An application of Data Envelopment Analysis to benchmark CEO remuneration

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TO WHOM IT MAY CONCERN

I, the undersigned, SUZETTE WESSELS from above-mentioned address, confirm herewith that I have carried out the proofreading and language editing of the text of Marli Theunissen's mini-dissertation, with the title: "An application of data envelopment analysis to benchmark CEO remuneration".

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Yours faithfully

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ABSTRACT

The purpose of this study is to determine whether the Data Envelopment Analysis (DEA) can be applied to Chief Executive Officer (CEO) remuneration of companies listed on the Johannesburg Stock Exchange (JSE) by defining inputs in terms of remuneration factors and outputs in terms of business factors in order to establish a benchmark for CEO remuneration.

An exploratory study is conducted, using cross-sectional data from a secondary source. The sample consists of 221 companies listed on the JSE that disclosed their financial and non-financial information during 2010. The DEA was performed to estimate the relative technical efficiency of CEOs to convert their remuneration into company performance indicators. Base Pay, Perquisites and Pension, Annual Bonus Plans and Long-term Incentives were used as the inputs to the DEA model and company performance and size, measured by Return on Equity (ROE) and Total Assets respectively, were used as the outputs to the model.

The empirical results prove that the DEA can be successfully applied as a benchmarking model for CEO remuneration that incorporates multiple inputs and outputs and establishes benchmarks and potential improvements for overpaid, inefficient CEOs. The CEOs from 80 of the 221 companies included in the sample emerged as the benchmark CEOs and formed the efficiency frontier against which inefficient CEOs were compared in order to determine the potential improvements for these CEOs.

From a research perspective, this study contributes to the advancement of CEO remuneration research by introducing an alternative model by which CEO remuneration can be analysed. Future studies can analyse CEO remuneration by using other variables or time series data in the DEA model or combine the DEA with other methods like the regression analysis to perform more comprehensive investigations.

From a practical perspective, the DEA can be used to establish a benchmark for CEO remuneration. Remuneration committees can use the results of the DEA as a guide to determine acceptable remuneration levels and decrease the pay gap between CEOs and the average worker.

The originality of this study lies in the fact that it is the first South African study that used the DEA instead of the regression analysis to analyse CEO remuneration of companies listed on the JSE. This study also disaggregated Total CEO Remuneration into Base Pay, Perquisites and Pension, Annual Bonus Plans and Long-term Incentives to provide more accurate benchmark information. In addition, this is the first study that established benchmark CEO remuneration levels and suggested improvements to the remuneration package structure of overpaid, under-performing CEOs of companies listed on the JSE.

KEYWORDS: Data Envelopment Analysis (DEA), Chief Executive Officers (CEO), Remuneration, Benchmark

OPSOMMING

Die doel van hierdie studie is om te bepaal of die Data Omhulsel Analise *(Data Envelopment Analysis*, DEA) toegepas kan word op die vergoeding van Hoof Uitvoerende Beamptes van maatskappye wat op die Johannesburgse Effektebeurs (JSE) genoteer is deur insette in terme van vergoedingsfaktore en uitsette in terme van besigheidsfaktore te definieer om sodoende 'n maatstaf vir uitvoerende hoofde se vergoeding vas te stel.

'n Verkennende studie is gedoen deur gebruik te maak van deursnee-data vanaf 'n sekondêre bron. Die steekproef bestaan uit 221 JSE-genoteerde maatskappye wat hul finansiële en nie-finansiële inligting gedurende 2010 bekend gemaak het. Die DEA is uitgevoer om te beraam wat uitvoerende hoofde se relatiewe tegniese doeltreffendheid is om hul vergoeding te omskep in die maatskappy se prestasie-aanwysers. Basiese Salaris, Byvoordele en Pensioen, Jaarlikse Bonus Planne en Langtermyn-Aansporingskemas dien as insette tot die DEA model en die prestasie en grootte van die maatskappy, gemeet deur Opbrengs op Ekwiteit en Totale Bates onderskeidelik, dien as die uitsette tot die model.

Die empiriese resultate bewys dat die DEA suksesvol toegepas kan word as 'n normeringsmodel vir uitvoerende hoofde se vergoeding wat verskeie insette en uitsette inkorporeer en ook maatstawwe en potensiële verbeteringe vir oorbetaalde, ondoeltreffende uitvoerende hoofde voorstel. Die uitvoerende hoofde van 80 uit die 221 maatskappye wat ingesluit is in die steekproef, het as die maatstaf vir uitvoerende hoofde na vore gekom en het die doeltreffendheidsgrens gevorm waarteen ondoeltreffende uitvoerende hoofde vergelyk is ten einde die potensiële verbeteringe vir hierdie uitvoerende hoofde vas te stel.

Uit 'n navorsingsoogpunt dra hierdie studie by tot die bevordering van navorsing oor uitvoerende hoofde se vergoeding deur die bekendstelling van

'n alternatiewe model waarmee uitvoerende hoof vergoeding ontleed kan word. Toekomstige studies kan uitvoerende hoofde se vergoeding ontleed deur gebruik te maak van ander veranderlikes of tydreeksdata in die DEA model of deur die DEA te kombineer met ander metodes, soos ‘n regressie-ontleding, om meer omvattende ondersoeke uit te voer.

Uit 'n praktiese oogpunt kan die DEA gebruik word om 'n maatstaf vir uitvoerende hoofde se vergoeding daar te stel. Vergoedingskomitees kan die resultate van die DEA gebruik as 'n gids om aanvaarbare vergoedingsvlakke te bepaal en die salarisgaping tussen uitvoerende hoofde en die gemiddelde werker te verminder.

Die oorspronklikheid van hierdie studie lê in die feit dat dit die eerste Suid-Afrikaanse studie is wat die DEA, in plaas van ‘n regressie-ontleding, gebruik om die vergoeding van uitvoerende hoofde van JSE-genoteerde maatskappye te ontleed. Hierdie studie het ook Totale Uitvoerende Hoof-vergoeding opgedeel in Basiese Salaris, Byvoordele en Pensioen, Jaarlikse Bonus Planne en Langtermyn-Aansporingskemas om meer akkurate maatstaf-inligting te verskaf. Verder is dit die eerste studie wat ‘n maatstaf vir uitvoerende hoofde se vergoedingsvlakke bepaal en verbeteringe aan die vergoedingspakkette vir oorbetaalde, ondoeltreffende uitvoerende hoofde van JSE-genoteerde maatskappye voorstel.

SLEUTELWOORDE: Data Omhulsel Analise *(Data Envelopment Analysis,* DEA), Hoof Uitvoerende Beampte, Vergoeding, Maatstaf

PRESENTATIONS AND PUBLICATIONS

This study formed part of two other South African studies regarding the benchmarking of CEO remuneration. Both of these papers have been presented at academic conferences and submitted for publication in peer reviewed journals.

The first paper, titled "Benchmarking of CEO compensation" (Oberholzer & Theunissen, 2012), partially falls outside the scope of this study by empirically comparing CEO compensation benchmarks as set by the frequently used Linear Regression Analysis (LRA), which is based on "averages" and Data Envelopment Analysis (DEA), which is based on "best practices". It has been presented at the Clute Institute 2012 Rome/Mediterranean Cruise Conference and was subsequently published in the International Business & Economics Research Journal.

The second paper, titled "An application of Data Envelopment Analysis to benchmark CEO remuneration: A South African study" (Theunissen & Oberholzer, 2012), is a summarised version of this study for academic journal publication purposes. It has been presented at the Southern African Accounting Association Central Region Conference and submitted for publication in the Southern African Journal of Economic and Management Sciences.

- **Conferences**

Oberholzer, M. & Theunissen, M. 2012. Benchmarking of CEO compensation. *Clute Institute: 2012 Rome/Mediterranean Cruise Conference*, 10-17 Jun. Italy/Mediterranean.

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DEFINING THE CONCEPTS

- **Benchmark:** A standard or point of reference against which things may be compared or assessed.

- **Chief executive officer (CEO):** Top executive responsible for a company's overall operations and performance. He or she is the leader of the company and serves as the main link between the board of directors and the company's various parts or levels.

- **Data envelopment analysis (DEA):** A linear programming model that provides a means of calculating apparent efficiency levels within a group of organizations. The efficiency of an organization is calculated relative to the group's observed best practice.

- **Johannesburg Stock Exchange (JSE):** The Johannesburg Stock Exchange or the JSE Securities Exchange is the largest stock exchange in Africa. It is situated in Sandton, Johannesburg, South Africa.

- **Remuneration:** Remuneration usually consists of a fixed short-term pay in the form of a salary and benefits, fixed long-term pay in the form of a pension, variable short-term pay in the form of an annual bonus and variable long-term pay in the form of a deferred bonus and long-term incentive awards.

CHAPTER 1: INTRODUCTION AND OVERVIEW

1.1 INTRODUCTION

Excessive remuneration packages of CEOs recently became widely publicised and subjected to public scrutiny. The scope of this debated issue raised the attention of both international and local political figures.

United States president, Barack Obama, said that Americans are upset by the fact that executives are being rewarded for failure. *"For top executives to award themselves these kinds of compensation packages in the midst of this economic crisis are not only in bad taste, it's a bad strategy"* (The Associated Press & McClatchy Newspapers, 2009:1).

South African Finance Minister, Pravin Gordhan, deemed these excessive remuneration packages as unacceptable. *"There is a national discourse needed here, aimed at moderating high-earning remuneration levels within our large corporations, including state-owned enterprises, for the social dimensions of earning trends can surely not be ignored in the economic calculus of risk and rewards. We are creating a dangerous culture in South Africa."* According to him, remuneration committees and boards of directors need a change of mind and new parameters have to be set in order to address the problem (Ensor, 2010:1).

Former South African Finance Minister, Trevor Manuel, also expressed an opinion on the subject. *"In a country with the inequality and unemployment that we have, some of these exorbitant salaries are simply repulsive."* (Financial Mail, 2008:1).

According to these politicians, increasing levels of excessive remuneration are becoming a dangerous and unacceptable practice. The concern from a

management accounting viewpoint is that CEO's are remunerating themselves at the expense of shareholders' interests and the long-term success of the company (BPP Learning Media, 2010a:78). Management accountants are probably in the best position to make recommendations on the issue of CEO remuneration as they are equipped to provide accounting information that assists the board of directors in making informed business decisions. Using the key drivers of CEO remuneration in a combined statistical manner, these accountants can develop acceptable benchmarks to guide boards of directors when determining CEO remuneration. In doing so, the concerns of the above mentioned politicians can also be addressed.

1.1.1 Background

Hindery (2008:1) describes excessive CEO remuneration as a cancer that is at the core of America's economic ills. Several investigations into the matter all agreed that CEO remuneration is excessively high and could be linked to the global financial crisis, although they maintain different opinions on the factors that contributed to these pay hikes. Three of these factors are briefly discussed below.

Firstly, German chancellor Angela Merkel is researching ways to curb excessive executive pay that aroused from long term incentive schemes such as share options (Financial Mail, 2008:1). Recent investigations revealed that CEO's made millions when they exercised their share options. The size of the gain mainly depends on the number of share options and the prevailing share price on the date the option is exercised. To a certain extent, a CEO can influence the share price through good governance but there are also uncontrollable market factors that can influence the share price. This fuels the argument that CEO's reap the benefits of an increased share price while the increase was due to market factors and not so much to their own contribution.

A second contributing factor to the pay hikes is the discrepancy between pay and performance. A report by the Australian Productivity Commission stated that large payments, despite poor company performance, have fuelled community concerns that executive remuneration is out of control (Banks, 2009:xiv). Former finance minister, Trevor Manuel, reported that government is concerned as ever about pay levels, especially where there is no relation to the performance of the company of the executive (Financial Mail, 2008:1). Current finance minister, Pravin Gordhan shares this view by saying that extreme earnings disparities cause offence not just when they are associated with profiteering or financial malfeasance, but also when the reward for honest work seems disproportionate or weakly aligned with incentives (Ensor, 2010:1).

A third possible cause of pay hikes, examined by Hayes and Schaefer (2007), is known as the 'Lake Wobegon Effect'. Gareth Keillor, radio host and humorist, refers to a fictional hometown, Lake Wobegon, where every child is above average. This also seems to be the case with CEO's. Former DuPont CEO, Edward S. Woolard Jr, explained that companies are prepared to pay ever increasing salaries to convince shareholders that their CEO is above average because this makes the company look strong. Most boards want their CEO to be in the top half of the CEO peer group. Therefore, when another CEO gets a raise, their CEO gets one too even if he/she had a bad year (Hayes & Schaefer, 2007:2). This can lead to a continuous benchmarking practice with companies driving CEO remuneration higher and higher with little or no reference to company specific circumstances.

Apart from CEO remuneration simply being excessive, it has other detrimental effects on businesses as well. According to Professor Charles O'Reilly of the Stanford Graduate School of Business, the total cost of overpayment could in some cases significantly affect shareholder returns. It also affects employment turnover. Employees regard CEO remuneration as a beacon to determine the fairness of their own salaries. It is more likely for employees to

resign if their CEO is significantly overpaid (Amble, 2006:1; Wade et al, 2006:540).

The biggest concern however is that the gap between CEO salaries and the average wage of an ordinary worker is continuously increasing. A good example is the recent wage strikes in South Africa. Salaries of executives from the Top 40 JSE companies increased by 23% while their short term incentives increased by 56% during 2010. At the same time the National Union of Metalworkers of South Africa (NUMSA) is struggling to get a 13% raise on their workers' meagre salaries (Joubert, 2011:1). The Congress of South African Trade Unions (COSATU) claims that huge pay hikes of top executives are unacceptable while workers fight for reasonable wages. Workers from various South African workers' unions went on strike during July 2011 to express their discontent with the widening gap between CEO remuneration and their own wages (Sapa, 2011:1).

Some suggestions have been made to prevent this gap from increasing. CEO remuneration could be capped at a market related average amount (Brown, 2009:1; Hindery, 2008:2; The Associated Press & McClatchy Newspapers, 2009:1) or it could be calculated as a ratio of the average worker's salary (Brown, 2009:1). These may sound like simple solutions, but what amount of remuneration cap or ratio will be regarded as a reasonable and fair measure, given every business' unique operations? Brown (2009:1) and Hindery (2008:2) further suggested that shareholders should have more rights to influence executive remuneration or that CEO's should be penalised for excessive gains through revised taxation policies.

1.1.2 Literature Review

In South Africa, research has been conducted by a number of institutes and individuals. The findings of three of these reports are particularly relevant to the current study.

The South African trade union, Solidarity, published a report on CEO remuneration during July 2006. The purpose of their report was to give an overview of the trends of CEO remuneration of companies listed on the JSE. All JSE listed companies were included in the study, except companies with foreign CEO's or foreign companies listed on the JSE. Delisted, AltX, Development Capital and Venture Capital companies were also excluded from the study. One of their key findings was that there is no direct relationship between company profits and CEO remuneration when a separate comparison for each of the remuneration elements, namely salaries, bonuses and total remuneration were made to company profits for the current and previous year respectively (Krugel & Kruger, 2006).

A similar study was conducted by Theunissen and published during April 2010. The purpose of his study was to determine if CEO's in South Africa are well rewarded, to the detriment of other employees, and if their remuneration can be justified in comparison with their performance. In total 326 companies were analysed, that included JSE listed companies and state-owned companies. Theunissen performed a regression analysis of total CEO remuneration with several business factors such as turnover, turnover growth, total assets, total equity and profit and found that no single business factor emerged as the main determinant of CEO remuneration (Theunissen, 2010).

A research project published by Dommisse at the end of March 2011 investigated if total remuneration of CEO's could be justified on the strength of the individual companies' performance. His study only included the top 120 companies on the JSE, determined as the 120 companies with the largest market capitalisation at the end of 2009. A correlation between total CEO remuneration, including all cash and share rewards, was brought in relation with turnover, total income and earnings before interest and tax (EBIT). He found that more than 80% of all correlation observations resulted in a positive correlation meaning that CEO remuneration only increased when there was an increase in turnover, income and EBIT. Therefore, CEO remuneration of

the vast majority of JSE listed companies demonstrates a strong correlation with the company's financial achievements (Dommisse, 2011).

To summarise, the researchers of the above mentioned reports analysed CEO remuneration by means of a two dimensional statistical model, namely the regression analysis. Although these studies found a positive correlation between CEO remuneration and certain business factors, none of these factors could individually serve as a convincing measure to determine CEO remuneration because of its weak correlation with it. A further limitation of these researchers' studies is that none of them suggested a benchmarking model to determine acceptable levels of CEO remuneration.

1.2 PROBLEM STATEMENT

Mark Bussin, chairman of 21st Century Pay Solutions, asks 'a tricky question': *"How do you judge if someone is overpaid?"* (Financial Mail, 2008:5). Gerald Seegers, South African partner of PriceWaterhouse-Coopers, is of the opinion that new executive reward models are required that can be tailored to specific businesses, that are both relevant and simple in terms of design and number of elements. He continued that existing executive pay models have largely failed to serve as a motivational tool and failed to establish goal congruence between executives and shareholders (PWC, 2010:1).

Seegers seeks a business-specific, multi-element model to benchmark CEO remuneration and therefore a simple two dimensional model will not suffice. CEO remuneration, consisting of a basic salary, short and long term incentives, has to be benchmarked in context of the different factors on which the basic salary and additional incentives are based, such as company size and profits. An acceptable benchmarking model is therefore needed to firstly determine if a particular CEO is being over- or underpaid in context of business specific elements and secondly, the model should be able to indicate an acceptable level of remuneration.

The main problem is that up till now, South African researchers only used two dimensional statistical models to analyse CEO remuneration. None of them considered all the inputs like total remuneration, basic salary and bonuses together with all the outputs like profit, turnover and total assets in a single model. A two dimensional statistical model can only indicate if there is a linear relationship and correlation between two factors. It fails to indicate an appropriate level of inputs or outputs that will represent an optimal solution. Hence, the gap in the literature is that no research has been conducted on JSE listed companies to investigate the possibilities of a three dimensional statistical model that incorporates all inputs and outputs and suggest an optimal solution in terms of the inputs and outputs defined.

The statistical method of the data envelopment analysis (DEA) may provide a potential benchmarking model. It is a linear programming technique that allows relative efficiency to be defined in terms of multiple inputs and outputs. What makes it further appealing is that it indicates which units should be benchmarked and the potential improvements that exist for inefficient units (Avkiran, 1999:206). Only three previous studies could be identified which combines the DEA with CEO remuneration. The first study is by Mohan and Ruggiero (2003) who used DEA to investigate the compensation differences between male and female CEOs for publicly traded firms. The second study, which is most relevant to the current study, is by Cordeiro et al (2006). They point out the shortcomings of traditional parametric approaches, such as regression analysis, when analysing CEO remuneration practices and suggest a non-parametric alternative, namely the DEA. Total CEO Remuneration was the only input to their model and various measures of company size and performance were used as the outputs. The third study, done by Bowlin and Renner (2008), uses DEA to study gender equity in top-management-team (TMT) compensation. The TMT they investigate consist of the four executives ranking immediately below the CEO in pay and for this reason they include CEO pay as an input to their DEA model, but they do not make any conclusions about CEO remuneration.

The question therefore is whether the DEA can be applied to CEO remuneration of companies listed on the JSE by defining inputs in terms of remuneration factors and outputs in terms of business factors in order to establish a benchmark for CEO remuneration. When applied to CEO remuneration, it could provide the solution Seegers is looking for in order to answer Bussin's question.

1.2.1 Contribution of Study

The contribution of this study is two-fold. From a research perspective it contributes to the advancement of CEO remuneration research by introducing an alternative, multi-dimensional statistical model by which CEO remuneration can be analysed.

From a practitioner's perspective, boards of directors can justify the level of remuneration paid to CEO's in terms of the company's size and performance by applying the DEA. This model also provides a benchmark for CEO remuneration in terms of the inputs and outputs defined.

A recent article in Business Report announced that Bobby Godsell, chairman of Business Leadership SA, has called for a commission on high pay to be set up in South Africa similar to the UK's High Pay Commission. The High Pay Commission is an independent body that researches executive pay and its recommendations include appointing employees to remuneration committees, forcing companies to publish a pay ratio between the highest paid executive and the company median, requiring a radical simplification of executive pay packages and the establishment of a new national body to monitor high pay (Crotty, 2012:1). Commissions like these can use the DEA as a guide to determine acceptable remuneration levels and to decrease the gap between CEO remuneration and the salary of an average worker.

1.3 OBJECTIVES

The main objective of the study is to apply the DEA on CEO remuneration to determine if it is an appropriate benchmarking model.

The secondary objectives of the study are to:

- define the remuneration factors to be used as inputs and the business factors to be used as outputs in the DEA model;
- describe the DEA and discuss its' potential to be used as a benchmarking model for CEO remuneration;
- estimate input- and output-orientated technical efficiencies of all JSE listed company CEOs to convert remuneration into company performance and size;
- develop an efficiency frontier to serve as a benchmark to suggest acceptable CEO remuneration levels based on a company's performance and size as defined in the DEA model.

1.4 RESEARCH DESIGN

Research in accounting is concerned with solving problems, investigating relationships and building a body of knowledge (Smith, 2009:1). The first step in any research project involves transforming an interesting research idea into a feasible, researchable research problem (Mouton, 2001:48). These ideas can be drawn from real-life problems which can be addressed by turning it into a research problem. However, not all ideas will translate into good research. Smith (2009:2) explains that the difference between good and bad research lies in a study's ability to generate sound evidence in order to overturn or revise existing theories. Healthy competition between rival ideas will lead to better explanations and more reliable predictions. Mouton's (2001:137) 'Three Worlds Framework' helps to explain the interplay between

everyday life and scientific research and provides a framework to distinguish between a real-life problem and a research problem:

- *World 1: Everyday Life and Common Sense*
  In the world of everyday life we produce and use knowledge of different kinds to solve problems, reach consensus and gain insight into everyday tasks. In this world, social or practical problems exist that requires some form of intervention in order to be resolved.
- *World 2: Science and Scientific Research*
  Scientists (researchers) will select phenomena from World 1 and subject it to systematic and rigorous enquiry. The aim is to generate valid and reliable descriptions, models and theories of these phenomena.
- *World 3: Meta-science*
  The world of meta-science involves critical reflection on the nature of science and scientific research in order to continuously improve the nature of scientific inquiry.

In order to construct theories or test observations, the two main approaches of reasoning in World 2 are inductive and deductive reasoning. Inductive reasoning is the process of developing new theories from fresh observations. Deductive reasoning, on the other hand, is where theory provides the basis for testing empirical observations and its reliability depends on the integrity of the quantitative and statistical methods (Smith, 2009:21). The difference between empirical and non-empirical observations is that empirical observations refer to real-life problems that can be solved by collecting new data or analysing existing data about World 1. Non-empirical observations are based on the 'entities' in World 2 such as the meaning of scientific concepts or the plausibility of new scientific theories. These issues can be resolved by analysing the body of scientific knowledge in World 2 without recourse to World 1 (Mouton, 2001:53).

