.8264
[5]	1.1794	0.8369	0.34258	0.013	0.6354	1.0803
[6]	1.4495	0.3193	1.13012	0.0838	-0.156	0.9603
[7]	1.0000	1.3219	-0.3219	0.0516	1.0152	1.8625
[8]	1.9464	1.3695	0.57683	0.0453	0.981	1.8024
[9]	1.0000	0.1398	0.8601	0.0468	-0.239	0.5993
[10]	1.8317	1.3572	0.47448	0.0285	1.0565	1.7215
[11]	1.0000	0.4071	0.59288	0.0823	-0.077	1.0267
[12]	1.0000	0.4467	0.55327	0.0915	-0.037	1.1027
[13]	4.0909	5.2723	-1.1814	0.5313	4.1466	6.5359
[14]	4.2666	5.1828	-0.9161	0.2479	4.3328	6.1946
[15]	1.6133	1.5029	0.11038	0.0148	1.2734	1.7464
[16]	1.5352	0.3335	1.20167	0.0452	-0.078	0.7535
[17]	1.0000	0.9303	0.06962	0.0077	0.7804	1.1237
[18]	1.0000	1.2384	-0.2384	0.022	1.017	1.5797
[19]	1.0000	1.0957	-0.0957	0.007	0.9597	1.2839
[20]	1.0000	0.9352	0.06477	0.0082	0.7747	1.1242
[21]	1.0000	0.5987	0.40128	0.0144	0.3923	0.8467
[22]	1.0000	0.6064	0.39356	0.0261	0.3436	0.9543
[23]	2.5872	0.4699	2.11724	0.6944	-0.756	2.337
[24]	7.4166	7.1382	0.2784	1.503	4.8294	9.5327
[25]	1.0000	0.076	0.92394	0.0942	-0.409	0.7521
[26]	1.0000	1.0689	-0.0689	0.0073	0.9273	1.2604
[27]	1.0950	0.5945	0.50048	0.0184	0.3526	0.8751
[28]	1.8489	2.0394	-0.1904	0.0189	1.8184	2.3293
[29]	1.0000	0.7586	0.24135	0.0202	0.5088	1.0466
[30]	1.6842	0.564	1.12013	0.1186	-0.092	1.2482
[31]	6.5441	4.4072	2.13691	1.4442	2.3639	6.9235
[32]	2.3298	0.6765	1.65328	0.0904	0.1258	1.2872
[33]	1.0000	0.468	0.53194	0.0303	0.1208	0.7774

[34]	1.0000	0.7124	0.28753	0.0077	0.5499	0.8975
[35]	9.0816	10.188	-1.1066	1.1042	8.2929	12.36
[36]	1.0000	0.6144	0.38556	0.0074	0.4494	0.7883
[37]	1.1200	0.9792	0.14075	0.0185	0.733	1.233
[38]	1.0000	0.1526	0.84732	0.0229	-0.105	0.4798
[39]	1.0000	0.7614	0.23856	0.0107	0.5756	0.9735
[40]	1.0000	0.5527	0.44723	0.0247	0.3063	0.9209
[41]	1.0000	0.8651	0.13488	0.0285	0.5616	1.168
[42]	1.0000	-0.074	1.07482	0.1651	-0.691	0.8207
[43]	1.0000	1.3202	-0.3202	0.0508	1.0156	1.86
[44]	1.0000	1.3168	-0.3168	0.0512	1.0144	1.8589
[45]	1.7534	-2.321	4.07461	1.5959	-4.089	0.5924
[46]	1.3296	0.7035	0.62609	0.058	0.3163	1.2221
[47]	3.1666	3.5357	-0.369	0.1007	3.0135	4.2129
[48]	1.9360	1.3682	0.5677	0.0329	1.0234	1.7285
[49]	1.2750	1.2718	0.00326	0.0225	1.026	1.6056
[50]	1.8148	1.7211	0.09367	0.0174	1.4839	1.9989
[51]	1.0000	0.7061	0.29386	0.0154	0.4909	0.9694
[52]	1.5414	0.7455	0.79589	0.0227	0.4645	1.0498
[53]	1.7066	0.82	0.88657	0.0349	0.4574	1.1914
[54]	1.7307	0.7447	0.98602	0.2206	-0.082	1.6156
[55]	1.5609	0.8301	0.7308	0.0246	0.5458	1.1543
[56]	1.0000	0.0509	0.94905	0.0632	-0.366	0.5792
[57]	1.3132	0.2295	1.08368	0.0325	-0.118	0.5828
[58]	1.5125	1.374	0.13843	0.0111	1.1777	1.591
[59]	1.1445	0.3923	0.75227	0.0633	-0.023	0.9172
[60]	1.9000	1.7875	0.11246	0.0268	1.4981	2.1306
[61]	1.0000	-0.403	1.40333	0.109	-0.974	0.2482
[62]	1.0000	0.592	0.40792	0.0116	0.4089	0.8235
[63]	1.0000	0.6273	0.37266	0.0202	0.3749	0.9172
[64]	1.1842	0.2151	0.96909	0.1286	-0.432	0.9564
[65]	1.3224	1.0667	0.25565	0.0117	0.8673	1.2939
[66]	2.0454	0.8005	1.24486	0.4744	-0.369	2.0101
[67]	1.5797	0.8594	0.72029	0.0373	0.4878	1.2399
[67]	1.0000	0.2249	0.77505	0.026	-0.033	0.5785
Average	1.7613	1.2494	0.51191088	0.15403529	0.76678382	1.840980882

The above shows the Farrell Debreu FDH technical efficiency estimate for Kenyan Magistrates' Courts in the month of April, 2014. Looking at the table, one notes that the most biased estimates (presented under the header 'biased') fall outside of the constructed confidence intervals.



Correcting for the bias through bootstrap results in scores within the confidence interval; a look at column 4 header unbiased proves this.

## Appendix 2: Shephard Distance Results

Period	Biased (with outliers)	Biased (without outliers)
2014		
Jan	0.7879	0.7976
Feb	0.6855	0.8835
Mar	0.6286	0.8122
Apr	0.7523	0.7597
May	0.8914	0.8914
Jun	0.8914	0.9041
July	0.8595	0.8626
August	0.8297	0.8259
September	0.8659	0.8548
October	0.7925	0.8400
November	0.7842	0.7842
December	0.8094	0.8129
2015		
January	0.8012	0.8466
February	0.8249	0.8491
March	0.8820	0.8862
Missing		
July	0.7586	0.7586
August	0.8798	0.8785
September	0.8379	0.8379
October	0.8413	0.8413
November	0.8200	0.8287
December	0.7869	0.7869
2016		
January	0.7886	0.7945

Under output orientation, efficiency score represented by lamda is an index by which output are expanded. In this respect, it is bounded from below by 1 and has no upper bound. However, this may be hard to explain if efficiency is determined as the proportion of the optimal output a firm produces of which 1(100%) is the upper bound. In such interpretation, Shephard distance functions are most appropriate. This is got by simply taking the inverse of the of the Debrue-Farrel results (Daraio and Simar, 2007). The above table represents the corresponding Shephard results to those in table 3 (column 2 & 4).