The idea for this study has its origin in the public's discontent regarding excessive CEO remuneration levels. This idea was developed into a research problem which will be addressed by the deductive reasoning approach. This is an empirical problem, since it involves analysing existing data in World 1 about CEO remuneration and business factors. The agency theory provides the theoretical basis against which the empirical observations will be tested. Mouton (2001:144-146) presents a mapping framework that can be used to categorise the research design of a study. According to his classification, this study is an empirical study using secondary, numerical data with a low degree of control. The main limitation of this kind of design is that the researcher cannot control for data collection errors and this could have a significant impact on the validity and reliability of the findings (Mouton, 2001:165).

1.5 RESEARCH METHODOLOGY

In order to achieve the objectives of the study, information will initially be obtained from the available literature. The information will then be tested with empirical information.

1.5.1 Theoretical Review

The purpose of the theoretical review is primarily to define the DEA and to consider its' possibilities to be used as a benchmarking model for CEO remuneration. The secondary purpose is to gain insight into what CEO remuneration consists of and what theoretical framework underpins CEO remuneration research.

1.5.2 Empirical Research

An exploratory study will be conducted, using cross-sectional data from a secondary source. The sample for this study will consist of all the companies listed on the JSE that disclosed their financial and non-financial information during 2010. This will result in a sample which includes a diverse set of companies of different sizes and different industries.

The data will be retrieved from the McGregor B.F.A. (2012) database. The "Financial Statements" facility of this database will be used to obtain the financial information as shown in the Published JSE Annual Financial Statements and the "Director Search" facility will be used to obtain the CEO remuneration information of the companies included in the sample.

The database compiled from the above mentioned information will be consulted to obtain the data to be used as inputs and outputs for the DEA model. The anticipated structure of the DEA inputs and outputs is as follows, with the measures indicated in brackets:

- Inputs consisting out of remuneration factors:
  - **X1**: Base Pay
    (Salary)
  - **X2**: Perquisites and Pension
    (Total of Retirement and/or Medical contributions, Allowances and Benefits, Motor and Travel allowances and Fee/Levy Payment)
  - **X3**: Annual Bonus Plans
    (Total of Bonuses paid in current year, Performance Bonuses, Other Benefits and Once-off Payments)
  - **X4**: Long-term Incentives
    (Gains on Shares)

- Outputs consisting out of business factors:
  - **Y1**: Company Performance
    (Return on Equity)
  - **Y2**: Company Size
    (Total Assets, including intangible assets)

The DEA works best for a sample size that is at least three times larger than the sum of the number of inputs and outputs (Avkiran, 1999:208). Therefore, a sample size of at least 18 companies (4 inputs + 2 outputs = 6 x 3 = 18) will be sufficient for the study. The analysis will be performed on a total of 221 JSE listed companies, with an individual analysis for each industry within this total that contains at least 18 listed companies.

The aim of the DEA model is to estimate the relative technical efficiency, namely the efficiency of a CEO to convert his/her remuneration into company performance and size (outputs). First, an input-orientated approach (input minimisation) will be used, which examines the extent to which inputs can be reduced while maintaining output levels (Avkiran, 1999:211). This will indicate by how much CEO remuneration can be reduced while maintaining a certain level of company performance and size. Alternatively, an output-orientated approach (output maximisation) will be used, which investigates the extent to which outputs can be raised given the current input levels (Avkiran, 1999:211). This approach will indicate what level of company performance or size justifies the current CEO remuneration level.

1.6 CHAPTER OVERVIEW

The study will consist of the following chapters:

- **Chapter 1:**
  This chapter explains the background of the study and gives a brief overview of South African studies regarding CEO remuneration. The

research problem is formulated, followed by the objectives of the study and the research design and methodology to be used.

- **Chapter 2:**
  The second chapter will present the theoretical framework underlying this study, namely the agency theory, and will explain how this theory is rooted in CEO remuneration practices. The determinants of CEO remuneration will then be discussed to provide insight into the business factors to be used as outputs in the DEA model. Similarly, the components of CEO remuneration to be used as inputs to the DEA model will be discussed.

- **Chapter 3:**
  This chapter will provide the theoretical background to the DEA model by describing some of the characteristics of the DEA and its potential to be used as a benchmarking model for CEO remuneration. A simple numerical example will be given to facilitate the reader in understanding the analysis performed in this study. The limitations of the DEA model will be presented before formulating the input- and output-orientated models to be used in the analysis of CEO remuneration.

- **Chapter 4:**
  The fourth chapter will describe the variables to be used in the DEA model and will then apply the DEA on JSE listed companies. The first part of the results will present the input- and output-orientated efficiency scores for JSE listed companies and the second part of the results will present the benchmark companies within each industry and suggestions for acceptable CEO remuneration levels in terms of the inputs and outputs used in the model.

- **Chapter 5:**
  The last chapter will provide a brief overview of the preceding chapters and will present the research conclusions with reference to the main and

secondary objectives of the study. The contribution and limitations of the study and suggestions for future research will be discussed before the final conclusion is drawn.

CHAPTER 2: THEORETICAL FRAMEWORK

2.1 INTRODUCTION

Accounting researchers have little theory of their own and rely on theories, methods and instruments that have been adapted from other disciplines like economics, finance, psychology and sociology (Smith, 2009:1). A theory adopted from economics and frequently used in research concerning CEO remuneration is the principle-agent theory (Janssen, 2009:6). This theory, also known as the agency theory, provides a framework to understand how remuneration affects the relationship between shareholders (principals) and the CEO (agent).

In this chapter the agency theory and its link with CEO remuneration will be discussed. This will be followed by an overview of the business factors that serve as determinants of CEO remuneration and an explanation of the different components of CEO remuneration.

2.2 AGENCY THEORY

In large companies, the management of the business is often separated from its ownership by the employment of professional managers. These managers are referred to as the agents of the owners (the principals). The study of the relationship between the agent and the principal is called the agency theory (BPP Learning Media, 2010b:502). Jensen and Meckling (1976:5) provides a more formal definition by stating that the agency relationship is a contract under which one person (the principal) engage another person (the agent) to perform some service on the principal's behalf which involves delegating some decision making authority to the agent.

The agency theory has developed along two streams: positivist research and principal-agent research. Positivist researchers focus on identifying situations in which the principal and agent are likely to have conflicting goals and then describe governance mechanisms that will limit the agent's self-serving behaviour. Principal-agent researchers focus on a general theory of the principal-agent relationship that can be applied to other agency relationships such as employer-employee, lawyer-client and buyer-supplier relationships. These streams are complimentary in the sense that the positivist theory identifies various contract alternatives and the principal-agent theory indicates which contract is the most efficient under varying levels of outcome uncertainty, risk aversion, information and other variables (Eisenhardt, 1989).

According to Eisenhardt (1989:60), positivist researchers have focused almost exclusively on the owner-CEO relationship of large companies. Shareholders entrust their money to CEOs because they believe that CEOs have superior skills and/or information to make good investment decisions (Murphy, 1999:28), but shareholders do not often know what actions the CEO can take or which of these actions will increase shareholder wealth (Jensen & Murphy, 1990:1). The separation of ownership from control can lead to many asymmetries between the principal and agent. These asymmetries are classified as follow:

- *Informational Asymmetries*

  This occurs where either the agent has information to fulfil a task which the principal does not have or both have the same information but the agent can fulfil the task at a lower cost (Saam, 2007:826). The agent possesses private information about his effort level, the state of nature etc. that can only be obtained at a cost by the principal (Kunz & Pfaff, 2002:277). The principal needs this information in order to pay the agent based on his/her effort.

- *Different Risk Preferences*

  The principal and agent have different attitudes towards risk because the principal can diversify to lower his risk while the agent cannot (Saam, 2007:827).
- *Goal Conflict*

  The agent wants to maximise his income while minimising his/her effort (Kunz & Pfaff, 2002:277), whereas the principal wants to maximise his returns. Both the income of the agent and the returns of the principal are based on the agent's effort and exogenous random elements (Saam, 2007:827).

The problems which arise from these asymmetries are called the agency problems. These problems are broadly classified into two categories:

- *Adverse Selection*

  This problem occurs when the principal lacks the information necessary to make a good choice because the agent withheld information from him/her, thus creating information asymmetry (BPP Learning Media, 2010a:502).
- *Moral Hazard*

  This problem arises when people are protected from the adverse consequences of their actions, in other words, they are free to act irresponsibly (BPP Learning Media, 2010a:503). In the principal-agent relationship the agent may shirk, e.g. he/she may choose to work less but pretend to work hard (Saam, 2007:828).

Within the agency theory, mechanisms have been developed to overcome these agency problems. This is also where CEO remuneration is brought into play in the principal-agent relationship. There are many ways in which principals can induce their agents to have common interests and learn about their agents' activities (Lupia, 2001:5). A few of these methods are described below with an indication of how remuneration is used within the method to reduce the agency problems.

Jensen and Meckling (1976:7) advocate the structuring of a contractual relation, including compensation incentives, between the principal and agent to provide appropriate incentives for the agent to make choices which will maximize the principal's welfare. Kunz and Pfaff (2002:277) states that the precise conditions of an optimal contract are dependent on the prevailing situational characteristics, but in most cases they involve a variable component that varies with an indicator of the agent's effort level. This variable component will typically be compensation that is tied to production indicators which at least partially correlate with the agent's actions or effort level (Kunz & Pfaff, 2002:278). Two contract alternatives are available to principals, namely behaviour-based contracts and outcome-based contracts (Eisenhardt, 1989:58). Behaviour-based contracts are used when principals can observe the agents' actions easily at a low cost. Rewards for this type of contract are paid in the form of a salary. Outcome-based contracts are used when principals cannot monitor the agents' actions at a low cost and in this case rewards are paid as incentives, designed to induce actions that are linked to desired outcomes (Yanadori et al, 2002:9). Other solutions proposed to mitigate the problems of adverse selection and moral hazard include the following:

- *Incentive Compensation Systems*
  When it is difficult or costly to monitor the agent's activities, incentives are more important. Incentive compensation systems align the interests of the agent and principal (Jensen & Meckling, 1976:26) because the rewards for both of them (shareholder wealth for the shareholder and compensation for the CEO) depend on the same actions (Saam, 2007:828).
- *Monitoring Systems or Information Systems*
  Monitoring systems are used to control the behaviour of the agent (Jensen & Meckling, 1976:26). Information systems are used to inform the principal about what the agent is actually doing, making it more difficult for the agent to deceive the principal (Eisenhardt, 1989:60). However, the implementation of monitoring or information systems such as budgeting systems, reporting procedures, boards of directors and additional layers of

management are not efficient on their own and have to be complimented by control or incentive compensation systems (Saam, 2007:828).

- *Bonding*

  In this case the agent will expend resources (bonding costs) to guarantee that he/she will not take certain actions which would harm the principal or to ensure that the principal will be compensated if he does take such actions (Jensen & Meckling 1976:5). Ideally, the income of the agent must depend at least partially on his/her taking of the right actions (Saam, 2007:829). Lippert and Moore (1994:322) further state that bonding (alignment) is a substitute for monitoring so that a condition under which monitoring is inefficient should induce more bonding and vice versa.

It is evident from the above that CEO remuneration plays an important part in regulating the agency relationship between the CEO and the shareholders. However, the extent of the effect of CEO remuneration on this relationship is dependent on several business factors which will be discussed in the following section.

2.3 DETERMINANTS OF CEO REMUNERATION

Lippert and Moore (1994:321) state that existing theoretical models of compensation contracts do not offer predictions of compensation alignment in situations where multiple sources of agency conflict or alternative control devices exist, but current theory is identifying company and industry attributes and CEO characteristics that should be associated with CEO-Shareholder compensation alignment. Consideration of these attributes or determinants when designing compensation contracts can greatly improve our understanding of the composition and level of CEO remuneration and therefore it will be included in the DEA model. Janssen (2009:9) presents the determinants of remuneration in three subdivisions, namely the Rationale Perspective, Political perspective and Operating Characteristics as shown in Figure 2.1:

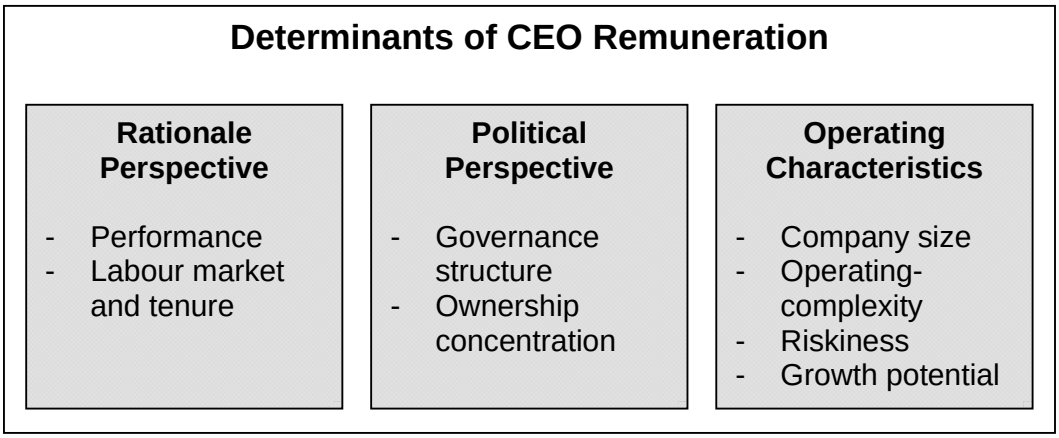

Figure 2.1: Determinants of CEO remuneration

Figure 2.1 shows the three subdivisions together with the main determinants within each subdivision. Each subdivision will be explained below with reference to the nature and working of the main determinants listed in Figure 2.1.

2.3.1 Rationale Perspective

Determinants within the rationale perspective have to be considered from an economical viewpoint and are concerned about how the performance of the CEO, labour market and the CEO's tenure affects the value of the company as a whole.

- *Company Performance*

  According to Murphy (1999:30), CEO wealth is explicitly tied to the principal's objective (creation of shareholder wealth) through his holdings of stock, restricted stock, and stock options. In addition, CEO wealth is implicitly tied to stock-price performance through accounting-based bonuses (reflecting the correlation between accounting returns and stock price performance) and through year-to-year adjustments in salary levels, target bonuses, and option and restricted stock grant sizes. Therefore, payouts should be positively related to the principal's objective (increasing shareholder wealth) and to other measures, like accounting measures of

firm performance, that provide imperfect incentives to the CEO to take actions generally consistent with value maximization. However, firm performance is not only a function of managerial actions but also of factors which are not under managerial control (Devers et al, 2007:1021; Janssen, 2009:6). This lead to the inclusion of other variables, such as labour market, governance structure, company size, etc. that may be relevant in improving our understanding of the relationship between pay and performance (Devers et al, 2007:1020).

- *Labour Market and Tenure*

  Finkelstein and Hambrick (in Janssen, 2009:11) believe that the height and structure of compensation is significantly influenced by the supply and demand for top-function qualified CEOs. The CEO becomes a commodity and, like other tradable goods, the market mechanism will decide the price (Janssen, 2009:11). According to Stiles and Taylor (quoted by Janssen, 2009:11) this market mechanism that influences CEO remuneration seems to work through comparison with other executives in relevant labour markets. This is consistent with Hayes and Schaefer's (2007) Lake Wobegon Effect as discussed in Chapter 1 whereby companies attempt to influence market perceptions of their CEO's value by increasing his/her pay levels.

  Various factors can influence the market for top executives and Janssen (2009:12) argues that the demand for a particular CEO could be reflected by his/her tenure. He explains that the higher the amount of years a person has functioned as a CEO, the more experience, skills and knowledge the person will have and that he/she needs to be compensated accordingly.

2.3.2 Political Perspective

The Political perspective involves determinants that reflect the power play between the different levels within the organisation like the governance structure and ownership concentration.

- *Governance Structure*

  A weak supervisory board with little power in a company's decision making process can lead to higher CEO remuneration as a result of increasing agency costs. The supervisory board is seen as 'weak' when the CEO is either part of the board, appointed the members of the board or when the members are also active elsewhere in the company (Janssen, 2009:19) because this compromises the board's ability to fairly and objectively determine the CEO's remuneration. Eisenhardt (1989:65) advocates the use of the board of directors as an effective monitoring device for shareholders' interests. When they provide richer information, remuneration is less likely to be based on company performance and executives are more likely to engage in behaviour that is consistent with the shareholders' interests.

- *Ownership Concentration*

  The level of ownership influences the alignment of the CEO and the shareholders' interests and also the extent of managerial monitoring and control. The more shares a shareholder has in the company, the more he/she will be affected by stock market fluctuations and consequently, he/she will have more incentive to monitor the CEO (Janssen, 2009:22, Lippert & Moore, 1994:324). Janssen (2009:23) found that closer control due to high ownership concentration reduces the discretionary behaviour of a CEO and therefore discourages him/her to reward himself/herself extraordinary high wages.

2.3.3 Operating Characteristics

Janssen follows Lippert and Moore (1994:322) by including the Operating Characteristics subdivision which contains factors such as company size, operating-complexity, riskiness and growth potential.

- *Company Size*

  The effect of an increase in company size on CEO remuneration is frequently investigated in CEO remuneration research. In fact, Devers et al (2007:1020) reports that a meta-analysis in the area of CEO remuneration research demonstrated that company size accounted for over 40% of the variance in total CEO remuneration, while firm performance contributed less than 5%. The reason they provide for this phenomenon may be that the link between company performance and CEO remuneration becomes elusive, depending on the variables examined and the pay elements considered.

  Researchers make several suggestions as to why larger companies might have higher CEO remuneration levels: larger firms may employ better-qualified and better-paid managers (Murphy, 1999:6), have more operations, subsidiaries and layers of management (Lippert & Moore, 1994:323), require a higher level of responsibility and have more complex tasks and therefore place greater value on decision making (Janssen, 2009:13). Taken together, these factors suggest that a CEO in a larger company deserves to be paid more to compensate him/her for the increased risks, responsibilities and complexities of his/her job.

- *Operating-Complexity*

  Janssen (2009:14) uses the degree of diversification as an indicator of operating complexity. He justifies this by stating that a higher degree of diversification, both geographically and activity-based, creates a more complex working environment which will be reflected in a CEO's

remuneration package since the CEO has to deal with complex issues like information asymmetries, multiple currencies and auditing difficulties.

- *Riskiness*

  Lippert and Moore (1994:322) advise that compensation contracts should be designed to tie pay closely to company performance in circumstances of change and uncertainty. High levels of uncertainty can impede monitoring and in such situations Lippert and Moore suggests that bonding (alignment) should be used as a substitute for monitoring. According to Janssen (2009:17), a risk-averse manager operating in a risky industry will probably make different choices depending on how he/she is compensated. For instance, if a large percentage of a CEO's remuneration is based on shares and options, he/she will be more exposed to company specific risk and he/she will avoid taking unnecessary risks in order to protect his/her income.

- *Growth Potential*

  Companies with substantial growth opportunities may have greater information asymmetry than companies whose value consists principally of tangible assets (Lippert & Moore, 1994:323). In the context of the agency theory, the problem of information asymmetry can be solved by either increasing monitoring activities or by aligning CEO remuneration closer to performance (bonding). For companies with high growth potential, CEO remuneration will be higher due to the capabilities that the CEO has to possess in order to guide the innovative process to achieve growth (Janssen, 2009:17).

All the business factors discussed above have some effect on CEO remuneration but CEO remuneration packages consist of multiple components and each component is affected differently by the business factors. The following section provides a brief description of the different components of CEO remuneration and the business factors affecting it.

2.4 COMPONENTS OF CEO REMUNERATION

Pay practices vary substantially across companies and industries but mostly it will contain the following components: Salary, benefits and pension, annual bonus, stock options and long-term incentive plans. A brief description of each component will be given below to provide a better understanding of the component that will be included in the DEA model.

- *Salary*

  The salary is the fixed cash component that reflects the value of the work or skills of the CEO (Yanadori et al, 2002:14). Base salaries for CEOs are usually determined through competitive benchmarking practices that are based on industry salary surveys. These surveys adjust for company size in order to formalise and reinforce the relation between remuneration and company size.

- *Benefits and Pension*

  Benefits are non-cash compensation paid indirectly to employees (Yanadori et al, 2002:15) and can include various perquisites like motor, travel and other allowances. Remuneration packages also include pension and medical allowances but obtaining comprehensive information on these forms of pay has been difficult until recent years because of insufficient disclosure. However, ignoring pensions can result in significant underestimations of total CEO remuneration (Frydman & Jenter, 2010:6).

- *Annual Bonus*

  Bonuses are typically non-discretionary, tied to one or more accounting performance measures and paid in either cash or stock (Frydman & Jenter, 2010:4). Bonuses are paid annually based on a single-year's performance and, under the typical bonus plan, no bonus is paid until a threshold performance level is achieved and a minimum bonus is paid at the threshold performance level. A target bonus is paid for achieving the

performance standard and usually there is a cap on the bonus paid. The range between the threshold and the cap is the 'incentive zone' that indicates the range of performance realisations where incremental improvement in performance corresponds to incremental improvements in the bonus (Murphy, 1999:10).

- *Stock Options*

  Stock options are contracts which give the recipient the right to buy a share of stock at a pre-specified exercise (or strike) price for a pre-specified term (Murphy, 1999:16). The purpose of stock options as a form of compensation is to tie remuneration directly to share prices and thus give CEOs an incentive to increase shareholder value (Frydman & Jenter, 2010:4). Stock options are not the same as stock ownership. Options reward only stock-price appreciation and not total shareholder returns (which include dividends). Furthermore, the value of an option increases with stock-price volatility so CEOs with options have more incentive to engage in riskier investments than if they owned the stock (Murphy, 1999:17).

- *Long-Term Incentive Plans.*

  Long-term incentives are generally paid in equity form where the amount is usually based on the stock price and reward is paid over multiple years (Yanadori et al, 2002:15). Frydman and Jenter (2010:4) explain that long-term incentive plans (including restricted option grants and restricted stock grants) are in effect bonus plans that are based on multi-year performance and that payment can be either cash or stock.

The degree to which each business factor affects each component is difficult to determine. By combining the business factors and remuneration factors in one comprehensive statistical model such as the DEA, we might be able to determine an acceptable level for each component that takes the weights of each business factor into account.

2.5 SUMMARY

The study of the relationship between the agent (CEO) and the principals (shareholders) is called the agency theory. The separation of ownership from control can lead to many asymmetries between the principal and agent and agency problems can arise from these asymmetries. CEO remuneration can be used as a mechanism to overcome these agency problems and regulate the agency relationship between the CEO and the shareholders. CEO remuneration is determined by several business factors which can be sorted into the Rationale Perspective, Political Perspective and Operating Characteristics subdivisions. CEO remuneration packages consist of multiple components and each component is affected differently by the business factors. The DEA model (as discussed in Chapter 3) could be used to determine acceptable levels for each component of CEO remuneration in terms of the various business factors.

CHAPTER 3: DATA ENVELOPMENT ANALYSIS

3.1 INTRODUCTION

The most common method used in South African and international research concerning CEO remuneration is the regression analysis. Regression analysis is a parametric method that requires the user to specify a general model for the relationship between input and output levels (Thanassoulis, 1993:1129). In this study, data envelopment analysis (DEA) will be used to analyse CEO remuneration. The DEA is a non-parametric method that does not have the same requirements as the regression analysis. Both regression analysis and DEA has its limitations but by using alternative methodologies to analyse CEO remuneration, the impact of model limitations and assumptions on research conclusions can be restricted. If different methodologies lead to the same conclusions, researchers can feel more confident that the results are valid (Bowlin & Renner, 2008:432).

The first section of this chapter describes the characteristics of the DEA and includes a simple example to illustrate how the DEA works. After that follows a discussion of the limitations of the DEA and finally the formulation of the DEA model to be used in this study.

3.2 CHARACTERISTICS OF THE DEA

The concept of establishing a satisfactory measure of productive efficiency which takes account of all inputs was first introduced by Farrell (1957). The DEA model was later developed and formalised by Charnes, Cooper and Rhodes (1978) in response to the challenge laid down by Farrell which was to estimate the production function either through a parametric approach or by using non-parametric linear technology (Avkiran & Rowlands, 2008:319).

The most comprehensive definition of the DEA is that it is a non-parametric linear programming technique that computes a comparative ratio of outputs to inputs for each unit, which is reported as the relative efficiency score (Avkiran, 1999:206). It creates a frontier of the best performing units within the data set (Bowlin & Renner, 2008:433) which consists of units that possess some common functional traits but whose efficiency may vary due to internal differences (El-Mahgary & Lahdelma, 1995:700). Its main usefulness lies in its ability to identify units to benchmark against and to generate potential improvements for inefficient units (Avkiran, 1999:206). In the original DEA model, these units refer to decision-making units (DMUs) but for the purpose of this study, the units will represent the JSE-listed companies with CEO remuneration as input variable and remuneration determinants as output variables. Some of the elements within this definition will be discussed in more detail below.

3.2.1 Multiple Input and Output Variables

The DEA allows the analyst to select multiple inputs and outputs in accordance with a managerial focus and it can work with variables of different units without the need for standardisation (i.e. Rand, percentage, number of employees, etc.). This process involves identifying performance variables (outputs) that reflect the corporate objectives and strategies of the company and then determining the input variables that can be demonstrated to manifest themselves as outputs (Avkiran, 1999:207,208). This characteristic is especially useful in this study where there are multiple CEO remuneration components (inputs) and determinants (outputs) to consider. Furthermore, there are no multi-collinearity problems with the DEA like there are with regression analysis, so variables that measure similar CEO or company characteristics (determinants) can be used simultaneously in the model (Bowlin & Renner, 2008:433). Another common practice in DEA is to allow the optimisation program to determine the weights for each variable included in the model. However, it is possible to restrict the weight of variables if

management is concerned that a variable might be under- or over-represented (Avkiran, 1999:212).

The analyst also has the model options of input minimisation and output maximisation with the DEA. Input minimisation (input-orientated approach) examines the extent to which inputs can be reduced while maintaining output levels. Potential improvements indicated by the DEA may suggest increasing outputs and lowering inputs at the same time if output slacks depict under-produced outputs. Alternatively, output maximisation (output-orientated approach) investigates the extent to which outputs can be raised given current input levels. The results may suggest raising outputs as well as reducing inputs if inputs are over-utilised (Avkiran, 1999:211). Farrell (1957:259) provides a concise explanation for these two approaches by stating that the given output could have been efficiently produced with only a fraction of the given inputs (input minimisation) and 'x' times as great an output could have been produced from the given input (output maximisation).

In this study, CEO remuneration components will be the inputs and business factors (determinants) will be the outputs of the model. The input-orientated approach will be applied to indicate by how much CEO remuneration can be reduced while maintaining a certain level of company performance and size. The output-orientated approach will also be applied to indicate what level of company performance or size justifies the current CEO remuneration level.

3.2.2 Efficiency Frontier

The efficiency frontier, or envelope, is the foundation for the whole concept of DEA. The frontier defines a standard of best performance based on observed data (as opposed to some imaginary standard) that indicates the maximum amount of outputs that can be obtained from a given combination of inputs. The frontier is drawn by connecting the efficient units with straight segments

so that the inefficient units are enveloped within (El-Mahgary & Lahdelma, 1995:702).

The efficiency of a company represents its success in producing as large as possible an output from a given set of inputs (Farrell, 1957:254). The traditional DEA model measures technical efficiency which investigates how well the production process converts inputs into outputs (Avkiran, 1999:207). In this study, efficiency is represented by the incentive of the different remuneration components to encourage CEO's to improve company performance in terms of size and profits. The technical efficiency of each unit is calculated relative to all other units in the sample (Bowlin, 1997:210; Farrell, 1957:260) because, like Farrell (1957:255) states, it is better to compare performances with the best actually achieved rather than with some unattainable ideal. A given unit is efficient if no other unit, or some combination of other units, can produce at least the same amount of output with less input or can produce more output with the same, or less, input (Bowlin, 1997:210).

The concept of the efficiency frontier is best explained visually. Figure 3.1 is based on the explanation of the efficiency frontier given by El-Mahgary and Lahdelma (1995:702):

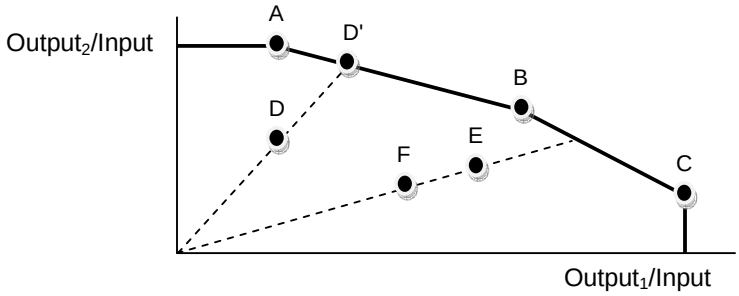

Figure 3.1: Efficiency Frontier

Figure 3.1 represents a case with a single input and two outputs. This visualisation can be interpreted as follows:

- Units A, B and C lie on the frontier and represent efficient units each with an efficiency score of 1.0 or 100%;
- Units D, E and F are inefficient and have efficiency scores that are not equal to 1.0;
- Unit D is compared to units A and B (its reference set or peer group), whereas the reference set for units E and F are units B and C.
- Point D' is the hypothetical composite optimum that unit D could achieve. It lies closer to unit A than B which means that unit D has an output mix that closer resembles that of unit A than B;
- Unit E and F lie on the same line drawn from the origin and are therefore similar in their output mixes;
- Of all the efficient units, B acts as a reference unit for a greater number of units than A or C. This suggests that unit B is more likely to offer truly good performance and is referred to as the global leader (Avkiran, 1999:212).

The frontier shows the relative efficiency of each unit and it shows the reference units against which an inefficient unit's performance has most directly been compared. This way, the efficiency frontier indicates what input/output mix will make an inefficient unit efficient (El-Mahgary & Lahdelma, 1995:702). It should be kept in mind that this model represented a case with a single input and two outputs and therefore it could be visualised with a two-dimensional drawing. When there are more inputs and outputs the two-dimensional drawing will be transformed into a three-dimensional one which can only be generated by using specialised computer software.

3.2.3 Identifying Benchmarks

One of the advantages of the DEA is that it measures performance against efficient rather than average performance (Thanassoulis, 1993:1142, El-Mahgary & Lahdelma, 1995:701). As an efficient frontier technique, the DEA identifies inefficiency in a particular unit by comparing it to similar units regarded as efficient (Avkiran, 1999:207). This was the basic principal of the

concept developed by Farrell (1957:256) which was to measure the technical efficiency of a unit by comparing it with a hypothetical unit (or virtual unit) which uses the factors in the same proportions.

If a given producer, A, is capable of producing Y_A units of output with X_A inputs, then other producers should also be able to do the same if they were to operate efficiently. Similarly, if producer B is capable of producing Y_B units of output with X_B inputs, then other producers should also be capable of the same production schedule (Anderson, 1996:2). Producers A and B can be combined to form a hypothetical unit which is constructed as a weighted average of the two observed units (reference set). Each of its inputs and outputs is the same weighted average of those of the observed units, with the weights being chosen in order to give the desired factor proportions (Farrell 1957:256). The unit that most frequently appears in reference sets are referred to as the global leader in the model (Avkiran, 1999:212).

Anderson (1996:2) states that the heart of the DEA lies in finding the 'best' virtual unit for each real unit. If the virtual unit is better than the original unit by generating more output with the same input or generating the same output with less input, the original unit is inefficient. If the analyst knows which efficient units are most comparable to the inefficient unit, they will develop a better understanding of the nature of the inefficiencies and can re-allocate scarce resources in order to improve productivity (Avkiran, 1999:207). In the case of CEO remuneration, the remuneration package can be adjusted to provide more incentive for the CEO to perform better. This way the DEA can also be used to benchmark the best practice in a particular group of units (Avkiran, 1999:213). The remuneration committee can examine the input/output configuration of efficient and inefficient CEOs to gain better insight on how to set up an acceptable remuneration package for their own CEO.

3.2.4 Functional Form

The DEA does not require the specification of or assumption about a functional form for the relationship between CEO remuneration and business factors. It neither assumes nor requires that all CEOs in the analysis have the same functional relationship between remuneration and business factors such as company performance or size (Bowlin & Renner, 2008:433). Avkiran (1999:207) states that the importance of this feature is that a unit's efficiency can be assessed based on other observed performance rather than trying to associate it with statistical averages that may not be applicable to the unit.

Another feature of the DEA, for which the analyst should make some assumptions, regard the nature of returns to scale that best reflects the operations of the units in the sample. The two types of returns to scale to consider are constant returns to scale (CRS) or variable returns to scale (VRS). CRS implies a proportionate rise in outputs when inputs are increased. In this case, the scale of operations does not influence the efficiency of the unit. VRS implies a disproportionate rise or fall in outputs when inputs are increased. This means that as a unit grows in size, its efficiency would either rise or fall (Avkiran, 1999:211).

The original Charnes, Cooper, and Rhodes (CCR) version of the DEA model assumes constant returns to scale. The Banker, Charnes, and Cooper (BCC) version was later developed to allow for flexible (variable) returns to scale. A 'flexible' frontier as Bowlin and Renner (2008:433) calls it, recognises different relationships between business factors and remuneration components. As a result, the DEA is flexible in accommodating companies that have different CEO remuneration policies and recognises that the remuneration committee may create different remuneration schemes which weigh the various factors differently. The DEA therefore allows companies to place differing importance on company performance and size in setting its remuneration package. (Bowlin & Renner, 2008:433).

3.2.5 DEA Example

In order to demonstrate how the DEA works, an example based on Anderson (1996:2) will be presented to facilitate the reader in understanding the DEA model used and the results obtained in the next chapter. This example will explain a single input, two-output, constant returns to scale case.

As stated earlier, the heart of the DEA lies in finding the 'best' virtual unit for each real unit. The best virtual unit can be found by using linear programming. A linear programming model needs to be formulated for each unit in the analysis in order to determine its efficiency. *Lambda* (λ) is a vector describing the percentages of other units used to construct the virtual unit. *Lambda* X (λX) is the input vector and *lambda* Y (λY) is the output vector for the analysed unit and these represent the virtual inputs and outputs. The value of *theta* (θ) represents the unit's efficiency. The DEA Input-Oriented Primal Formulation is presented below:

$$\min\ \theta,$$
$$subject\ to$$
$$\Upsilon\lambda \geq \Upsilon_0,$$
$$\theta X_0 - X\lambda \geq 0,$$
$$\theta \text{ free}, \qquad \lambda \geq 0$$

The first constraint forces the virtual unit ($Y\lambda$) to produce at least as many outputs as the studied unit (Y_0). The second constraint determines how much less input the virtual unit ($X\lambda$) would need (input minimisation). The factor used to scale back the inputs is *theta* (θ) and this value shows the efficiency of the unit. Consider the data in Table 3.1 for a simple numerical example of the DEA:

Table 3.1: DEA Example Data

	Input	Output	
CEO	**Remuneration Basic salary**	**Company performance (Return on Equity)**	**Company size (Total Assets)**
A	1 000	15 %	100 000
B	1 000	12 %	150 000
C	1 000	10 %	300 000

From Table 3.1 it can be concluded that CEO_A is relatively fully efficient in terms of ROE, since no combination of CEOs B and C can generate a return on equity of 15% with the constraint of only R 1 000 in basic salary. Table 3.1 also shows that CEO_C is relatively fully efficient in terms of company size because no combination of CEOs A and B can run a company the size of R 300 000 in total assets with a salary of R 1 000. CEOs A and C will both receive an efficiency score of 1.0 and lie on the efficiency frontier. CEO_B will receive a score other than 1.0 because he/she is not that efficient as CEOs A and C and lies below the frontier. The efficiency frontier of this example is presented in Figure 3.2:

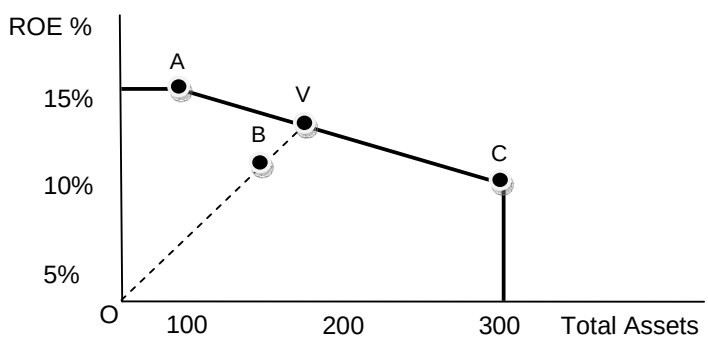

Figure 3.2: DEA Example

Figure 3.2 shows the frontier that represents all the combinations of CEOs A and C that will create the highest output for the given input. Figure 3.2 also shows that the efficiency of CEO_B can be determined by comparing it to a virtual CEO (V) that is formed by CEOs A and C. Figure 3.2 further shows that the virtual CEO is the benchmark for CEO_B and consists of approximately

61% of CEO_A (length of VC ÷ length of AC) and 39% of CEO_C (length of VA ÷ length of AC). The percentages of the virtual CEO can be presented as λ = [0.61, 0.39]. The virtual vector output is now:

$$\lambda Y = [A\% \times ROE_A + C\% \times ROE_C,\ A\% \times Size_A + C\% \times Size_C]$$

$$\lambda Y = [0.61 \times 15\% + 0.39 \times 10\%,\ 0.61 \times 100\,000 + 0.39 \times 300\,000]$$
$$= [13.05\%, 178\,000]$$

The efficiency of CEO_B can be calculated by finding the fraction of inputs that the virtual CEO would need to produce as many outputs as CEO_B. In Figure 3.2, this is calculated by using the line from the origin (O) to the virtual CEO (V). The relative efficiency of CEO_B is about 77% (length of OB ÷ length of OV). In the same way, the efficiency scores of CEOs A and C can be calculated by the ratio of OA÷OA and OC÷OC respectively. Since the numerator and denominator are the same, the efficiency scores of these CEOs are both 1.0 (100%).

From an input orientated view, the return on equity and total assets values of CEO_B could have been achieved by only paying 77% of the basic salary to the virtual CEO. Alternatively, 1.3 times (1÷0.77) as great an output (return on equity and total assets) could have been achieved by the virtual CEO from the given basic salary. The graphical method can be used effectively in simple single input, two output models, but when the model gets more complicated by including more inputs and outputs or by having unequal values of inputs, computerised linear programming models have to be used to determine efficiency.

3.3 LIMITATIONS OF THE DEA

The characteristics explained above are also the advantages of the DEA over other parametric methods such as the regression analysis in analysing CEO

remuneration. However, no method is without limitations and those of the DEA have to be kept in mind when interpreting the results.

The most important limitation of the DEA is that it assumes data to be free of measurement error. If the integrity of data has been violated, DEA results cannot be interpreted with confidence because the efficiency scores of units both on and under the frontier will be biased. A second limitation of the DEA is that those units indicated as efficient, are only efficient in relation to others inside the sample. There may be units outside the sample with higher efficiency than the best practice inside the sample (Avkiran, 1999:207). Thirdly, the DEA is a good indicator of relative efficiency but not absolute efficiency. In other words, it indicates how well a unit is doing compared to its peers but not compared to a theoretical maximum (Anderson, 1996:7). Furthermore, the DEA will not discriminate well if the ratio of units to the product of inputs and outputs is low because most units would simply appear as efficient and lie on the frontier (Avkiran, 1999:214).

According to Avkiran (1999:208), a homogeneous group of units should be used in the DEA to minimise confounding effects and to obtain comparable results because different businesses have different operational and production variables. The DEA is a useful tool in setting targets for inefficient units to improve performance, but the drawback is that it does not tell the analyst how to reach those targets or why the unit is not performing well. The reference set is a good starting point, but further analysis is necessary to identify specific problems within a unit.

3.4 MODEL FORMULATION

This study is based on the DEA model presented by Zhu (2004) for both the input- and output-orientated approaches. These models are based on the less restricted VRS which takes into account of different CEO remuneration policies across the different companies under review.

A set of n observations will be considered on the CEOs. Each observation, CEO_j $(j = 1, \ldots, n)$, uses m inputs x_{ij} $(i = 1, 2, \ldots, m)$ to produce s outputs y_{rj} $(r = 1, 2, \ldots, s)$. The efficiency frontier will be determined by these n observations. The mathematical formulations of the input- and output-orientated approaches are shown in Table 3.2:

Table 3.2: DEA Models

Input-Orientated	Output-Orientated
$min\theta - \varepsilon(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+)$	$max\phi - \varepsilon(\sum_{i=1}^{m} s_i^- + \sum_{r=1}^{s} s_r^+)$
$Subject\ to$	$Subject\ to$
$\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = \theta x_{i0} \quad i = 1, 2, \ldots, m;$	$\sum_{j=1}^{n} \lambda_j x_{ij} + s_i^- = x_{i0} \quad i = 1, 2, \ldots, m;$
$\sum_{j=1}^{n} \lambda_j y_{rj} - s_r^+ = y_{r0} \quad r = 1, 2, \ldots, s;$	$\sum_{j=1}^{n} \lambda_j y_{rj} - s_r^+ = \phi y_{r0} \quad r = 1, 2, \ldots, s;$
$\sum_{j=1}^{n} \lambda_j = 1$	$\sum_{j=1}^{n} \lambda_j = 1$
$\lambda_j \geq 0 \qquad j = 1, 2, \ldots n.$	$\lambda_j \geq 0 \qquad j = 1, 2, \ldots n.$

In Table 3.2, CEO_0 represents one of the n CEOs under review and x_{i0} and y_{r0} are the ith input and rth output for CEO_0, respectively. The value of θ in Table 3.2 represents the input-orientated efficiency score and ϕ the output-orientated efficiency score of CEO_0. If $\theta = 1$ or $\phi = 1$, CEO_0 lies on the frontier. If $\theta < 1$ or $\phi > 1$, CEO_0 is inefficient and should either decrease its input levels or increase its output levels.

It is possible for the DEA to indicate an individual input reduction or output increase for a specific CEO in order to move it onto the frontier. These input reductions or output increases are called input or output slacks and are represented in Table 3.2 by s_i^- and s_r^+, respectively. In Table 3.2, the presence of ε in the input-orientated model allows the minimization over θ to pre-empt the optimization involving the slacks, s_i^- and s_r^+. The model is therefore calculated in a two-stage process. First, maximal reduction of inputs

is achieved by optimising θ. Secondly, movement onto the frontier is achieved by optimizing the slack variables. Similarly, the output-orientated model is also calculated in a two-stage process by first calculating ϕ and then optimizing the slacks by fixing ϕ. Ray (2004:35) clarifies slacks with a simple example: suppose that in a particular application $\phi^* = 1.25$ is obtained. This means that all the outputs should be increased by 25% for the company to become fully efficient. Now suppose that $s_1^{+*} = 10$. This implies that output$_1$ can be further increased by 10 units. Moreover, if any one of the input slacks is strictly positive, the previous expansion of the outputs can be achieved while reducing individual inputs at the same time.

The left-hand side of the models shown in Table 3.2 are called the 'Reference Set' and the right-hand side represents the specific CEO under evaluation. The non-zero optimal λ_j in Table 3.2 represents the benchmarks for the specific CEO under evaluation. The reference set as shown in Table 3.2 provides coefficients (λ_j) to form the hypothetical efficient CEO. The reference set shows how inputs can be decreased and outputs increased to make the CEO under evaluation efficient.

3.5 SUMMARY

The DEA is a non-parametric, linear programming technique that computes a relative efficiency score for each unit. It creates an efficiency frontier that defines a standard of best performance based on the observed data. The frontier shows the relative efficiency of each unit and its reference set against which an inefficient unit's performance has been compared. The DEA can be used to benchmark the best practice in a particular group of units and the remuneration committee can use this to set up an acceptable remuneration package for their CEO. Multiple CEO remuneration components (inputs) and determinants (outputs) can be considered in a single model and both the input- and output-orientated approaches can be performed to analyse CEO remuneration. The DEA allows for VRS and does not require that all CEOs in

the analysis have the same functional relationship between remuneration and the business factors. The DEA has many advantages over parametric methods but it also has limitations, the most important being that it assumes data to be free of measurement error. In the next chapter the VRS input- and output-orientated models presented by Zhu (2004) will be used to analyse CEO remuneration of JSE listed companies.

CHAPTER 4: EMPIRICAL RESULTS

4.1 INTRODUCTION

The aim of this study is to apply the DEA on CEO remuneration in order to benchmark best practice and to identify potential improvements for inefficient CEOs. Multiple CEO remuneration components and business factors will be considered together in the DEA model to produce the empirical results for this study. The input-orientated approach will show by how much CEO remuneration can be reduced while maintaining company performance and size and the output-orientated approach will indicate what level of company performance or size justifies the current CEO remuneration level. Boards of directors can use this information to make informed decisions when determining CEO remuneration and decrease the pay gap between CEOs and the average worker by setting an acceptable remuneration benchmark.

The first section briefly explains how the concepts of the remuneration components, company size and performance have been operationalised to provide measureable indicators for the inputs and outputs of the model. The sample statistics will then be presented to put the empirical results into perspective, followed by the presentation and interpretation of the results for both the input- and output-orientated approaches, as applied to the sample.

4.2 VARIABLE DESCRIPTION

A concept is an abstract idea that is not directly observable or measurable which must first be operationalised in some way to provide measurable indicators. This is achieved by identifying a variable that is an adequate substitute for the concept (Smith, 2009:34). Table 4.1 indicates the concepts that form the DEA inputs and outputs for this study and shows the measure by which it has been operationalised:

Table 4.1: Input and Output Measures

	Symbol	Concept	Measure
Inputs: Remuneration components	X_1	Base Pay	'Salary'
	X_2	Perquisites and Pension	Total of 'Retirement and/or Medical' contributions, 'Allowances and Benefits', 'Motor and Travel' allowances and 'Fee/Levy Payment'
	X_3	Annual Bonus Plans	Total of 'Bonus paid in current year', 'Performance Bonus', 'Other Benefits' and 'Once-off Payments'
	X_4	Long-term Incentives	'Gains on Shares'
Outputs: Determinants	Y_1	Company Performance	Return on Equity
	Y_2	Company Size	Total Assets (Including intangible assets)

In Table 4.1, the inputs to the DEA model represent the components of CEO remuneration and correspond to the symbols X_1, X_2, X_3 and X_4. The measures of the remuneration components are in accordance with the terms and classification used in the McGregor B.F.A. (2012) database from where the data has been drawn. The four inputs shown in Table 4.1, namely Base Pay, Perquisites and Pension, Annual Bonus Plans and Long-term Incentives, represent the fixed and variable short-term and long-term components of CEO remuneration. This classification allows for more accurate benchmarking because it makes it possible to pinpoint which component has to be increased or reduced to improve the efficiency score of a CEO rather than just suggesting an increase or reduction of Total CEO Remuneration. Table 4.1 further shows that 'Base Pay' is measured by the amount of salary paid to the CEO, 'Perquisites and Pension' is calculated as the total of retirement and/or medical contributions, allowances and benefits, motor and travel allowances and a fee/levy payment, 'Annual Bonus Plans' is calculated as the total of the bonus paid in the current year, a performance bonus, other benefits and once-off payments and 'Long-term Incentives' is measured by the gains on shares

a CEO has earned during the year. Only the amount gained on schemes during the year is used in order to avoid valuation differences for the different types of schemes awarded to CEOs.

Also in Table 4.1 are the outputs to the DEA model which represent the determinants of CEO remuneration and correspond to the symbols Y_1 and Y_2. Company performance and company size are among the most popular variables considered in CEO remuneration research and will therefore be included in this study as well. There are many other determinants of CEO remuneration as discussed in Chapter 2 but due to inadequate information on the McGregor B.F.A. (2012) database, no suitable measures could be obtained to operationalise these concepts and therefore these determinants were excluded from this study. Table 4.1 shows that 'Company Performance' is measured in terms of Return on Equity (ROE). ROE can be disaggregated using the DuPont model as shown below (Feroz et al, 2003:49, Correia et al, 2011):

$$ROE = \frac{Net\ Income}{Sales} \times \frac{Sales}{Total\ Assets} \times \frac{Total\ Assets}{Common\ Equity}$$

This disaggregation facilitates the examination of ROE in terms of a measure for profitability (Net Income ÷ Sales), level of assets required to generate sales (Sales ÷ Total Assets) and the financing of those assets (Total Assets ÷ Common Equity) (Feroz et al, 2003:49). ROE is therefore a suitable measure for company performance because it encompasses three dimensions (profit margins, asset utilisation and financing) that are all affected by the CEO's actions and decisions.

Following Ciscel (1974) and Bowlin and Renner (2008), Total Assets was chosen as a measure for 'Company Size' as shown in Table 4.1 because it represents managerial concern with company growth and size. The value of Total Assets used in this study includes intangible assets to account for the

size of companies that own non-monetary assets without physical substance such as intellectual or human capital.

4.3 SAMPLE STATISTICS

The McGregor B.F.A (2012) database was used to gather financial and CEO remuneration data for JSE-listed companies with financial year ends during 2010. The initial dataset consisted of 359 companies but since the software of Zhu (2004) used in this analysis only accepts positive data, companies with negative financial data were eliminated. Companies that did not provide CEO remuneration data on the McGregor B.F.A (2012) database were also eliminated because the data could not be manually retrieved from the annual reports in the same format as the McGregor B.F.A (2012) database. After elimination of the above mentioned companies, the final sample consists of 221 companies across nine different industries. Following Cordeiro et al (2006), each industry will be analysed separately with the DEA to account for the variation across industries. Table 4.2 summarizes the number of companies and different industries in the sample:

Table 4.2: Sample Statistics

Sample	n	Industry	n
Companies	221	Basic Materials	41
CEOs	221	Consumer Goods	20
Industries	9	Consumer Services	33
		Financial	48
		Health Care	5
		Industrials	57
		Oil & Gas	1
		Technology	11
		Telecommunications	5
		Total	**221**

In order to discriminate well between the efficient and inefficient CEOs, the sample size has to be at least three times larger than the sum of the number

of inputs and outputs (Avkiran, 1999:208). Therefore, a sample size of at least 18 companies in each industry (4 inputs + 2 outputs = 6 x 3 = 18) is required to analyse it separately. Table 4.2 indicates that the Health Care, Oil and Gas, Technology and Telecommunications industries have less than 18 companies and can therefore not be analysed separately. In order to include these companies in the analysis, these industries were joined with industries of a similar kind to obtain a sample of 18 or more companies. Oil and Gas was joined with Basic Materials while Health Care, Technology and Telecommunications were joined together since all three of these industries involves some form of technology, technological equipment or technology related services.

Descriptive statistics describes the main features of a collection of data and provides information about the central tendency (i.e. mean and median) and variability (i.e. standard deviation, minimum and maximum) of the data. All the monetary values in the dataset were adjusted with the Producer Price Index (PPI) factor. The PPI measures the average change in selling prices received by domestic producers of goods and services over time. December 2010 was chosen as the base month and every other month of 2010 was expressed as a factor of the base month. This adjustment was made to make the figures of companies with different financial year ends more comparable. Companies trading on the JSE in a foreign currency were included in the sample by converting the monetary values to Rand, using the appropriate exchange rate on the financial year end date for each company. Table 4.3 shows the descriptive statistics for the remuneration components (inputs):

Table 4.3: Descriptive Statistics for CEO Remuneration Components

Remuneration Components	Salary (R)	Perquisites and Pension (R)	Annual Bonus Plans (R)	Gains On Shares (R)
Mean (Average)	3,503,827	633,207	3,098,542	3,466,495
Median	2,650,000	356,563	1,663,000	0
Standard Deviation	3,870,023	1,292,309	4,595,824	39,314,269
Minimum	567,820	0	0	0
Maximum	44,100,687	14,734,000	27,879,360	583,020,833

Table 4.3 indicates that the average salary earned by the CEOs during 2010 is R 3,503,827 and ranges from R 567,820 to R 44,100,687. Table 4.3 also points out that the minimum values of Perquisites and Pension, Annual Bonus Plans and Gains on Shares are all zero which indicate that some CEOs did not receive certain allowances, benefits, bonuses or gains on their shares. The most significant figure in Table 4.3 is the maximum of R 583,020,833 earned by a CEO through gains on shares.

Table 4.4 shows the descriptive statistics for the remuneration determinants (outputs):

Table 4.4: Descriptive Statistics for Remuneration Determinants

Remuneration Determinants	Return On Equity	Total Assets (Incl. Intangible Assets) (R'000)
Mean (Average)	19.61%	41,863,062
Median	14.07%	3,817,608
Standard Deviation	32.50%	145,473,062
Minimum	0.00%	48,677
Maximum	430.18%	1,336,308,000

According to Table 4.4, company performance (ROE) ranges from zero to 430.18% with an average of 19.61%. Table 4.4 further shows that Total Assets (including intangible assets) which represents company size, ranges

from R 48,677,000 to R 1,336,308,000,000 while the average sized company owns assets to the value of R 41,863,062,000.

4.4 RESULTS

This section presents the results obtained from the DEA. The first part presents the descriptive statistics again but divides the sample this time into efficient and inefficient CEOs of the companies analysed. The second and third parts provide an overview per industry of the efficient and inefficient CEOs as well as the distribution of the CEOs with efficiency scores within a certain range for the input- and output-orientated approaches, respectively. The last part presents the results from two of the most useful features of the DEA, namely to indicate the benchmark CEOs and to suggest potential improvements for inefficient CEOs.

4.4.1 DEA Descriptive Statistics

After the DEA has been applied on the sample, a distinction could be made between the efficient and inefficient CEOs. Table 4.5 presents the descriptive statistics for these two groups within the sample:

Table 4.5: Descriptive Statistics for Efficient and Inefficient CEOs

	Salary (R)	Perquisites and Pension (R)	Annual Bonus Plans (R)	Gains on Shares (R)	ROE	Total Assets (R'000)
Average						
Efficient	3,830,728	569,075	2,828,450	901,929	27.63%	58,724,823
Inefficient	3,318,351	669,594	3,251,786	4,921,568	15.06%	32,296,106
Minimum						
Efficient	567,820	0	0	0	0.00%	48,677
Inefficient	829,665	0	0	0	0.75%	86,720
Maximum						
Efficient	44,100,687	6,105,861	27,879,360	36,720,160	430.18%	1,336,308,000
Inefficient	24,860,518	14,734,000	25,957,049	583,020,833	99.64%	828,919,309

Table 4.5 points out that the average salary paid to CEOs of efficient companies (technical efficiency score of 1, from here on referred to as 'efficient CEOs') is higher than the average salary paid to CEOs of inefficient companies ('inefficient CEOs'). Table 4.5 also points out that the average amounts of Perquisites and Pension, Annual Bonus Plans and Gains on shares for inefficient CEOs exceed those of the efficient CEOs while company performance (ROE) and size (Total Assets) are less than that of efficient CEOs. This explains why these CEOs are deemed as inefficient because their current remuneration levels are not justified by the company's current performance and size.

Table 4.5 also provides interesting insights when compared to the descriptive statistics for the whole sample as shown in Tables 4.3 and 4.4. Both the minimum and maximum amounts of Salary for the whole sample lie within the group of efficient CEOs. The same goes for the value of Annual Bonus Plans, ROE and Total Assets, demonstrating that a certain minimum or maximum level of remuneration or company performance and size does not necessarily indicate whether a CEO is either efficient or inefficient.

4.4.2 Input-Orientated Results

The input-orientated approach is also known as input minimisation which indicates by how much inputs can be reduced while the outputs are held constant (Avkiran, 1999:211). The input-orientated efficiency score is expressed as 1.0 (or 100%) for efficient CEOs and less than 1.0 (or < 100%) for inefficient CEOs. Each industry was analysed separately with the DEA and Table 4.6 shows how the CEOs in each industry are distributed between the efficient and inefficient groups for the input-orientated approach:

Table 4.6: Input-Orientated Efficiency Score Distribution

INPUT-ORIENTATED	Efficient		Inefficient			Minimum Efficiency Score	Average Efficiency Score
Industry	No.	%	No.	%	Total		
Basic Materials, Oil & Gas	14	33%	28	67%	42	0.259	0.709
Consumer Goods	13	65%	7	35%	20	0.628	0.923
Consumer Services	8	24%	25	76%	33	0.389	0.757
Financial	13	27%	35	73%	48	0.134	0.577
Health Care, Technology, Telecommunications	12	57%	9	43%	21	0.222	0.730
Industrials	20	35%	37	65%	57	0.356	0.763

Distribution of CEOs with Input-Orientated efficiency between:					
	0%-25%	25%-50%	50%-75%	75%-100%	Total
Basic Materials, Oil & Gas	0	10	15	17	42
Consumer Goods	0	0	3	17	20
Consumer Services	0	5	10	18	33
Financial	8	16	10	14	48
Health Care, Technology, Telecommunications	2	5	2	12	21
Industrials	0	11	15	31	57

Table 4.6 shows that the Consumer Goods industry has the highest percentage of efficient CEOs, followed by the Health Care, Technology and Telecommunications industry while the Consumer Service industry has the lowest percentage of efficient CEOs. Table 4.6 further shows that the lowest input-orientated efficiency score of 0.134 falls within the Financial industry and that this industry also has the lowest average input-orientated efficiency score of 0.577. This means that on average, CEOs within this industry are only 57.7% efficient and their remuneration packages has to be reduced by at least 42.3% in order for them to become efficient (57.7% + 42.3% = 100%).

Figure 4.1 is based on the data in Table 4.6 and visually expresses how the CEOs are distributed over the range from lowest to highest efficiency score for the input-orientated approach:

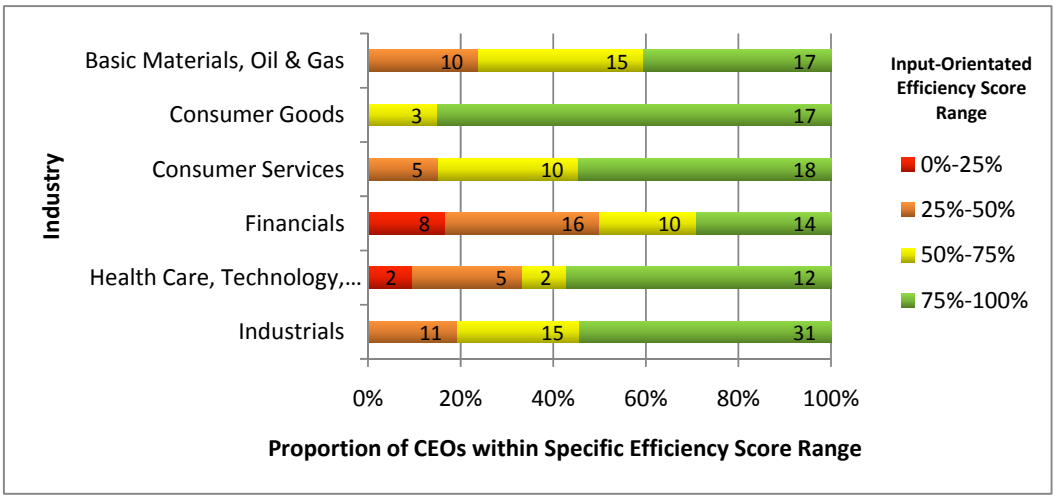

Figure 4.1: Input-Orientated CEO Distribution

In Figure 4.1, the colours of the bars represent a specific input-orientated efficiency score quartile and ranges from red for CEOs with a low efficiency to green for CEOs with a high efficiency. Figure 4.1 indicates the number of CEOs in each quartile on the bars and the length of each coloured bar shows the proportion of the quartile within each industry. Figure 4.1 visually conveys that Consumer Goods is the most efficient industry since most of the CEOs lie within the 75%-100% quartile and the rest within the 50%-75% quartile. Alternatively, Figure 4.1 shows that the Financial industry is the least efficient since half of this industry is made up of CEOs within the 0-25% and 25%-50% quartiles and that it has the smallest proportion of CEOs within the 75%-100% quartile.

4.4.3 Output-Orientated Results

The output-orientated approach is also known as output maximisation and indicates by how much outputs can be increased while the inputs are held constant (Avkiran, 1999:211). The output-orientated efficiency score is also expressed as 1.0 (or 100%) for efficient CEOs but more than 1.0 (or > 100%) for inefficient CEOs. Table 4.7 shows how the CEOs in each industry are

distributed between the efficient and inefficient groups for the output-orientated approach:

Table 4.7: Output-Orientated Efficiency Score Distribution

OUTPUT-ORIENTATED	Efficient		Inefficient			Maximum Efficiency Score	Average Efficiency Score
Industry	No.	%	No.	%	Total		
Basic Materials, Oil & Gas	14	33%	28	67%	42	15.494	3.796
Consumer Goods	13	65%	7	35%	20	5.629	1.376
Consumer Services	8	24%	25	76%	33	19.258	2.406
Financial	13	27%	35	73%	48	15.066	2.801
Health Care, Technology, Telecommunications	12	57%	9	43%	21	6.141	1.793
Industrials	20	35%	37	65%	57	11.736	1.991

Distribution of CEOs with Output-orientated efficiency between:					
	1.0 - 1.2	1.2 - 3.0	3.0 - 10.0	> 10.0	Total
Basic Materials, Oil & Gas	16	8	15	3	42
Consumer Goods	15	4	1	0	20
Consumer Services	11	16	5	1	33
Financial	15	21	10	2	48
Health Care, Technology, Telecommunications	12	5	4	0	21
Industrials	24	25	7	1	57

The same number of CEOs per industry is efficient under the output-orientated approach in Table 4.7 compared to the input-orientated approach in Table 4.6. In Table 4.7, the highest efficiency score indicates the least efficient CEO. Table 4.7 shows that the maximum output-orientated efficiency score of 19.258 exists in the Consumer Services industry which means that the CEO of that company has to increase current company performance and size by more than 19 times in order to justify his/her current remuneration. Table 4.7 further points out that the Basic Materials and Oil & Gas industry has the highest average output-orientated efficiency score of 3.796, indicating that on average these CEOs have to increase company performance and size by almost 4 times in order to be efficient.

Figure 4.2 is a representation of the data in Table 4.7 and shows how the CEOs are distributed over the range from lowest to highest efficiency score for the output-orientated approach:

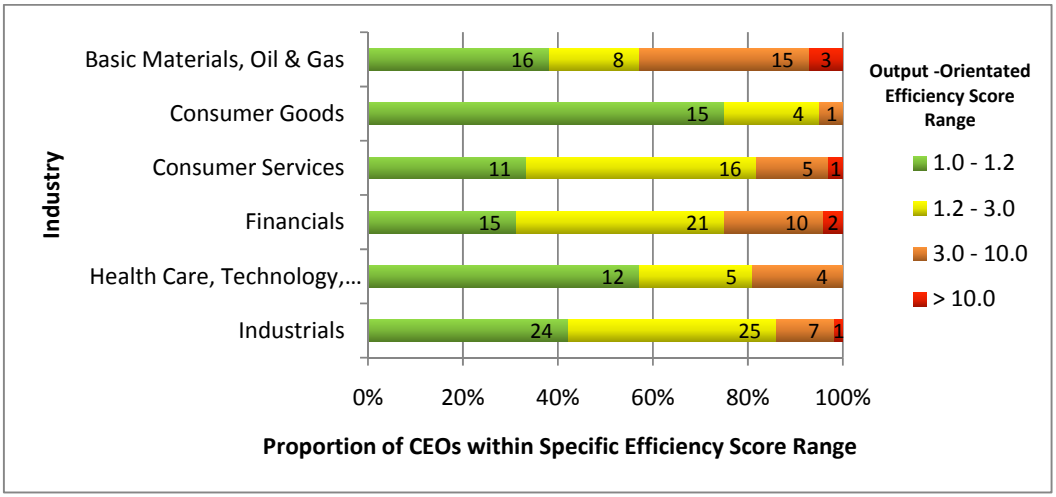

Figure 4.2: Output-Orientated CEO Distribution

Like Figure 4.1, Figure 4.2 enforces the conclusions drawn from Table 4.7 with the added benefit of visually expressing the results. However, the output-orientated efficiency scores could not be grouped into quartiles like the input-orientated approach because the scores did not fall between a specific lower and upper limit like 0% and 100% for the input-orientated approach. Instead, output-orientated efficiency score ranges were manually chosen to represent the different degrees of efficiencies. Figure 4.2 still points out that the Consumer Goods industry has the most efficient CEOs. Figure 4.2 further shows the proportions of the efficiency score ranges for the Basic Materials and Oil & Gas industry and indicates that less than half of this industry's CEOs are in the top efficiency range between 1.0 and 1.2 which explains this industry's high average output-orientated efficiency score.

4.4.4 Benchmarks and Improvements

The main objective of this study is to apply the DEA on CEO remuneration to determine if it is an appropriate benchmarking model. This part of the results showcases the unique abilities of the DEA when analyzing CEO remuneration which other models, such as the regression analysis, do not have.

Multiple remuneration components and determinants were combined in a single model and linear programming techniques were employed to determine the efficiency of each CEO. Not only can the DEA identify benchmark CEOs at this stage, but it can go a step further by suggesting improvements for inefficient CEOs by comparing them to the efficiency frontier created by the benchmark CEOs.

The benchmarking power of the DEA lies in its ability to identify efficient CEOs and to suggest target remuneration levels, company performance and size values for the inefficient CEOs by comparing them to the efficiency frontier created by the efficient CEOs. After applying the DEA, CEOs from several companies emerged as the benchmark CEOs within each industry. The benchmark CEOs are those CEOs who obtained an efficiency score of 1.0 under the input- or output-orientated approach. Table 4.8 shows which companies' CEOs served as the benchmarks for each industry in alphabetical order:

Table 4.8: Benchmark Companies per Industry

Basic Materials, Oil & Gas	Consumer Goods	Consumer Services
ANGLO AMERICAN PLC	AMALGAMATED APPLIANCE HOLDINGS	CASHBUILD
AQUARIUS PLATINUM	ASTRAL FOODS	CITY LODGE HOTELS
BHP BILLITON PLC	BRITISH AMERICAN TOBACCO PLC	CULLINAN HOLDINGS
DELTA EMD	COMPAGNIE FINANCIERE RICHEMONT SA	KAGISO MEDIA
INFRASORS HOLDINGS	COUNTRY BIRD HOLDINGS	NASPERS
INSIMBI REFRACTORY & ALLOY SUP	CROOKES BROTHERS	NICTUS BEPERK
JCI	DISTELL GROUP	PICK N PAY STORES
PALABORA MINING COMPANY	ILLOVO SUGAR	TASTE HOLDINGS
PAN AFRICAN RESOURCES PLC	METAIR INVESTMENTS	
RANDGOLD & EXPLORATION COMPANY	SABMILLER PLC	**Industrials**
ROLFES HOLDINGS	STEINHOFF INTERNATIONAL HOLDINGS	
SPANJAARD	TIGER BRANDS	AMALGAMATED ELECTRONICS CORP
WESIZWE PLATINUM	TONGAAT HULETT	ARB HOLDINGS
YORK TIMBER HOLDINGS		BOWLER METCALF
		CARGO CARRIERS
Health Care, Technology, Telecommunications	**Financial**	ESORFRANKI
		EXCELLERATE HOLDINGS
ADAPTIT HOLDINGS	ABSA GROUP	GROUP FIVE
BLUE LABEL TELECOMS	ACUCAP PROPERTIES	HOWDEN AFRICA HOLDINGS
COMPU-CLEARING OUTSOURCING	CLIENTELE	ILIAD AFRICA
EOH HOLDINGS	CORONATION FUND MANAGERS	IMPERIAL HOLDINGS
GIJIMA GROUP	FAIRVEST PROPERTY HOLDINGS	KAP INTERNATIONAL HOLDINGS
MEDICLINIC INTERNATIONAL	FORTRESS INCOME FUND	KAYDAV GROUP
MTN GROUP	NEW EUROPE PROPERTY INVESTMENTS PLC	METROFILE HOLDINGS
MUSTEK	PSG GROUP	MURRAY & ROBERTS HOLDINGS
NETCARE	PUTPROP	PRETORIA PORTLAND CEMENT COMPANY
SECUREDATA HOLDINGS	REDEFINE PROPERTIES	
TELKOM SA	RESILIENT PROPERTY INCOME FUND	REMGRO
VODACOM GROUP	RMB HOLDINGS	SANTOVA LOGISTICS
	STANDARD BANK GROUP	THE BIDVEST GROUP
		TRENCOR
		WILSON BAYLY HOLMES-OVCON

Table 4.8 lists the companies with 100% efficient CEOs under both the input- and output-orientated approaches for each industry. In total, CEOs from 80 of the 221 companies included in the sample emerged as the benchmark CEOs and formed the efficiency frontier against which the inefficient CEOs were compared. According to the results of the DEA, the CEOs of these companies receive a fair remuneration in terms of the performance and size of the companies they manage.

The DEA compares each of the inefficient CEOs to the benchmark CEOs within its industry to establish specific targets for both the inputs and outputs

which the inefficient company or CEO has to obtain in order to be efficient. Under the input-orientated approach, the input-reductions required to reach the input targets are also an indication of how much overpaid the CEO is. Alternatively, under the output-orientated approach, the output-increases required to reach the output targets is an indication of how much the CEO is currently underperforming. Table 4.9 summarises the potential improvements for inefficient CEOs by presenting it as input reductions and output increases required per industry:

Table 4.9: Potential Improvements for Inefficient CEOs

	Reduction required				Increase required	
	Salary	Perquisites and Pension	Annual Bonus Plans	Gains on Shares	ROE	Total Assets
Basic Materials, Oil & Gas						
Average	-43.6%	-45.3%	-59.1%	-25.0%	35.2%	419.4%
Min	-0.3%	0.0%	0.0%	0.0%	1.8%	1.9%
Max	-74.1%	-86.8%	-92.4%	-100.0%	135.4%	1449.4%
Consumer Goods						
Average	-21.9%	-29.1%	-21.6%	-24.3%	7.9%	146.2%
Min	-2.4%	-8.0%	0.0%	0.0%	1.1%	35.3%
Max	-37.2%	-39.3%	-37.2%	-88.1%	16.1%	462.9%
Consumer Services						
Average	-34.1%	-49.5%	-59.7%	-28.0%	17.9%	233.3%
Min	-1.9%	-1.9%	0.0%	0.0%	1.4%	7.0%
Max	-86.4%	-90.8%	-94.6%	-100.0%	42.2%	1825.8%
Financial						
Average	-58.4%	-57.4%	-67.4%	-14.3%	20.8%	410.6%
Min	-24.1%	0.0%	0.0%	0.0%	1.0%	9.4%
Max	-86.6%	-98.4%	-100.0%	-100.0%	42.6%	2450.8%
Health Care, Technology, Telecommunications						
Average	-62.9%	-67.3%	-72.7%	-22.2%	24.7%	331.7%
Min	-37.5%	-42.6%	-42.6%	0.0%	10.6%	69.3%
Max	-77.8%	-77.8%	-91.1%	-100.0%	57.2%	837.0%
Industrials						
Average	-36.5%	-47.6%	-36.4%	-8.1%	11.5%	152.7%
Min	-0.7%	0.0%	0.0%	0.0%	0.5%	5.8%
Max	-64.4%	-96.3%	-82.1%	-100.0%	33.3%	1073.6%

The information contained in Table 4.9 should serve as a guideline to boards of directors when the CEO remuneration package is structured. Table 4.9 shows by how much CEOs are currently overpaid and by how much their

remuneration should be reduced in order to be in line with the benchmark CEOs. In effect, the inputs should be reduced by the total of 1 minus the CEO's efficiency score (or 100% - efficiency %), e.g. a company whose CEO obtains an efficiency score of 0.684 has to reduce all the inputs with 31.6% (100%-68.4%) but the DEA might show a reduction of 31.6% for Salary, 42.8% for Perquisites and Pension, 86.4% for Annual Bonus Plans and 0% for Gains on Shares. The reason for all reductions not being equal to 31.6% is due to input slacks (note that this CEO did not receive any Gains on Shares, hence a reduction of 0% is required). As explained in Chapter 3 Section 3.4, the DEA can indicate individual input reductions or output increases for a specific CEO. This means that a reduction of 31.6% in all the inputs (excluding Gains on Shares) will make the CEO fully efficient and place it on the efficiency frontier but a further reduction of 11.2% (42.8%-31.6%) in Perquisites and Pension and 54.8% (86.4%- 31.6%) in Annual Bonus Plans will move the CEO along the frontier because he/she can achieve the same efficient output levels (company performance and size) by reducing certain inputs even more.

According to Table 4.9, the lowest minimum reduction required for Salary is 0.3% which means that all of the inefficient CEOs are overpaid to some extent in terms of their base salary. Table 4.9 further shows that Perquisites and Pension, Annual Bonus plans and Gains on Shares indicate minimum reductions of 0% which means that the current amounts paid in terms of these remuneration components to some CEOs are acceptable. However, the DEA returned interesting results for the Gains on Shares component of remuneration. Only a few CEOs received payment in the form of Gains on Shares during 2010 but unless these were CEOs of efficient companies, Table 4.9 shows that the DEA suggested a 100% reduction in Gains on Shares (with the exception of two cases within the Consumer Goods industry, (Appendix 1)), meaning that the target amount of Gains on Shares for all inefficient CEOs is zero. This finding supports public belief that long term incentive schemes, such as share options, enable CEOs to earn excessive

remuneration despite poor company performance and the DEA suggests that CEOs should not be paid any amount in terms of this component.

Slacks are also present in the output-orientated approach which, as explained on the previous page, suggest further increases in the outputs than the increase required for a CEO to become 100% efficient. In Table 4.9, the output-orientated approach suggest considerable increases in ROE and Total Assets which means that most of the inefficient CEOs are earning the same as CEOs in much bigger and better performing companies while their company's current size and performance does not permit him/her being remunerated at such a high level. The output-orientated information is also valuable to boards of directors in showing what the ROE and Total Assets values should be if they were to continue remunerating their CEO at the current level. Table 4.9 indicates that ROE has to be increased with as little as 0.5% to a maximum of 135.4% and Total Assets by a minimum of 1.9% to a maximum of 2450.8%. It is questionable how inefficient companies manage to afford such excessive remuneration packages when that money could have been utilised elsewhere to improve the performance or size of the company.

A detailed breakdown per company of the specific reductions required for each remuneration component or increase required in company performance and size is shown in Appendix 1. These tables show both the input- and output-orientated efficiency scores in descending order together with the input reductions and output increases for the CEOs in each industry. Appendix 1 also includes a table with the monetary values (PPI and currency adjusted) of the remuneration components and determinants which can be referred to in order to view the amounts paid to CEOs and the ROE and Total Asset values for 2010.

Another set of tables in Appendix 1 compares the efficiency scores per industry for the input- and output orientated approaches where the amount of Gains on Shares are both included and excluded from the analysis. This analysis was performed to determine whether the efficiency scores were

severely distorted by the many zero values and the few excessive amounts of Gains on Shares for some CEOs. In most cases, efficiency scores were unaffected when Gains on Shares were excluded from the analysis. In the few cases where the efficiency score changed, efficiency never increased but only decreased (lower input-orientated efficiency scores or higher output-orientated efficiency scores) when Gains on Shares were excluded.

4.5 SUMMARY

This chapter addressed the research question of this study which is to determine whether the DEA can be applied to CEO remuneration of companies listed on the JSE by defining inputs in terms of remuneration factors and outputs in terms of business factors in order to establish a benchmark for CEO remuneration. Multiple inputs and outputs were used in the DEA model after being operationalised with suitable measures. The sample consisted of 221 companies over nine different industries. Smaller industries were grouped together and the final analysis was performed on a total of six industry groups. The DEA results showed that a certain minimum or maximum level of remuneration or company performance and size does not necessarily indicate whether a CEO is either efficient or inefficient. The same CEOs are efficient under the input-orientated approach compared to the output-orientated approach but the distribution of CEOs over specific efficiency score ranges differ between the two approaches. The last part of the results showcased the unique abilities of the DEA and contributed to the main aim of the study by presenting the benchmark CEOs and the potential improvements for inefficient CEOs. The empirical results prove that the DEA can indeed be used to analyse CEO remuneration and that this information can be used to develop acceptable benchmarks to guide boards of directors when determining CEO remuneration.

CHAPTER 5: SUMMARY AND CONCLUSIONS

5.1 INTRODUCTION

Politicians and the public alike are concerned about the economic effects of excessive CEO remuneration packages. Several national and international studies into the matter attempted to explain the relationship between remuneration and its determinants but failed to identify factors that could individually serve as a convincing measure to determine CEO remuneration and to establish a benchmark to determine acceptable levels of remuneration. An alternative, business specific, multi-element model is needed to analyse CEO remuneration and this study applied the DEA on CEO remuneration to determine if it can be used as an acceptable benchmarking model.

The remainder of this chapter will provide an overview of the topics discussed in the previous chapters and the research conclusions will be presented with reference to the main and secondary objectives of the study. This will be followed by a short discussion of the contribution and limitations of this study and suggestions for future research will be made before drawing the final conclusion.

5.2 SUMMARY OF CHAPTERS

5.2.1 Chapter 1

Chapter 1 explained that the idea for this study had its origin in politicians and the public's discontent regarding excessive CEO remuneration levels. The biggest concern is that the gap between CEO salaries and the average wage of an ordinary worker is continuously increasing. The literature review in Chapter 1 revealed that up till now, South African researchers analysed CEO

remuneration by means of two dimensional statistical models such as the regression analysis and that these studies found no individual business factor that could serve as a convincing measure to determine CEO remuneration with and none of these studies suggested a benchmarking model to determine acceptable levels of CEO remuneration. Therefore, the gap in the literature is that no research has been conducted on JSE listed companies to investigate the possibilities of a three dimensional statistical model that incorporates multiple inputs and outputs and suggests an optimal solution in terms of the inputs and outputs defined. The DEA has been identified as a potential benchmarking model for CEO remuneration and Chapter 1 presented the research design and methodology of this study to empirically test if the DEA can be applied to CEO remuneration of companies listed on the JSE.

5.2.2 Chapter 2

The agency theory, which is the study of the relationship between the agent (CEO) and the principals (shareholders), was discussed in Chapter 2. This chapter explained that the separation of ownership from control can lead to many asymmetries between the principal and agent which cause agency problems. Chapter 2 further explained how CEO remuneration can be used to overcome these agency problems and to regulate the agency relationship between the CEO and the shareholders. This chapter grouped and explained the determinants of remuneration in terms of the Rationale Perspective, Political Perspective and Operating Characteristics Perspective. The different components of CEO remuneration packages were also discussed to provide a better understanding of the components included in the DEA model.

5.2.3 Chapter 3

Chapter 3 provided more insight into the DEA, a non-parametric, linear programming technique that computes a relative efficiency score for each unit within a certain sample. This chapter explained that multiple CEO remuneration components (inputs) and determinants (outputs) can be considered in a single model and that an input- and output-orientated approach can be performed on CEO remuneration. Chapter 3 further explained the efficiency frontier and the DEA's ability to benchmark the best practice in a particular group of units, a facility that can be used to determine acceptable CEO remuneration levels. The DEA also allows for variable returns to scale (VRS) and does not require that all CEOs in the analysis have the same functional relationship between remuneration and the business factors. Chapter 3 contained a simple example to illustrate how the DEA works and listed the limitations of the model before presenting the VRS formulation of the model that was used in this study.

5.2.4 Chapter 4

Chapter 4 addressed the research question of this study which was to determine whether the DEA can be applied to CEO remuneration of companies listed on the JSE by defining inputs in terms of remuneration factors and outputs in terms of business factors in order to establish a benchmark for CEO remuneration. Chapter 4 described the multiple inputs and outputs used in the DEA model and the reasoning behind the measures chosen for these variables. The sample of 221 companies was subdivided into six industry groups for the analysis to account for variations across industries. Chapter 4 presented the empirical results of the distribution of input- and output–orientated efficiency scores, the benchmark CEOs within each industry and the potential improvements for inefficient units. The research conclusions drawn from these results are discussed in the next section with reference to the specific objectives of this study.

5.3 RESEARCH CONCLUSIONS

The main objective of this study is to apply the DEA on CEO remuneration to determine if it is an appropriate benchmarking model. In order to achieve this, the secondary objectives had to be addressed first by means of a literature review and an empirical study. The secondary objectives are listed below together with a short reference to the chapter in which it was addressed:

- *'define the remuneration factors to be used as inputs and the business factors to be used as outputs in the DEA model'*

Chapter 2 addressed this objective through a literature review that explains the theoretical framework underlying this study, namely the agency theory. The components and determinants of CEO remuneration were also discussed in Chapter 2 to provide insight into the variables used as inputs and outputs in the DEA model.

- *'describe the DEA and discuss its potential to be used as a benchmarking model for CEO remuneration'*

This objective was addressed in Chapter 3 through a literature review that described the unique characteristics of the DEA and explained the working of the DEA through a simple numerical example which illustrated its potential to be used as a benchmarking model for CEO remuneration.

- *'estimate input- and output-orientated technical efficiencies of all JSE listed company CEOs to convert remuneration into company performance and size'*

Chapter 4 addressed this secondary objective empirically by applying the DEA on JSE listed companies and presenting the input- and output-orientated efficiency scores for the different industries in the sample.

- *'develop an efficiency frontier to serve as a benchmark to suggest acceptable CEO remuneration levels based on a company's performance and size as defined in the DEA model'*

Chapter 4 also addressed this secondary objective by indicating the benchmark CEOs that form the efficiency frontier for CEO remuneration and the potential improvements to remuneration levels of inefficient CEOs as suggested by the DEA.

The empirical results were obtained after applying the DEA on six industry groups that was formed from the sample of 221 JSE listed companies. The results pointed out the following:

- Efficient CEOs earn a higher average salary than inefficient CEOs (Table 4.5);
- Inefficient CEOs earn higher amounts of Perquisites and Pension, Annual Bonus Plans and Gains on Shares than efficient CEOs while their company performance (ROE) and size (Total Assets) are less than that of efficient CEOs (Table 4.5);
- Both the minimum and maximum amounts of Salary, Annual Bonus Plans, ROE and Total Assets for the whole sample lie within the group of efficient CEOs (Table 4.5);
- The Consumer Goods industry has the highest percentage of efficient CEOs, followed by the Health Care, Technology and Telecommunications industry while the Consumer Service industry has the lowest percentage of efficient CEOs (Table 4.6);
- The Financial industry contains the lowest input-orientated efficiency score of the sample and has the lowest average input-orientated efficiency score of 0.577. On average, CEOs within this industry are only 57.7% efficient and their remuneration packages have to be reduced by at least 42.3% (Table 4.6);

- The same number of CEOs per industry is efficient under the output-orientated approach compared to the input-orientated approach (Table 4.7);
- The maximum output-orientated efficiency score of 19.258 exists in the Consumer Services industry which means that the CEO of that company has to increase current company performance and size by more than 19 times in order to justify his/her current remuneration (Table 4.7);
- The Basic Materials and Oil & Gas industry has the highest average output-orientated efficiency score of 3.796, indicating that on average these CEOs have to increase company performance and size by almost 4 times in order to justify their current remuneration (Table 4.7);
- In total, CEOs from 80 of the 221 companies included in the sample emerged as the benchmark CEOs and formed the efficiency frontier against which inefficient CEOs were compared (Table 4.8);
- The lowest minimum reduction suggested by the DEA for Salary is 0.3% which means that all of the inefficient CEOs are overpaid to some extent in terms of their base salary (Table 4.9);
- The DEA suggests minimum reductions of 0% for Perquisites and Pension, Annual Bonus plans and Gains on Shares which means that the current amounts paid in terms of these remuneration components to some inefficient CEOs are acceptable (Table 4.9);
- The DEA suggests a 100% reduction in Gains on Shares earned by inefficient CEOs (with the exception of two cases within the Consumer Goods industry), meaning that the target amount of Gains on Shares for all inefficient companies is zero (Table 4.9);
- The DEA suggests that ROE has to be increased with as little as 0.5% to a maximum of 135.4% and Total Assets by a minimum of 1.9% to a maximum of 2450.8% in order to justify the current remuneration of inefficient CEOs (Table 4.9).

The conclusions that can be drawn from these results are that some CEOs are remunerated at an acceptable level because they efficiently turn their

remuneration into a number of company performance indicators while other CEOs are inefficient because their current remuneration levels are not justified by the company's current performance and size. However, contrary to the public's perception, the empirical results showed that a certain minimum or maximum level of remuneration or company performance and size does not necessarily indicate whether a CEO is either efficient or inefficient or alternatively, over- or underpaid. For example, one CEO might be earning more than another CEO but if he/she is efficiently converting his/her remuneration into company performance and his/her remuneration level is justified by the company's size, one cannot automatically conclude that the higher paid CEO is the overpaid one.

The results obtained also support public belief that long term incentive schemes, such as share options, enable CEOs to earn excessive remuneration despite poor company performance. The DEA indicated that Gains on Shares earned were acceptable for efficient CEOs but not for inefficient CEOs. In the most efficient industry, Consumer Goods, the DEA suggested a reduction of 82.3% and 88.1% in Gains on Shares for two of the inefficient CEOs (these two CEOs were also the only inefficient CEOs that received Gains on Shares) (Appendix 1). For the rest of the industries, the DEA suggested a 100% reduction in Gains on Shares for inefficient CEOs, proving that the poor company performance that lead to these CEOs being classified as inefficient, does not justify the amounts they earned through Gains on Shares.

Considerable increases are required in ROE and Total Assets in order to improve the efficiency score of inefficient CEOs and this means that most of the inefficient CEOs are earning the same as CEOs in much bigger and better performing companies, while their company's current size and performance does not permit him/her being remunerated at such a high level. If the remuneration package of an overpaid CEO is restructured and reduced, the savings can be utilised in other areas of business to not only improve the CEO's efficiency score, but also the performance or size of the company.

Instead of identifying a single factor that serves as a convincing measure to determine CEO remuneration, this study combined multiple variables in the DEA model to establish a benchmark for remuneration and it suggested how overpaid CEOs' remuneration packages should be structured to conform to acceptable levels of remuneration as set by the benchmark CEOs. Therefore, the main objective of this study has been reached since the empirical results prove that the DEA can be successfully applied as a benchmarking model for CEO remuneration that incorporates multiple inputs and outputs and establishes benchmarks and potential improvements for overpaid, inefficient CEOs.

5.4 CONTRIBUTION OF STUDY

Despite its potential limitations, this is the first study that used the DEA to analyse CEO remuneration of companies listed on the JSE. Instead of only using Total CEO Remuneration in the analysis, this study disaggregated total remuneration into Base Pay, Perquisites and Pension, Annual Bonus Plans and Long-term Incentives to provide more accurate benchmark information. Contrary to other South African studies on CEO remuneration, this study combined the determinants and components of CEO remuneration in a single model to establish benchmarks and then suggested improvements to the remuneration package structure for overpaid, underperforming CEOs.

In Chapter 1 (p. 8), Godsell's idea to set up a South African High Pay Commission was mentioned. This commission can use the DEA as part of their research to set benchmarks for remuneration that will in turn help to monitor high pay. Furthermore, remuneration committees can use this information to simplify the structuring of remuneration packages and to establish reasonable pay ratios to decrease the pay gap between the highest paid executive and the rest of the employees.

5.5 LIMITATIONS AND FUTURE RESEARCH SUGGESTIONS

It is important to bear in mind the potential limitations of the study when interpreting the results. The specific limitations of the DEA were discussed in Chapter 3 and these limitations will also have an effect on the results of this study.

The first limitation of this study is that numerical data from a secondary source was used and the researcher had limited control over data collection errors. The DEA assumes data to be free of measurement error so the validity and reliability of the results of this study depends on the integrity of the secondary source.

The second limitation is that a number of companies had to be excluded from the initial sample because the software of Zhu (2004) cannot analyse companies with negative financial data and the McGregor B.F.A (2012) database did not provide CEO remuneration data for all the companies. This links with the limitation of the DEA that units indicated as efficient are only efficient in relation to others inside the sample. Therefore, CEOs of companies that emerged as benchmarks in this study are only benchmarks in terms of the other JSE listed companies' CEOs included in the sample.

Although the different industries have been analysed separately to account for variation across industries, a third limitation is that there might still be considerable differences between CEOs of companies within the same industry that are not reflected in the DEA results. Further investigation is required, by analysing similar companies with other statistical models, to uncover the specific causes of inefficiencies.

A fourth limitation is that the DEA will not discriminate well if the ratio of units to the product of inputs and outputs is low because most units would simply appear as efficient and lie on the frontier. Table A1.8 in Appendix 1 shows

the ratio for each industry group analysed and according to this table, the ratio of units to the product of inputs and outputs is quite low for Consumer Goods and Health Care, Technology and Telecommunications when compared to the other industries. It is possible that the DEA results are impaired for these industries because these two groups have the lowest number of companies compared to the other industry groups.

Despite these limitations, this study provides an alternative way to analyse CEO remuneration and the multi-dimensionality of the DEA allows for many different research scenarios. Firstly, future studies can experiment by using different sets of inputs and outputs by including different remuneration or determinant variables with different measures for these variables. Secondly, the effect of time lags on remuneration can be investigated by using time series data in the DEA. Thirdly, the DEA can also be extended to analyse the remuneration of employees other than the CEO and finally, the DEA can be used with other statistical models to perform a more comprehensive analysis of CEO remuneration.

5.6 FINAL CONCLUSION

In Chapter 1 Mark Bussin, chairman of 21st Century Pay Solutions, was quoted asking 'a tricky question': *"How do you judge if someone is overpaid?"*. Chapter 1 further explained that Gerald Seegers, South African partner of PriceWaterhouse-Coopers, is of the opinion that new executive reward models are required that can be tailored to specific businesses that are both relevant and simple in terms of design and number of elements.

The DEA has been identified as an alternative statistical model that can be used to analyse CEO remuneration with. The results of the DEA are tailored to each unit when a particular sample is analysed. The DEA is designed to combine multiple inputs and outputs in a single model to determine efficiency benchmarks. It can determine both the input- and output-orientated efficiency

and indicates target inputs for a given level of outputs or target outputs for a given level of inputs. This function enables the analyst to calculate by how much inputs and outputs has to be reduced or increased respectively for a unit to become efficient. The DEA also calculates further improvements for the inputs and outputs in the form of slacks which represent excess inputs or insufficient outputs even if a unit is 100% efficient. In terms of CEO remuneration, the DEA can combine all of these functions to determine if a certain CEO's remuneration is justifiable in comparison with the benchmark CEOs within the sector.

The main and secondary objectives of this study have been reached and the final conclusion that can be drawn is that the DEA is a good alternative model to analyse CEO remuneration with. It can be used as the executive reward model that Seegers is looking for and its ability to establish benchmarks and demonstrate to what extent CEOs are overpaid, provides an answer to Bussin's 'tricky question'.

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APPENDIX 1

LIST OF APPENDIX TABLES

Table A1.1: Basic Materials and Oil & Gas Results

Basic Materials, Oil & Gas	Input-Orientated Efficiency	Reduction required					Output-Orientated Efficiency	Increase required	
		Salary	Perquisites and Pension	Annual Bonus Plans	Gains on Shares			ROE	Total Assets
ANGLO AMERICAN PLC	1.000						1.000		
AQUARIUS PLATINUM	1.000						1.000		
BHP BILLITON PLC	1.000						1.000		
DELTA EMD	1.000						1.000		
INFRASORS HOLDINGS	1.000						1.000		
INSIMBI REFRACTORY & ALLOY SUP	1.000						1.000		
JCI	1.000						1.000		
PALABORA MINING COMPANY	1.000						1.000		
PAN AFRICAN RESOURCES PLC	1.000						1.000		
RANDGOLD & EXPLORATION COMPANY	1.000						1.000		
ROLFES HOLDINGS	1.000						1.000		
SPANJAARD	1.000						1.000		
WESIZWE PLATINUM	1.000						1.000		
YORK TIMBER HOLDINGS	1.000						1.000		
HWANGE COLLIERY COMPANY	0.997	-0.3%	-22.0%	0.0%	0%	HWANGE COLLIERY COMPANY	1.019	2.1%	1.9%
METMAR	0.874	-12.6%	-12.6%	-12.6%	0%	METMAR	1.149	5.0%	14.9%
ARCELORMITTAL SOUTH AFRICA	0.813	-18.7%	-18.7%	-18.7%	0%	ARCELORMITTAL SOUTH AFRICA	1.303	1.8%	30.3%
WESCOAL HOLDINGS	0.736	-26.4%	-26.4%	-26.4%	0%	SASOL	1.445	7.5%	44.5%
KEATON ENERGY HOLDINGS	0.727	-27.3%	-32.4%	0%	0%	KUMBA IRON ORE	1.472	47.0%	47.2%
ROYAL BAFOKENG PLATINUM	0.719	-28.1%	-28.1%	-61.8%	0%	DRDGOLD	2.112	14.9%	111.2%
KUMBA IRON ORE	0.707	-29.3%	-29.3%	-29.3%	0%	ANGLO AMERICAN PLAT	2.272	24.2%	127.2%
SASOL	0.704	-29.6%	-29.6%	-81.2%	0%	ROYAL BAFOKENG PLATINUM	2.321	38.2%	132.1%
NORTHAM PLATINUM	0.693	-30.7%	-30.7%	-30.7%	-100%	EXXARO RESOURCES	2.369	40.9%	136.9%
TRANS HEX GROUP	0.684	-31.6%	-42.8%	-86.4%	0%	IMPALA PLATINUM HOLDINGS	2.644	17.7%	164.4%
OPTIMUM COAL HOLDINGS	0.643	-35.7%	-35.7%	-84.7%	0%	NORTHAM PLATINUM	3.047	14.9%	204.7%
OMNIA HOLDINGS	0.622	-37.8%	-37.8%	-80.6%	-100%	GOLD FIELDS	3.245	16.0%	224.5%
AFRICAN OXYGEN	0.585	-41.5%	-41.5%	-86.8%	0%	OPTIMUM COAL HOLDINGS	3.790	15.9%	279.0%
DRDGOLD	0.544	-45.6%	0%	-45.6%	0%	ANGLOGOLD ASHANTI	3.856	19.5%	285.6%
ANGLO AMERICAN PLAT	0.542	-45.8%	-45.8%	-45.8%	0%	Mondi	4.787	30.7%	378.7%
MERAFE RESOURCES	0.532	-46.8%	-51.4%	-84.5%	0%	Mondi plc	4.787	30.7%	378.7%
A E C I	0.524	-47.6%	-58.4%	-72.8%	0%	AFRICAN RAINBOW MINERALS	5.161	42.4%	416.1%
SENTULA MINING	0.505	-49.5%	-57.3%	-49.5%	0%	KEATON ENERGY HOLDINGS	5.307	5.6%	430.7%
IMPALA PLATINUM HOLDINGS	0.486	-51.4%	-51.4%	-51.4%	-100%	A E C I	6.085	71.1%	508.5%
GOLD FIELDS	0.434	-56.6%	-58.9%	-78.8%	-100%	LONMIN PLC	6.711	26.1%	571.1%
EXXARO RESOURCES	0.430	-57.0%	-57.0%	-62.3%	-100%	OMNIA HOLDINGS	7.060	17.2%	606.0%
ASSORE	0.409	-59.1%	-70.2%	-92.4%	0%	SENTULA MINING	7.435	55.8%	643.5%
AFRICAN RAINBOW MINERALS	0.384	-61.6%	-61.6%	-82.9%	0%	AFRICAN OXYGEN	7.489	22.6%	648.9%
LONMIN PLC	0.321	-67.9%	-86.8%	-87.3%	-100%	ASSORE	8.200	135.4%	720.0%
Mondi	0.309	-69.1%	-69.1%	-69.1%	0%	HULAMIN	9.297	21.5%	829.7%
Mondi plc	0.309	-69.1%	-69.1%	-69.1%	0%	MERAFE RESOURCES	11.612	114.9%	1061.2%
HULAMIN	0.301	-69.9%	-69.9%	-76.2%	-100%	WESCOAL HOLDINGS	13.948	51.4%	1294.8%
ANGLOGOLD ASHANTI	0.259	-74.1%	-74.1%	-86.8%	0%	TRANS HEX GROUP	15.494	95.8%	1449.4%

Table A1.2: Consumer Goods Results

Consumer Goods	Input-Orientated Efficiency	Reduction required					Output-Orientated Efficiency	Increase required	
		Salary	Perquisites and Pension	Annual Bonus Plans	Gains on Shares			ROE	Total Assets
AMALGAMATED APPLIANCE HOLDINGS	1.000						1.000		
ASTRAL FOODS	1.000						1.000		
BRITISH AMERICAN TOBACCO PLC	1.000						1.000		
COMPAGNIE FINANCIERE RICHEMONT SA	1.000						1.000		
COUNTRY BIRD HOLDINGS	1.000						1.000		
CROOKES BROTHERS	1.000						1.000		
DISTELL GROUP	1.000						1.000		
ILLOVO SUGAR	1.000						1.000		
METAIR INVESTMENTS	1.000						1.000		
SABMILLER PLC	1.000						1.000		
STEINHOFF INTERNATIONAL HOLDINGS	1.000						1.000		
TIGER BRANDS	1.000						1.000		
TONGAAT HULETT	1.000						1.000		
NU-WORLD HOLDINGS	0.976	-2.4%	-39.3%	0%	0%	OCEANA GROUP	1.044	1.1%	178.3%
OCEANA GROUP	0.920	-8.0%	-8.0%	-8.0%	0%	NU-WORLD HOLDINGS	1.121	1.3%	110.5%
AFGRI	0.802	-19.8%	-32.7%	-19.8%	0%	AFGRI	1.353	6.7%	35.3%
PIONEER FOOD GROUP	0.795	-20.5%	-20.5%	-20.5%	-82.3%	PIONEER FOOD GROUP	1.660	8.5%	66.0%
RAINBOW CHICKEN	0.673	-32.7%	-32.7%	-32.7%	0%	RAINBOW CHICKEN	1.701	9.4%	70.1%
AVI	0.670	-33.0%	-33.0%	-33.0%	-88.1%	AVI	2.002	16.1%	100.2%
SOVEREIGN FOOD INVESTMENTS	0.628	-37.2%	-37.2%	-37.2%	0%	SOVEREIGN FOOD INVESTMENTS	5.629	12.3%	462.9%

Table A1.3: Consumer Services Results

Consumer Services	Input-Orientated Efficiency	Reduction required					Output-Orientated Efficiency	Increase required	
		Salary	Perquisites and Pension	Annual Bonus Plans	Gains on Shares			ROE	Total Assets
CASHBUILD	1.000						1.000		
CITY LODGE HOTELS	1.000						1.000		
CULLINAN HOLDINGS	1.000						1.000		
KAGISO MEDIA	1.000						1.000		
NASPERS	1.000						1.000		
NICTUS BEPERK	1.000						1.000		
PICK N PAY STORES	1.000						1.000		
TASTE HOLDINGS	1.000						1.000		
ITALTILE	0.981	-1.9%	-1.9%	-21.2%	0%	ITALTILE	1.070	1.4%	7.0%
VERIMARK HOLDINGS	0.941	-5.9%	-90.8%	-5.9%	0%	VERIMARK HOLDINGS	1.095	2.3%	662.6%
CAXTON CTP PUBLISHERS & PRINTERS	0.917	-8.3%	-8.3%	-66.7%	0%	CLICKS GROUP	1.135	6.7%	13.5%
THE SPAR GROUP	0.913	-8.7%	-42.5%	-28.2%	-100%	THE SPAR GROUP	1.205	8.6%	20.5%
LEWIS GROUP	0.827	-17.3%	-48.4%	-32.3%	-100%	SHOPRITE HOLDINGS	1.226	8.7%	22.6%
COMAIR	0.813	-18.7%	-31.8%	-84.1%	0%	SUN INTERNATIONAL	1.227	10.3%	22.7%
PHUMELELA GAMING & LEISURE	0.794	-20.6%	-83.8%	0%	0%	MASSMART HOLDINGS	1.289	9.0%	28.9%
1TIME HOLDINGS	0.764	-23.6%	-23.6%	-80.3%	0%	PHUMELELA GAMING & LEISURE	1.369	6.3%	226.8%
AFRICAN AND OVERSEAS ENTERPRISES	0.762	-23.8%	-23.8%	-94.6%	0%	LEWIS GROUP	1.480	8.7%	48.0%
REX TRUEFORM CLOTHING COMPANY	0.762	-23.8%	-23.8%	-94.6%	0%	WOOLWORTHS HOLDINGS	1.487	18.0%	48.7%
ADVTECH	0.735	-26.5%	-63.0%	-30.4%	0%	TRUWORTHS INTERNATIONAL	1.624	22.9%	62.4%
MASSMART HOLDINGS	0.734	-26.6%	-26.6%	-71.1%	0%	ADVTECH	1.670	14.7%	104.4%
CLICKS GROUP	0.732	-52.6%	-26.8%	-55.3%	-100%	MR PRICE GROUP	1.875	28.5%	87.5%
SUN INTERNATIONAL	0.681	-31.9%	-31.9%	-31.9%	-100%	FAMOUS BRANDS	1.989	32.4%	98.9%
SPUR CORPORATION	0.652	-34.8%	-65.4%	-34.8%	-100%	CAXTON CTP PUBLISHERS & PRINTERS	2.033	8.6%	103.3%
FAMOUS BRANDS	0.595	-40.5%	-63.0%	-57.8%	0%	THE FOSCHINI GROUP	2.270	26.3%	127.0%
TSOGO SUN HOLDINGS	0.559	-44.1%	-60.5%	-84.4%	-100%	COMAIR	2.385	17.3%	138.5%
MR PRICE GROUP	0.556	-44.4%	-68.8%	-82.5%	0%	REX TRUEFORM CLOTHING COMPANY	2.573	20.4%	176.1%
AVUSA	0.538	-46.2%	-59.4%	-93.0%	0%	AFRICAN AND OVERSEAS ENTERPRISES	2.766	21.3%	176.6%
WOOLWORTHS HOLDINGS	0.505	-49.5%	-49.5%	-84.8%	0%	JD GROUP	3.204	22.0%	220.4%
THE FOSCHINI GROUP	0.489	-51.1%	-70.1%	-51.1%	0%	SPUR CORPORATION	3.310	22.6%	524.3%
COMBINED MOTOR HOLDINGS	0.475	-52.5%	-60.0%	-78.4%	0%	COMBINED MOTOR HOLDINGS	4.333	36.2%	333.3%
TRUWORTHS INTERNATIONAL	0.445	-55.5%	-71.6%	-88.2%	0%	TSOGO SUN HOLDINGS	4.605	36.8%	360.5%
JD GROUP	0.436	-56.4%	-56.4%	-78.9%	0%	AVUSA	4.913	42.2%	391.3%
SHOPRITE HOLDINGS	0.389	-86.4%	-85.8%	-61.1%	-100%	1TIME HOLDINGS	19.258	16.2%	1825.8%

Table A1.4: Financial Results

Financial	Input-Orientated Efficiency	Reduction required					Output-Orientated Efficiency	Increase required	
		Salary	Perquisites and Pension	Annual Bonus Plans	Gains on Shares			ROE	Total Assets
ABSA GROUP	1.000						1.000		
ACUCAP PROPERTIES	1.000						1.000		
CLIENTELE	1.000						1.000		
CORONATION FUND MANAGERS	1.000						1.000		
FAIRVEST PROPERTY HOLDINGS	1.000						1.000		
FORTRESS INCOME FUND	1.000						1.000		
NEW EUROPE PROPERTY INVESTMENTS PLC	1.000						1.000		
PSG GROUP	1.000						1.000		
PUTPROP	1.000						1.000		
REDEFINE PROPERTIES	1.000						1.000		
RESILIENT PROPERTY INCOME FUND	1.000						1.000		
RMB HOLDINGS	1.000						1.000		
STANDARD BANK GROUP	1.000						1.000		
ORION REAL ESTATE	0.759	-24.1%	-82.4%	-24.1%	0%	ORION REAL ESTATE	1.058	1.0%	85.9%
FIRSTRAND	0.737	-26.3%	-26.3%	-26.3%	0%	SANTAM	1.094	3.2%	9.4%
INGENUITY PROPERTY INVESTMENTS	0.720	-28.0%	0%	-28.0%	0%	FIRSTRAND	1.230	4.1%	23.0%
INVESTEC	0.715	-30.1%	-28.5%	-88.2%	0%	INVESTEC	1.373	5.1%	37.3%
INVESTEC PLC	0.715	-30.1%	-28.5%	-88.2%	0%	INVESTEC PLC	1.373	5.1%	37.3%
EMIRA PROPERTY FUND	0.684	-31.6%	-91.7%	-94.0%	0%	HOSKEN CONSOLIDATED INVESTMENTS	1.396	5.2%	39.6%
SANTAM	0.618	-48.5%	0%	-38.2%	0%	M CUBED HOLDINGS	1.618	3.9%	1800.5%
M CUBED HOLDINGS	0.589	-41.1%	0%	0%	0%	NEDBANK GROUP	1.732	7.8%	73.2%
NEDBANK GROUP	0.583	-41.7%	-41.7%	-84.8%	-100%	ZEDER INVESTMENTS	1.760	4.1%	76.0%
EFFICIENT GROUP	0.549	-45.1%	-95.1%	0%	0%	PEREGRINE HOLDINGS	1.784	14.0%	78.4%
ZEDER INVESTMENTS	0.534	-46.6%	-96.8%	0%	0%	CAPITEC BANK HOLDINGS	1.786	22.1%	78.6%
VUKILE PROPERTY FUND	0.474	-52.6%	0%	-52.6%	0%	SANLAM	1.854	14.8%	85.4%
BRIMSTONE INVESTMENT CORPORATION	0.469	-53.1%	-92.6%	-53.1%	-100%	LIBERTY HOLDINGS	1.858	17.9%	85.8%
HOSKEN CONSOLIDATED INVESTMENTS	0.462	-53.8%	0%	-53.8%	-100%	BRIMSTONE INVESTMENT CORPORATION	1.926	24.3%	92.6%
SEKUNJALO INVESTMENTS	0.443	-55.7%	0%	-100.0%	0%	CAPITAL SHOPPING CENTRES GROUP PLC	2.071	24.4%	107.1%
ZURICH INSURANCE COMPANY S A	0.419	-58.1%	0%	-58.1%	0%	VUKILE PROPERTY FUND	2.238	21.1%	123.8%
SABVEST	0.412	-58.8%	-87.2%	-94.5%	0%	JSE	2.378	29.1%	137.8%
SANLAM	0.394	-60.6%	-71.9%	-60.6%	0%	DISCOVERY HOLDINGS	2.460	29.9%	146.0%
HYPROP INVESTMENTS	0.387	-61.3%	-77.7%	-79.4%	0%	INGENUITY PROPERTY INVESTMENTS	2.717	11.3%	462.1%
LIBERTY HOLDINGS	0.379	-62.1%	-62.1%	-62.1%	0%	EMIRA PROPERTY FUND	2.739	16.2%	173.9%
GRAND PARADE INVESTMENTS	0.375	-62.5%	0%	-62.5%	0%	MVELAPHANDA GROUP	2.742	31.9%	174.2%
PEREGRINE HOLDINGS	0.353	-64.7%	0%	-64.7%	0%	SABVEST	2.839	30.4%	1535.4%
CADIZ HOLDINGS	0.315	-68.5%	-92.5%	-98.1%	0%	EFFICIENT GROUP	2.862	10.9%	2450.8%
SASFIN HOLDINGS	0.286	-71.4%	-95.2%	-97.1%	0%	AFRICAN BANK INVESTMENTS	3.057	31.6%	205.7%
JSE	0.271	-72.9%	-96.4%	-72.9%	-100%	GRAND PARADE INVESTMENTS	3.345	13.9%	234.5%
CONDUIT CAPITAL	0.268	-73.2%	0%	-97.8%	0%	ZURICH INSURANCE COMPANY S A	3.369	18.2%	236.9%
MERCANTILE BANK HOLDINGS	0.264	-73.6%	-94.8%	-90.4%	0%	CADIZ HOLDINGS	3.568	36.3%	256.8%
AFRICAN BANK INVESTMENTS	0.236	-76.4%	-87.8%	-76.4%	0%	BRAIT SE	3.780	37.3%	278.0%
DISCOVERY HOLDINGS	0.230	-77.0%	-88.7%	-89.6%	0%	SASFIN HOLDINGS	3.832	37.2%	283.2%

Table A1.4: Financial Results Continued…

Financial Continued…	Input-Orientated Efficiency	Reduction required					Output-Orientated Efficiency	Increase required	
		Salary	Perquisites and Pension	Annual Bonus Plans	Gains on Shares			ROE	Total Assets
CAPITAL SHOPPING CENTRES GROUP PLC	0.199	-80.1%	-95.9%	-80.1%	0%	GROWTHPOINT PROPERTIES	6.028	37.3%	502.8%
MVELAPHANDA GROUP	0.187	-81.3%	-95.0%	-81.3%	-100%	MERCANTILE BANK HOLDINGS	7.442	42.6%	644.2%
BRAIT SE	0.160	-84.0%	-94.5%	-99.2%	0%	CONDUIT CAPITAL	8.570	33.9%	757.0%
CAPITEC BANK HOLDINGS	0.140	-86.0%	-93.0%	-86.0%	0%	SEKUNJALO INVESTMENTS	14.414	26.3%	1341.4%
CAPITAL & COUNTIES PROPERTIES PLC	0.134	-86.6%	-98.4%	-93.0%	0%	CAPITAL & COUNTIES PROPERTIES PLC	15.066	40.8%	1406.6%

Table A1.5: Health Care, Technology, Telecommunications Results

Health Care, Technology, Telecommunications	Input-Orientated Efficiency	Reduction required					Output-Orientated Efficiency	Increase required	
		Salary	Perquisites and Pension	Annual Bonus Plans	Gains on Shares			ROE	Total Assets
ADAPTIT HOLDINGS	1.000						1.000		
BLUE LABEL TELECOMS	1.000						1.000		
COMPU-CLEARING OUTSOURCING	1.000						1.000		
EOH HOLDINGS	1.000						1.000		
GIJIMA GROUP	1.000						1.000		
MEDICLINIC INTERNATIONAL	1.000						1.000		
MTN GROUP	1.000						1.000		
MUSTEK	1.000						1.000		
NETCARE	1.000						1.000		
SECUREDATA HOLDINGS	1.000						1.000		
TELKOM SA	1.000						1.000		
VODACOM GROUP	1.000						1.000		
CONVERGENET HOLDINGS	0.625	-37.48%	-77.01%	-70.49%	0%	PINNACLE TECHNOLOGY HOLDINGS	1.409	10.6%	338.4%
ASPEN PHARMACARE HOLDINGS	0.574	-42.65%	-42.65%	-42.65%	0%	DATACENTRIX HOLDINGS	1.670	14.1%	717.8%
PINNACLE TECHNOLOGY HOLDINGS	0.419	-58.11%	-58.11%	-90.38%	-100%	ASPEN PHARMACARE HOLDINGS	1.693	13.4%	69.3%
ADCOCK INGRAM HOLDINGS	0.364	-63.65%	-63.65%	-63.65%	0%	ADCOCK INGRAM HOLDINGS	1.943	20.4%	94.3%
DATACENTRIX HOLDINGS	0.320	-68.04%	-68.04%	-91.09%	0%	ALLIED TECHNOLOGIES	2.096	26.9%	158.7%
BUSINESS CONNEXION GROUP	0.306	-69.43%	-69.43%	-69.43%	0%	CIPLA MEDPRO SOUTH AFRICA	3.093	23.0%	209.3%
ALLIED TECHNOLOGIES	0.273	-72.69%	-72.69%	-72.69%	-100%	DATATEC	3.166	57.2%	216.6%
CIPLA MEDPRO SOUTH AFRICA	0.236	-76.42%	-76.42%	-76.42%	0%	BUSINESS CONNEXION GROUP	4.437	28.3%	343.7%
DATATEC	0.222	-77.76%	-77.76%	-77.76%	0%	CONVERGENET HOLDINGS	6.141	28.8%	837.0%

Table A1.6: Industrials Results

Industrials	Input-Orientated Efficiency	Reduction required					Output-Orientated Efficiency	Increase required	
		Salary	Perquisites and Pension	Annual Bonus Plans	Gains on Shares			ROE	Total Assets
AMALGAMATED ELECTRONICS CORP	1.000						1.000		
ARB HOLDINGS	1.000						1.000		
BOWLER METCALF	1.000						1.000		
CARGO CARRIERS	1.000						1.000		
ESORFRANKI	1.000						1.000		
EXCELLERATE HOLDINGS	1.000						1.000		
GROUP FIVE	1.000						1.000		
HOWDEN AFRICA HOLDINGS	1.000						1.000		
ILIAD AFRICA	1.000						1.000		
IMPERIAL HOLDINGS	1.000						1.000		
KAP INTERNATIONAL HOLDINGS	1.000						1.000		
KAYDAV GROUP	1.000						1.000		
METROFILE HOLDINGS	1.000						1.000		
MURRAY & ROBERTS HOLDINGS	1.000						1.000		
PRETORIA PORTLAND CEMENT COMPANY	1.000						1.000		
REMGRO	1.000						1.000		
SANTOVA LOGISTICS	1.000						1.000		
THE BIDVEST GROUP	1.000						1.000		
TRENCOR	1.000						1.000		
WILSON BAYLY HOLMES-OVCON	1.000						1.000		
JASCO ELECTRONICS HOLDINGS	0.993	-0.7%	-62.7%	0%	0%	PROTECH KHUTHELE HOLDINGS	1.058	1.4%	5.8%
MICROMEGA HOLDINGS	0.971	-2.9%	-66.8%	0%	0%	JASCO ELECTRONICS HOLDINGS	1.068	0.5%	6.8%
INVICTA HOLDINGS	0.952	-4.8%	-4.8%	-12.7%	0%	INVICTA HOLDINGS	1.080	1.8%	8.0%
ARGENT INDUSTRIAL	0.947	-5.3%	-17.9%	-5.3%	0%	RAUBEX GROUP	1.133	3.5%	13.3%
RAUBEX GROUP	0.907	-9.3%	-9.3%	-9.3%	0%	ELB GROUP	1.255	4.4%	25.5%
ELB GROUP	0.884	-11.6%	-63.3%	-11.6%	0%	CERAMIC INDUSTRIES	1.385	5.5%	38.5%
MASONITE (AFRICA)	0.878	-12.2%	-54.0%	-12.2%	0%	ARGENT INDUSTRIAL	1.394	7.8%	39.4%
CERAMIC INDUSTRIES	0.837	-16.3%	-50.7%	-16.3%	0%	AVENG	1.451	6.9%	45.1%
PROTECH KHUTHELE HOLDINGS	0.819	-18.1%	-18.1%	-82.1%	0%	STEFANUTTI STOCKS HOLDINGS	1.558	12.8%	55.8%
ELLIES HOLDINGS	0.789	-21.1%	-21.1%	-21.1%	0%	AFRIMAT	1.586	7.6%	58.6%
AFRIMAT	0.774	-22.6%	-22.9%	-22.6%	0%	REUNERT	1.591	12.0%	59.1%
MAZOR GROUP	0.728	-27.2%	-27.2%	-27.2%	0%	TRANSPACO	1.605	15.1%	60.5%
CALGRO M3 HOLDINGS	0.727	-27.3%	-58.2%	0%	0%	GRINDROD	1.606	8.1%	60.6%
GRINDROD	0.712	-28.8%	-96.3%	-28.8%	-100%	NAMPAK	1.665	10.3%	66.5%
MIX TELEMATICS	0.643	-35.7%	0%	-53.8%	0%	ELLIES HOLDINGS	1.671	9.2%	67.1%
WINHOLD	0.627	-37.3%	-37.3%	-37.3%	0%	VALUE GROUP	1.692	13.0%	69.2%
TRANSPACO	0.619	-38.1%	-38.1%	-38.1%	0%	MIX TELEMATICS	1.751	7.6%	75.1%
KELLY GROUP	0.594	-40.6%	-68.7%	0%	0%	KELLY GROUP	1.777	8.5%	77.7%
SUPER GROUP	0.573	-42.7%	-42.7%	-42.7%	0%	MAZOR GROUP	1.791	11.4%	79.1%
AVENG	0.567	-43.3%	-43.3%	-68.5%	0%	CALGRO M3 HOLDINGS	1.891	9.0%	89.1%
CONSOLIDATED INFRASTRUCTURE GRP	0.529	-47.1%	-66.0%	-47.1%	0%	DISTRIB. AND WAREHOUSING NETWORK	2.021	9.3%	102.1%
AUSTRO GROUP	0.520	-48.0%	-48.0%	-48.0%	0%	MICROMEGA HOLDINGS	2.070	3.4%	107.0%
SANYATI HOLDINGS	0.518	-48.2%	-48.2%	-51.0%	0%	ALLIED ELECTRONICS CORPORATION	2.138	13.0%	113.8%

Table A1.6: Industrials Results Continued...

Industrials Continued…	Input-Orientated Efficiency	Reduction required					Output-Orientated Efficiency	Increase required	
		Salary	Perquisites and Pension	Annual Bonus Plans	Gains on Shares			ROE	Total Assets
HUDACO INDUSTRIES	0.514	-48.6%	-48.6%	-48.6%	-100%	ASTRAPAK	2.179	15.4%	117.9%
STEFANUTTI STOCKS HOLDINGS	0.512	-48.8%	-48.8%	-48.8%	0%	BASIL READ HOLDINGS	2.283	19.6%	128.3%
REUNERT	0.504	-49.6%	-49.6%	-66.1%	0%	DIGICORE HOLDINGS	2.390	13.2%	139.0%
ASTRAPAK	0.487	-51.3%	-51.3%	-51.3%	0%	SUPER GROUP	2.490	13.6%	149.0%
ADCORP HOLDINGS	0.485	-51.5%	-81.5%	-51.5%	0%	WINHOLD	2.757	17.5%	175.7%
CONTROL INSTRUMENTS GROUP	0.463	-53.7%	-53.7%	-53.7%	0%	HUDACO INDUSTRIES	2.827	33.3%	182.7%
DIGICORE HOLDINGS	0.462	-53.8%	-59.7%	-53.8%	0%	CONSOLIDATED INFRASTRUCTURE GRP	3.021	18.5%	202.1%
VALUE GROUP	0.462	-53.8%	-53.8%	-53.8%	0%	ADCORP HOLDINGS	3.052	23.6%	205.2%
BELL EQUIPMENT	0.455	-54.5%	-54.5%	-54.5%	0%	SANYATI HOLDINGS	3.181	15.1%	218.1%
NAMPAK	0.452	-54.8%	-54.8%	-54.8%	0%	MASONITE (AFRICA)	4.696	8.2%	369.6%
ALLIED ELECTRONICS CORPORATION	0.450	-55.0%	-55.0%	-55.0%	-100%	AUSTRO GROUP	4.707	15.7%	370.7%
SOUTH OCEAN HOLDINGS	0.433	-56.7%	-56.7%	-56.7%	0%	SOUTH OCEAN HOLDINGS	4.751	26.7%	375.1%
BASIL READ HOLDINGS	0.357	-64.3%	-64.3%	-64.4%	0%	BELL EQUIPMENT	7.183	15.3%	618.3%
DISTRIB. AND WAREHOUSING NETWORK	0.356	-64.4%	-64.4%	0%	0%	CONTROL INSTRUMENTS GROUP	11.736	8.1%	1073.6%

Table A1.7: Monetary Company Data (PPI and Currency adjusted)

Company	Return On Equity	Total Assets (Incl. Intangible Assets) (R'000)	Salary (R)	Perquisites and Pension (R)	Annual Bonus Plans (R)	Gains On Shares (R)
Basic Materials						
A E C I	13.98%	10,314,000	2,806,000	802,000	2,708,000	-
AFRICAN OXYGEN	3.49%	5,286,000	2,497,000	335,000	4,619,000	-
AFRICAN RAINBOW MINERALS	10.20%	27,687,851	4,768,120	1,266,072	6,676,545	-
ANGLO AMERICAN PLAT	19.02%	83,801,000	5,958,000	1,666,000	2,487,000	-
ANGLO AMERICAN PLC	17.83%	439,263,040	11,565,000	3,855,000	4,225,080	-
ANGLOGOLD ASHANTI	2.43%	62,629,000	11,447,000	2,089,000	8,888,000	-
AQUARIUS PLATINUM	3.32%	10,320,102	6,824,198	1,055,057	-	-
ARCELORMITTAL SOUTH AFRICA	5.96%	31,718,000	3,212,000	541,000	379,000	-
ASSORE	18.81%	12,111,534	3,726,626	1,164,080	11,143,592	-
BHP BILLITON PLC	25.88%	664,850,440	15,257,170	6,105,861	17,943,449	-
DELTA EMD	26.59%	606,222	3,301,000	285,000	-	-
DRDGOLD	13.41%	2,530,469	3,863,923	-	2,211,458	-
EXXARO RESOURCES	29.87%	28,609,000	5,233,000	555,000	3,156,000	4,457,000
GOLD FIELDS	5.44%	71,814,300	6,338,000	2,140,000	10,729,000	300,000
HULAMIN	1.57%	7,357,772	5,184,000	552,000	2,994,000	4,879,000
HWANGE COLLIERY COMPANY	10.71%	1,125,506	1,667,270	342,680	-	-
IMPALA PLATINUM HOLDINGS	10.77%	61,362,820	5,472,256	1,398,465	4,103,211	2,995,030
INFRASORS HOLDINGS	7.59%	612,990	3,097,775	-	-	-
INSIMBI REFRACTORY & ALLOY SUP	14.59%	261,799	1,325,835	190,296	110,226	-
JCI	89.49%	1,711,758	2,954,082	224,925	803,303	-
KEATON ENERGY HOLDINGS	1.31%	490,697	2,085,478	381,439	-	-
KUMBA IRON ORE	99.64%	27,875,000	3,953,000	447,000	2,095,000	-
LONMIN PLC	4.58%	33,943,875	6,087,039	4,150,254	10,060,215	343,088
MERAFE RESOURCES	10.82%	3,817,608	2,493,000	572,000	3,419,000	-
METMAR	33.28%	1,131,405	3,215,280	124,784	273,486	-
Mondi	8.11%	57,333,190	7,982,320	2,392,930	5,739,500	-
Mondi plc	8.11%	57,333,190	7,982,320	2,392,930	5,739,500	-
NORTHAM PLATINUM	7.26%	9,894,493	2,308,547	303,034	766,900	6,432,353
OMNIA HOLDINGS	2.84%	5,376,429	2,261,686	392,841	2,938,534	9,421,966
OPTIMUM COAL HOLDINGS	3.44%	11,223,900	2,488,000	368,000	5,092,000	-
PALABORA MINING COMPANY	26.83%	7,579,000	2,351,000	-	3,537,000	-
PAN AFRICAN RESOURCES PLC	19.43%	1,029,462	1,555,366	-	649,002	-
RANDGOLD & EXPLORATION COMPANY	430.18%	569,073	2,410,000	-	5,600,000	-
ROLFES HOLDINGS	17.00%	238,514	1,458,288	253,999	-	-
ROYAL BAFOKENG PLATINUM	28.93%	18,450,700	2,477,000	423,000	3,046,000	-
SENTULA MINING	8.67%	5,235,763	2,685,623	679,957	980,548	-
SPANJAARD	6.85%	64,069	1,236,406	247,489	381,633	-
TRANS HEX GROUP	6.61%	1,045,188	1,837,750	447,777	2,995,542	-

Company	Return On Equity	Total Assets (Incl. Intangible Assets) (R'000)	Salary (R)	Perquisites and Pension (R)	Annual Bonus Plans (R)	Gains On Shares (R)
WESCOAL HOLDINGS	3.97%	257,246	1,796,289	247,728	540,027	-
WESIZWE PLATINUM	14.19%	2,572,291	6,132,000	-	274,000	-
YORK TIMBER HOLDINGS	3.28%	3,203,969	2,140,849	298,130	-	-
Consumer Goods						
AFGRI	19.02%	8,313,930	2,638,059	658,044	4,425,859	-
AMALGAMATED APPLIANCE HOLDINGS	8.27%	609,301	1,183,694	255,960	4,327,790	-
ASTRAL FOODS	25.11%	3,144,591	2,539,156	677,510	521,703	-
AVI	16.04%	5,509,817	3,692,302	394,238	2,933,247	4,301,311
BRITISH AMERICAN TOBACCO PLC	31.27%	286,400,800	13,096,720	1,542,000	27,879,360	36,720,160
COMPAGNIE FINANCIERE RICHEMONT SA	10.60%	79,471,720	44,100,687	771,171	-	-
COUNTRY BIRD HOLDINGS	12.38%	1,291,033	3,279,431	145,142	-	-
CROOKES BROTHERS	6.04%	550,153	1,604,533	487,164	166,880	-
DISTELL GROUP	17.98%	8,042,678	2,546,855	812,993	-	2,323,257
ILLOVO SUGAR	12.03%	10,029,366	3,109,560	380,403	609,474	-
METAIR INVESTMENTS	21.25%	2,088,196	2,524,000	203,000	1,812,000	-
NU-WORLD HOLDINGS	11.06%	856,772	3,360,629	239,081	-	-
OCEANA GROUP	24.29%	1,852,829	2,710,042	675,500	1,079,594	-
PIONEER FOOD GROUP	4.98%	8,923,463	4,149,500	586,036	372,932	3,166,406
RAINBOW CHICKEN	13.36%	4,330,590	4,051,235	381,489	1,866,255	-
SABMILLER PLC	9.59%	284,943,790	13,209,254	5,179,873	18,227,617	-
SOVEREIGN FOOD INVESTMENTS	2.65%	1,157,999	2,726,541	753,906	392,031	-
STEINHOFF INTERNATIONAL HOLDINGS	14.76%	56,076,895	11,957,566	1,543,608	-	-
TIGER BRANDS	26.36%	13,051,524	2,697,979	545,828	3,267,932	-
TONGAAT HULETT	50.17%	13,856,198	5,313,201	569,049	3,990,602	5,319,420
Consumer Services						
1TIME HOLDINGS	0.75%	649,055	1,907,000	240,000	695,000	-
ADVTECH	21.95%	984,600	2,113,000	638,000	550,000	-
AFRICAN AND OVERSEAS ENTERPRISES	12.05%	284,689	2,123,196	120,625	846,336	-
AVUSA	10.79%	3,020,419	2,769,581	495,456	3,886,950	-
CASHBUILD	23.48%	1,825,322	2,039,837	212,810	-	-
CAXTON CTP PUBLISHERS & PRINTERS	7.20%	6,057,944	1,812,317	169,660	1,176,829	-
CITY LODGE HOTELS	66.10%	1,205,872	2,373,272	514,863	1,961,382	-
CLICKS GROUP	49.57%	3,962,321	4,765,230	401,039	4,014,246	20,084,725
COMAIR	12.48%	1,983,519	1,800,549	292,246	1,372,967	-
COMBINED MOTOR HOLDINGS	10.87%	2,085,114	3,091,536	499,138	1,039,871	-
CULLINAN HOLDINGS	20.04%	391,992	1,731,974	32,167	-	-
FAMOUS BRANDS	32.79%	1,113,524	2,952,193	823,578	1,836,412	-
ITALTILE	19.20%	2,026,108	1,639,715	147,104	543,303	-
JD GROUP	9.97%	9,101,794	4,113,999	299,111	2,504,685	-
KAGISO MEDIA	32.29%	1,110,561	2,031,992	-	1,404,350	-
LEWIS GROUP	18.07%	5,035,414	1,924,817	428,083	699,651	1,410,704
MASSMART HOLDINGS	31.09%	14,013,487	2,960,706	302,053	5,732,139	-

Company	Return On Equity	Total Assets (Incl. Intangible Assets) (R'000)	Salary (R)	Perquisites and Pension (R)	Annual Bonus Plans (R)	Gains On Shares (R)
MR PRICE GROUP	32.53%	3,742,090	3,280,585	991,950	5,229,243	-
NASPERS	9.68%	59,566,724	2,922,986	290,226	3,249,490	-
NICTUS BEPERK	10.17%	838,151	2,740,559	-	-	19,694
PHUMELELA GAMING & LEISURE	17.15%	558,477	2,225,211	329,087	-	-
PICK N PAY STORES	56.92%	11,645,304	3,440,932	895,329	310,921	-
REX TRUEFORM CLOTHING COMPANY	12.96%	284,728	2,123,196	120,625	846,336	-
SHOPRITE HOLDINGS	38.38%	17,644,296	24,860,518	5,784,116	1,743,669	583,020,833
SPUR CORPORATION	9.79%	520,477	2,201,651	558,013	212,810	4,292,485
SUN INTERNATIONAL	45.21%	10,595,386	3,995,335	824,761	1,204,289	4,040,447
TASTE HOLDINGS	15.93%	196,230	1,419,423	196,536	124,784	-
THE FOSCHINI GROUP	20.69%	9,574,230	3,672,390	873,786	1,554,780	-
THE SPAR GROUP	41.87%	7,568,113	2,299,917	654,391	2,033,536	351,823
TRUWORTHS INTERNATIONAL	36.70%	5,304,558	4,368,979	1,194,482	9,709,822	-
TSOGO SUN HOLDINGS	10.21%	4,587,942	2,739,522	515,150	2,278,271	536,917
VERIMARK HOLDINGS	23.93%	142,977	1,884,246	907,807	192,376	-
WOOLWORTHS HOLDINGS	37.01%	8,836,026	4,053,196	687,464	8,994,898	-
Financial						
ABSA GROUP	14.46%	716,470,000	2,561,000	613,000	10,504,000	-
ACUCAP PROPERTIES	4.22%	7,647,606	1,824,275	-	-	-
AFRICAN BANK INVESTMENTS	15.38%	39,406,177	3,036,734	379,969	402,083	-
BRAIT SE	13.43%	2,290,709	3,645,440	356,563	3,601,907	-
BRIMSTONE INVESTMENT CORPORATION	26.20%	3,619,830	1,835,000	204,000	1,663,000	6,136,000
CADIZ HOLDINGS	14.13%	2,463,266	1,859,517	277,787	1,697,820	-
CAPITAL & COUNTIES PROPERTIES PLC	2.90%	17,197,412	4,615,720	1,130,800	3,567,160	-
CAPITAL SHOPPING CENTRES GROUP PLC	22.82%	60,931,616	4,883,000	1,480,320	2,631,680	-
CAPITEC BANK HOLDINGS	28.14%	9,866,525	6,758,120	299,483	2,246,121	-
CLIENTELE	51.83%	1,965,765	1,627,947	36,286	8,696,768	-
CONDUIT CAPITAL	4.48%	691,805	2,179,685	-	302,707	-
CORONATION FUND MANAGERS	35.30%	25,736,432	990,130	-	8,786,526	-
DISCOVERY HOLDINGS	20.48%	20,588,628	3,107,810	253,018	21,524,207	-
EFFICIENT GROUP	5.83%	86,720	1,042,123	158,102	-	-
EMIRA PROPERTY FUND	9.31%	7,949,602	871,834	226,540	1,882,927	-
FAIRVEST PROPERTY HOLDINGS	0.00%	141,974	567,820	-	-	-
FIRSTRAND	17.82%	828,919,309	4,608,267	801,225	8,177,983	-
FORTRESS INCOME FUND	50.35%	2,984,093	1,560,279	-	407,967	-
GRAND PARADE INVESTMENTS	5.92%	2,234,484	1,628,928	-	337,358	-
GROWTHPOINT PROPERTIES	7.42%	36,963,227	3,108,791	703,155	3,800,178	-
HOSKEN CONSOLIDATED INVESTMENTS	13.02%	19,559,569	4,515,081	-	3,386,310	1,891,649
HYPROP INVESTMENTS	11.16%	11,457,385	1,571,000	109,000	800,000	-
INGENUITY PROPERTY INVESTMENTS	6.60%	590,129	867,632	-	192,807	-
INVESTEC	13.65%	537,274,745	4,268,492	461,459	25,957,049	-
INVESTEC PLC	13.65%	537,274,745	4,268,492	461,459	25,957,049	-

Company	Return On Equity	Total Assets (Incl. Intangible Assets) (R'000)	Salary (R)	Perquisites and Pension (R)	Annual Bonus Plans (R)	Gains On Shares (R)
JSE	21.10%	17,166,393	2,729,000	779,000	5,564,000	5,339,000
LIBERTY HOLDINGS	20.84%	237,841,000	3,995,000	468,000	4,853,000	-
M CUBED HOLDINGS	6.33%	308,487	1,484,935	-	-	-
MERCANTILE BANK HOLDINGS	6.61%	6,254,311	2,232,000	267,000	925,000	-
MVELAPHANDA GROUP	18.32%	7,213,039	3,504,990	486,423	2,549,797	3,708,974
NEDBANK GROUP	10.65%	608,718,000	4,790,000	669,000	7,000,000	8,383,000
NEW EUROPE PROPERTY INVESTMENTS PLC	4.46%	3,180,363	582,780	-	-	-
ORION REAL ESTATE	17.75%	647,599	829,665	117,683	29,421	-
PEREGRINE HOLDINGS	17.86%	11,795,145	2,969,629	-	4,664,339	-
PSG GROUP	13.27%	15,271,877	1,936,239	143,502	-	3,421,175
PUTPROP	16.08%	246,343	580,569	21,575	-	-
REDEFINE PROPERTIES	7.86%	33,714,382	1,579,091	-	3,615,135	-
RESILIENT PROPERTY INCOME FUND	19.05%	9,945,734	2,858,000	-	-	-
RMB HOLDINGS	15.79%	30,800,368	2,586,082	-	4,494,507	1,704,441
SABVEST	16.54%	495,486	1,432,000	164,000	3,844,000	-
SANLAM	17.38%	361,191,000	4,519,000	1,013,000	7,500,000	-
SANTAM	34.37%	17,735,000	2,741,000	-	5,770,000	-
SASFIN HOLDINGS	13.12%	3,482,946	2,052,586	420,716	1,635,793	-
SEKUNJALO INVESTMENTS	1.96%	701,469	1,295,664	-	1,083,576	-
STANDARD BANK GROUP	12.62%	1,336,308,000	5,428,000	851,000	246,000	-
VUKILE PROPERTY FUND	17.05%	5,831,014	1,779,705	-	2,089,624	-
ZEDER INVESTMENTS	5.42%	2,396,727	1,087,705	88,389	-	-
ZURICH INSURANCE COMPANY S A	7.67%	5,531,924	1,521,000	-	2,008,000	-
Health Care						
ADCOCK INGRAM HOLDINGS	21.63%	4,782,123	2,934,203	533,766	2,760,302	-
ASPEN PHARMACARE HOLDINGS	19.27%	19,418,566	4,341,519	527,612	4,868,150	-
CIPLA MEDPRO SOUTH AFRICA	10.99%	2,533,156	9,350,000	93,000	3,441,000	-
MEDICLINIC INTERNATIONAL	20.87%	39,765,048	4,571,053	831,289	2,125,902	-
NETCARE	29.90%	44,603,104	5,487,432	481,495	3,769,531	1,013,250
Industrials						
ADCORP HOLDINGS	11.49%	1,738,452	2,137,974	827,737	2,657,909	-
AFRIMAT	12.92%	876,908	1,621,158	188,217	359,795	-
ALLIED ELECTRONICS CORPORATION	11.44%	13,026,460	5,090,167	897,408	1,954,957	5,147,360
AMALGAMATED ELECTRONICS CORP	19.36%	174,484	1,604,533	-	124,382	-
ARB HOLDINGS	13.44%	746,197	1,270,976	131,413	203,984	-
ARGENT INDUSTRIAL	0.93%	2,043,603	1,373,389	371,074	286,079	-
ASTRAPAK	13.10%	2,096,354	2,798,292	111,266	1,666,913	-
AUSTRO GROUP	4.24%	622,346	2,663,631	164,850	144,605	-
AVENG	15.33%	23,676,040	6,214,639	928,714	8,759,533	-
BASIL READ HOLDINGS	15.26%	4,377,471	3,121,000	460,000	9,173,000	-
BELL EQUIPMENT	1.82%	2,645,280	2,638,000	437,000	2,150,000	-
BOWLER METCALF	19.65%	417,184	1,700,518	222,617	-	-

Company	Return On Equity	Total Assets (Incl. Intangible Assets) (R'000)	Salary (R)	Perquisites and Pension (R)	Annual Bonus Plans (R)	Gains On Shares (R)
CALGRO M3 HOLDINGS	10.08%	413,397	2,132,775	226,692	-	-
CARGO CARRIERS	7.61%	562,441	1,203,130	289,084	99,828	-
CERAMIC INDUSTRIES	14.38%	1,570,924	1,463,470	359,092	1,073,405	-
CONSOLIDATED INFRASTRUCTURE GRP	9.17%	1,408,330	2,393,701	782,797	433,816	-
CONTROL INSTRUMENTS GROUP	0.76%	554,767	2,920,000	103,000	374,000	-
DIGICORE HOLDINGS	9.53%	645,727	2,898,923	648,237	147,104	-
DISTRIB. AND WAREHOUSING NETWORK	9.12%	2,450,292	4,788,714	900,274	-	-
ELB GROUP	17.21%	936,742	1,508,303	532,515	770,823	-
ELLIES HOLDINGS	13.72%	790,573	1,720,661	80,672	512,624	-
ESORFRANKI	24.46%	1,713,524	1,822,893	-	997,236	87,349
EXCELLERATE HOLDINGS	10.13%	466,346	789,456	121,606	1,705,422	-
GRINDROD	13.32%	14,251,662	3,339,000	14,734,000	1,266,000	224,000
GROUP FIVE	10.75%	9,758,262	2,916,575	-	8,362,353	-
HOWDEN AFRICA HOLDINGS	40.18%	674,816	2,280,000	209,000	884,000	-
HUDACO INDUSTRIES	18.23%	4,057,177	2,644,852	325,844	2,447,340	5,384,951
ILIAD AFRICA	5.09%	2,187,460	2,650,000	-	-	-
IMPERIAL HOLDINGS	16.35%	33,562,190	4,612,190	2,375,234	5,575,229	-
INVICTA HOLDINGS	22.24%	6,153,937	1,451,128	208,340	5,182,599	-
JASCO ELECTRONICS HOLDINGS	7.59%	559,972	1,530,859	222,617	-	-
KAP INTERNATIONAL HOLDINGS	6.59%	2,461,731	1,625,005	346,184	-	-
KAYDAV GROUP	5.69%	203,405	1,372,000	-	153,000	-
KELLY GROUP	10.95%	628,455	2,655,760	439,276	-	-
MASONITE (AFRICA)	0.85%	495,450	1,250,000	536,000	579,000	-
MAZOR GROUP	14.41%	279,917	1,920,641	70,711	367,074	-
METROFILE HOLDINGS	21.98%	535,915	1,472,998	251,057	762,978	-
MICROMEGA HOLDINGS	2.00%	504,864	1,519,000	120,000	-	-
MIX TELEMATICS	10.17%	1,086,711	2,462,771	-	1,973,534	-
MURRAY & ROBERTS HOLDINGS	17.48%	21,528,424	2,844,004	614,893	1,493,592	-
NAMPAK	15.46%	12,992,418	4,584,755	305,583	5,578,906	-
PRETORIA PORTLAND CEMENT COMPANY	129.60%	6,143,833	2,853,786	965,000	1,047,427	104,542
PROTECH KHUTHELE HOLDINGS	24.36%	756,316	2,173,330	66,552	2,427,058	-
RAUBEX GROUP	26.25%	3,978,972	1,992,392	153,901	2,142,134	-
REMGRO	7.07%	47,130,051	7,906,331	2,087,891	-	-
REUNERT	20.25%	7,994,221	2,842,729	381,979	13,133,047	-
SANTOVA LOGISTICS	4.73%	250,361	1,455,819	-	-	-
SANYATI HOLDINGS	6.91%	1,559,969	2,599,677	47,834	1,195,851	-
SOUTH OCEAN HOLDINGS	7.12%	969,641	2,870,000	420,000	657,000	-
STEFANUTTI STOCKS HOLDINGS	22.88%	5,228,244	2,828,448	493,939	6,906,821	-
SUPER GROUP	5.63%	7,436,474	2,523,318	489,365	3,811,946	-
THE BIDVEST GROUP	19.91%	42,507,975	7,893,582	514,863	9,741,204	-
TRANSPACO	25.04%	423,636	2,611,580	360,894	1,274,898	-
TRENCOR	16.02%	13,364,000	2,190,000	27,000	1,672,000	-

Company	Return On Equity	Total Assets (Incl. Intangible Assets) (R'000)	Salary (R)	Perquisites and Pension (R)	Annual Bonus Plans (R)	Gains On Shares (R)
VALUE GROUP	18.84%	1,106,656	3,188,244	132,064	1,766,740	-
WILSON BAYLY HOLMES-OVCON	31.71%	9,177,398	1,272,937	391,296	9,005,686	-
WINHOLD	9.94%	706,365	1,798,318	267,385	956,958	-
Oil & Gas						
SASOL	16.83%	153,462,459	7,123,740	1,912,348	11,134,766	-
Technology						
ADAPTIT HOLDINGS	23.02%	122,332	716,885	78,455	254,980	-
BUSINESS CONNEXION GROUP	8.24%	2,368,725	3,526,444	212,088	2,896,928	-
COMPU-CLEARING OUTSOURCING	17.34%	48,677	926,753	390,315	58,841	-
CONVERGENET HOLDINGS	5.61%	701,340	1,193,477	516,723	936,079	-
DATACENTRIX HOLDINGS	20.99%	613,788	2,336,589	320,280	3,423,254	-
DATATEC	3.74%	15,269,232	9,119,583	1,364,726	11,150,617	-
EOH HOLDINGS	23.38%	1,098,694	1,671,570	-	4,597,543	-
Telecommunications						
GIJIMA GROUP	32.17%	1,583,352	3,281,392	-	-	-
MUSTEK	9.43%	1,727,706	1,699,538	379,527	-	-
PINNACLE TECHNOLOGY HOLDINGS	25.97%	1,230,602	2,696,900	321,667	2,643,943	67,668
SECUREDATA HOLDINGS	9.47%	410,047	1,387,974	-	1,402,492	-
BLUE LABEL TELECOMS	14.07%	4,535,247	5,760,433	-	85,642	-
MTN GROUP	19.90%	154,786,000	8,955,000	1,209,000	20,206,000	21,441,000
TELKOM SA	123.41%	58,894,023	3,685,865	4,171,992	2,410,945	-
VODACOM GROUP	30.54%	43,213,550	4,422,830	-	11,406,901	-

Table A1.8: Ratio of Units to Product of Inputs and Outputs

Industry	No. of Companies	Product of Inputs and Outputs (4 Inputs x 2 Outputs)	Ratio
Basic Materials, Oil & Gas	42	8	5.25
Consumer Goods	20	8	2.50
Consumer Services	33	8	4.13
Financial	48	8	6.00
Health Care, Technology, Telecommunications	21	8	2.63
Industrials	57	8	7.13

Table A1.9: Basic Materials, Oil & Gas Excluding Gains on Shares

	Input-Orientated Efficiency		Output-Orientated Efficiency	
Basic Materials, Oil & Gas	Including Gains on Shares	Excluding Gains on Shares	Including Gains on Shares	Excluding Gains on Shares
ANGLO AMERICAN PLC	1.000	1.000	1.000	1.000
AQUARIUS PLATINUM	1.000	1.000	1.000	1.000
BHP BILLITON PLC	1.000	1.000	1.000	1.000
DELTA EMD	1.000	1.000	1.000	1.000
INFRASORS HOLDINGS	1.000	1.000	1.000	1.000
INSIMBI REFRACTORY & ALLOY SUP	1.000	1.000	1.000	1.000
JCI	1.000	1.000	1.000	1.000
PALABORA MINING COMPANY	1.000	1.000	1.000	1.000
PAN AFRICAN RESOURCES PLC	1.000	1.000	1.000	1.000
RANDGOLD & EXPLORATION COMPANY	1.000	1.000	1.000	1.000
ROLFES HOLDINGS	1.000	1.000	1.000	1.000
SPANJAARD	1.000	1.000	1.000	1.000
WESIZWE PLATINUM	1.000	1.000	1.000	1.000
YORK TIMBER HOLDINGS	1.000	1.000	1.000	1.000
HWANGE COLLIERY COMPANY	0.997	0.997	1.019	1.019
METMAR	0.874	0.874	1.149	1.149
ARCELORMITTAL SOUTH AFRICA	0.813	0.813	1.303	1.303
WESCOAL HOLDINGS	0.736	0.736	13.948	13.948
KEATON ENERGY HOLDINGS	0.727	0.727	5.307	5.307
ROYAL BAFOKENG PLATINUM	0.719	0.719	2.321	2.321
KUMBA IRON ORE	0.707	0.707	1.472	1.472
SASOL	0.704	0.704	1.445	1.445
NORTHAM PLATINUM	0.693	0.693	3.047	3.047
TRANS HEX GROUP	0.684	0.684	15.494	15.494
OPTIMUM COAL HOLDINGS	0.643	0.643	3.790	3.790
OMNIA HOLDINGS	0.622	0.622	7.060	7.060
AFRICAN OXYGEN	0.585	0.585	7.489	7.489
DRDGOLD	0.544	0.544	2.112	2.112
ANGLO AMERICAN PLAT	0.542	0.542	2.272	2.272
MERAFE RESOURCES	0.532	0.532	11.612	11.612
A E C I	0.524	0.524	6.085	6.085
SENTULA MINING	0.505	0.505	7.435	7.435
IMPALA PLATINUM HOLDINGS	0.486	0.486	2.644	2.644
GOLD FIELDS	0.434	0.434	3.245	3.245
EXXARO RESOURCES	0.430	0.430	2.369	2.369
ASSORE	0.409	0.409	8.200	8.200
AFRICAN RAINBOW MINERALS	0.384	0.384	5.161	5.161
LONMIN PLC	0.321	0.321	6.711	6.711
Mondi	0.309	0.309	4.787	4.787
Mondi plc	0.309	0.309	4.787	4.787
HULAMIN	0.301	0.301	9.297	9.297
ANGLOGOLD ASHANTI	0.259	0.259	3.856	3.856

Table A1.10: Consumer Goods Excluding Gains on Shares

Consumer Goods	Input-Orientated Efficiency		Output-Orientated Efficiency	
	Including Gains on Shares	Excluding Gains on Shares	Including Gains on Shares	Excluding Gains on Shares
AMALGAMATED APPLIANCE HOLDINGS	1.000	1.000	1.000	1.000
ASTRAL FOODS	1.000	1.000	1.000	1.000
BRITISH AMERICAN TOBACCO PLC	1.000	1.000	1.000	1.000
COMPAGNIE FINANCIERE RICHEMONT SA	1.000	1.000	1.000	1.000
COUNTRY BIRD HOLDINGS	1.000	1.000	1.000	1.000
CROOKES BROTHERS	1.000	1.000	1.000	1.000
DISTELL GROUP	1.000	1.000	1.000	1.000
ILLOVO SUGAR	1.000	1.000	1.000	1.000
METAIR INVESTMENTS	1.000	1.000	1.000	1.000
SABMILLER PLC	1.000	1.000	1.000	1.000
STEINHOFF INTERNATIONAL HOLDINGS	1.000	1.000	1.000	1.000
TIGER BRANDS	1.000	1.000	1.000	1.000
TONGAAT HULETT	1.000	1.000	1.000	1.000
NU-WORLD HOLDINGS	0.976	0.949	1.121	1.191
OCEANA GROUP	0.920	0.920	1.044	1.097
AFGRI	0.802	0.802	1.353	1.353
PIONEER FOOD GROUP	0.795	0.795	1.660	1.660
RAINBOW CHICKEN	0.673	0.658	1.701	2.121
AVI	0.670	0.670	2.002	2.002
SOVEREIGN FOOD INVESTMENTS	0.628	0.625	5.629	7.596

Table A1.11: Consumer Services Excluding Gains on Shares

Consumer Services	Input-Orientated Efficiency		Output-Orientated Efficiency	
	Including Gains on Shares	Excluding Gains on Shares	Including Gains on Shares	Excluding Gains on Shares
CASHBUILD	1.000	1.000	1.000	1.000
CITY LODGE HOTELS	1.000	1.000	1.000	1.000
CULLINAN HOLDINGS	1.000	1.000	1.000	1.000
KAGISO MEDIA	1.000	1.000	1.000	1.000
NASPERS	1.000	1.000	1.000	1.000
NICTUS BEPERK	1.000	1.000	1.000	1.000
PICK N PAY STORES	1.000	1.000	1.000	1.000
TASTE HOLDINGS	1.000	1.000	1.000	1.000
ITALTILE	0.981	0.981	1.070	1.070
VERIMARK HOLDINGS	0.941	0.941	1.095	1.095
CAXTON CTP PUBLISHERS & PRINTERS	0.917	0.917	2.033	2.033
THE SPAR GROUP	0.913	0.913	1.205	1.205
LEWIS GROUP	0.827	0.827	1.480	1.480
COMAIR	0.813	0.813	2.385	2.385
PHUMELELA GAMING & LEISURE	0.794	0.794	1.369	1.369
1TIME HOLDINGS	0.764	0.764	19.258	19.258
AFRICAN AND OVERSEAS ENTERPRISES	0.762	0.762	2.766	2.766
REX TRUEFORM CLOTHING COMPANY	0.762	0.762	2.573	2.573
ADVTECH	0.735	0.735	1.670	1.670
MASSMART HOLDINGS	0.734	0.734	1.289	1.289
CLICKS GROUP	0.732	0.732	1.135	1.135
SUN INTERNATIONAL	0.681	0.681	1.227	1.227
SPUR CORPORATION	0.652	0.652	3.310	3.310
FAMOUS BRANDS	0.595	0.595	1.989	1.989
TSOGO SUN HOLDINGS	0.559	0.559	4.605	4.605
MR PRICE GROUP	0.556	0.556	1.875	1.875
AVUSA	0.538	0.538	4.913	4.913
WOOLWORTHS HOLDINGS	0.505	0.505	1.487	1.487
THE FOSCHINI GROUP	0.489	0.489	2.270	2.270
COMBINED MOTOR HOLDINGS	0.475	0.475	4.333	4.333
TRUWORTHS INTERNATIONAL	0.445	0.445	1.624	1.624
JD GROUP	0.436	0.436	3.204	3.204
SHOPRITE HOLDINGS	0.389	0.389	1.226	1.226

Table A1.12: Financial Excluding Gains on Shares

Financial	Input-Orientated Efficiency		Output-Orientated Efficiency	
	Including Gains on Shares	Excluding Gains on Shares	Including Gains on Shares	Excluding Gains on Shares
ABSA GROUP	1.000	1.000	1.000	1.000
ACUCAP PROPERTIES	1.000	1.000	1.000	1.000
CLIENTELE	1.000	1.000	1.000	1.000
CORONATION FUND MANAGERS	1.000	1.000	1.000	1.000
FAIRVEST PROPERTY HOLDINGS	1.000	1.000	1.000	1.000
FORTRESS INCOME FUND	1.000	1.000	1.000	1.000
NEW EUROPE PROPERTY INVESTMENTS PLC	1.000	1.000	1.000	1.000
PSG GROUP	1.000	1.000	1.000	1.000
PUTPROP	1.000	1.000	1.000	1.000
REDEFINE PROPERTIES	1.000	1.000	1.000	1.000
RESILIENT PROPERTY INCOME FUND	1.000	1.000	1.000	1.000
RMB HOLDINGS	1.000	1.000	1.000	1.000
STANDARD BANK GROUP	1.000	1.000	1.000	1.000
ORION REAL ESTATE	0.759	0.759	1.058	1.058
FIRSTRAND	0.737	0.737	1.230	1.230
INGENUITY PROPERTY INVESTMENTS	0.720	0.720	2.717	2.717
INVESTEC	0.715	0.715	1.373	1.373
INVESTEC PLC	0.715	0.715	1.373	1.373
EMIRA PROPERTY FUND	0.684	0.684	2.739	2.739
SANTAM	0.618	0.609	1.094	1.095
M CUBED HOLDINGS	0.589	0.589	1.618	1.618
NEDBANK GROUP	0.583	0.583	1.732	1.732
EFFICIENT GROUP	0.549	0.549	2.862	2.862
ZEDER INVESTMENTS	0.534	0.534	1.760	2.566
VUKILE PROPERTY FUND	0.474	0.474	2.238	2.244
BRIMSTONE INVESTMENT CORPORATION	0.469	0.469	1.926	1.926
HOSKEN CONSOLIDATED INVESTMENTS	0.462	0.462	1.396	1.396
SEKUNJALO INVESTMENTS	0.443	0.443	14.414	14.414
ZURICH INSURANCE COMPANY S A	0.419	0.419	3.369	3.369
SABVEST	0.412	0.412	2.839	2.839
SANLAM	0.394	0.394	1.854	1.854
HYPROP INVESTMENTS	0.387	0.387	4.111	4.111
LIBERTY HOLDINGS	0.379	0.379	1.858	1.858
GRAND PARADE INVESTMENTS	0.375	0.375	3.345	3.345
PEREGRINE HOLDINGS	0.353	0.353	1.784	1.791
CADIZ HOLDINGS	0.315	0.315	3.568	3.568
SASFIN HOLDINGS	0.286	0.286	3.832	3.832
JSE	0.271	0.271	2.378	2.378
CONDUIT CAPITAL	0.268	0.268	8.570	8.570
MERCANTILE BANK HOLDINGS	0.264	0.264	7.442	7.442
AFRICAN BANK INVESTMENTS	0.236	0.236	3.057	3.057
DISCOVERY HOLDINGS	0.230	0.230	2.460	2.460
GROWTHPOINT PROPERTIES	0.217	0.217	6.028	6.028
CAPITAL SHOPPING CENTRES GROUP PLC	0.199	0.199	2.071	2.071
MVELAPHANDA GROUP	0.187	0.187	2.742	2.742
BRAIT SE	0.160	0.160	3.780	3.780
CAPITEC BANK HOLDINGS	0.140	0.140	1.786	1.786
CAPITAL & COUNTIES PROPERTIES PLC	0.134	0.134	15.066	15.066

Table A1.13: Health Care, Technology and Telecommunications Excluding Gains on Shares

Health Care, Technology, Telecommunications	Input-Orientated Efficiency		Output-Orientated Efficiency	
	Including Gains on Shares	Excluding Gains on Shares	Including Gains on Shares	Excluding Gains on Shares
ADAPTIT HOLDINGS	1.000	1.000	1.000	1.000
BLUE LABEL TELECOMS	1.000	1.000	1.000	1.000
COMPU-CLEARING OUTSOURCING	1.000	1.000	1.000	1.000
EOH HOLDINGS	1.000	1.000	1.000	1.000
GIJIMA GROUP	1.000	1.000	1.000	1.000
MEDICLINIC INTERNATIONAL	1.000	1.000	1.000	1.000
MTN GROUP	1.000	1.000	1.000	1.000
MUSTEK	1.000	1.000	1.000	1.000
NETCARE	1.000	1.000	1.000	1.000
SECUREDATA HOLDINGS	1.000	1.000	1.000	1.000
TELKOM SA	1.000	1.000	1.000	1.000
VODACOM GROUP	1.000	1.000	1.000	1.000
CONVERGENET HOLDINGS	0.625	0.625	6.141	6.141
ASPEN PHARMACARE HOLDINGS	0.574	0.480	1.693	1.893
PINNACLE TECHNOLOGY HOLDINGS	0.419	0.419	1.409	1.409
ADCOCK INGRAM HOLDINGS	0.364	0.328	1.943	1.943
DATACENTRIX HOLDINGS	0.320	0.318	1.670	1.670
BUSINESS CONNEXION GROUP	0.306	0.306	4.437	4.437
ALLIED TECHNOLOGIES	0.273	0.273	2.096	2.096
CIPLA MEDPRO SOUTH AFRICA	0.236	0.236	3.093	3.093
DATATEC	0.222	0.178	3.166	6.482

Table A1.14: Industrials Excluding Gains on Shares

Industrials	Input-Orientated Efficiency		Output-Orientated Efficiency	
	Including Gains on Shares	Excluding Gains on Shares	Including Gains on Shares	Excluding Gains on Shares
AMALGAMATED ELECTRONICS CORP	1.000	1.000	1.000	1.000
ARB HOLDINGS	1.000	1.000	1.000	1.000
BOWLER METCALF	1.000	1.000	1.000	1.000
CARGO CARRIERS	1.000	1.000	1.000	1.000
ESORFRANKI	1.000	1.000	1.000	1.000
EXCELLERATE HOLDINGS	1.000	1.000	1.000	1.000
GROUP FIVE	1.000	1.000	1.000	1.000
HOWDEN AFRICA HOLDINGS	1.000	0.823	1.000	1.157
ILIAD AFRICA	1.000	1.000	1.000	1.000
IMPERIAL HOLDINGS	1.000	1.000	1.000	1.000
KAP INTERNATIONAL HOLDINGS	1.000	1.000	1.000	1.000
KAYDAV GROUP	1.000	1.000	1.000	1.000
METROFILE HOLDINGS	1.000	0.865	1.000	1.546
MURRAY & ROBERTS HOLDINGS	1.000	1.000	1.000	1.000
PRETORIA PORTLAND CEMENT COMPANY	1.000	1.000	1.000	1.000
REMGRO	1.000	1.000	1.000	1.000
SANTOVA LOGISTICS	1.000	1.000	1.000	1.000
THE BIDVEST GROUP	1.000	1.000	1.000	1.000
TRENCOR	1.000	1.000	1.000	1.000
WILSON BAYLY HOLMES-OVCON	1.000	1.000	1.000	1.000
JASCO ELECTRONICS HOLDINGS	0.993	0.993	1.068	1.068
MICROMEGA HOLDINGS	0.971	0.971	2.070	2.070
INVICTA HOLDINGS	0.952	0.945	1.080	1.095
ARGENT INDUSTRIAL	0.947	0.947	1.394	1.394
RAUBEX GROUP	0.907	0.814	1.133	1.372
ELB GROUP	0.884	0.801	1.255	2.212
MASONITE (AFRICA)	0.878	0.878	4.696	4.696
CERAMIC INDUSTRIES	0.837	0.798	1.385	2.150
PROTECH KHUTHELE HOLDINGS	0.819	0.754	1.058	1.302
ELLIES HOLDINGS	0.789	0.789	1.671	2.026
AFRIMAT	0.774	0.774	1.586	2.264
MAZOR GROUP	0.728	0.728	1.791	1.975
CALGRO M3 HOLDINGS	0.727	0.727	1.891	1.891
GRINDROD	0.712	0.712	1.606	1.606
MIX TELEMATICS	0.643	0.634	1.751	2.277
WINHOLD	0.627	0.627	2.757	4.462
TRANSPACO	0.619	0.521	1.605	2.548
KELLY GROUP	0.594	0.594	1.777	1.777
SUPER GROUP	0.573	0.573	2.490	2.490
AVENG	0.567	0.567	1.451	1.515
CONSOLIDATED INFRASTRUCTURE GRP	0.529	0.528	3.021	5.122
AUSTRO GROUP	0.520	0.520	4.707	5.311
SANYATI HOLDINGS	0.518	0.518	3.181	3.708
HUDACO INDUSTRIES	0.514	0.514	2.827	2.827
STEFANUTTI STOCKS HOLDINGS	0.512	0.457	1.558	2.569
REUNERT	0.504	0.504	1.591	1.957
ASTRAPAK	0.487	0.487	2.179	2.556
ADCORP HOLDINGS	0.485	0.484	3.052	5.252
CONTROL INSTRUMENTS GROUP	0.463	0.463	11.736	11.749
DIGICORE HOLDINGS	0.462	0.462	2.390	3.651
VALUE GROUP	0.462	0.444	1.692	2.062
BELL EQUIPMENT	0.455	0.455	7.183	7.183
NAMPAK	0.452	0.452	1.665	1.841
ALLIED ELECTRONICS CORPORATION	0.450	0.450	2.138	2.138
SOUTH OCEAN HOLDINGS	0.433	0.433	4.751	7.231
BASIL READ HOLDINGS	0.357	0.357	2.283	3.497
DISTRIB. AND WAREHOUSING NETWORK	0.356	0.356	2.021	2.021