Sculpting global leaders

Determinants of Eskom’s Key Financial Ratios

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Supervised by Prof. Christopher Malikane

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DETERMINANTS OF ESKOM'S KEY FINANCIAL RATIOS

By

SENZESIHLE PHILANI NDLOVU

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A Dissertation submitted in partial fulfilment of the requirements for the Degree of Master of Management in Finance and Investment

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ABSTRACT

This research estimates an empirical model to determine the key drivers of Eskom's profitability measures. These measures are return on assets (ROA) and net profit margin (NPM). The explanatory variables used were the real GDP growth rate, relative coal price, relative electricity price, USDZAR exchange rate, SA government bond yield, and Eskom's default risk premium. The paper applies Ordinary Least Squares (OLS) estimation to time-series data collected from the period 2000 to 2018 using multivariate regression analysis. The study finds that the key drivers of Eskom's ROA are the growth rate of real GDP and the growth rate of relative coal prices. The growth rate of real GDP has a significant and positive impact on ROA. The second part of the investigation focused on the drivers of Eskom's NPM. Of the six independent variables tested, only one variable was found to be statistically significant, and that variable was real GDP growth. The growth rate of real GDP has a significant and positive impact on NPM.

Keywords: Eskom, OLS estimation, multivariate regression analysis, ROA, NPM, real GDP growth rate, Eskom default risk premium, relative coal prices, relative electricity prices, USDZAR exchange rate, SA government bond yield

DECLARATION

*I, **Mr Senzesihle Philani Ndlovu**, declare that this research was carried out by me under the supervision of **Professor Christopher Malikane** for the period 2019/20. This research is my unaided work unless where otherwise stated. I have correctly referenced and scrupulously cited the work of the respective authors used throughout this research. Where I have used quotes, I have properly indicated and/or cited the relevant author. This research report has not been previously accepted for any degree and is not being currently considered for any other degree from any University.*

Parktown, Johannesburg, April 2020.

Mr Senzesihle Philani Ndlovu

*I, **Professor Christopher Malikane**, confirm that I provided academic oversight as a Supervisor to **Mr Senzesihle Philani Ndlovu** during the completion of the degree of Master of Management in Finance and Investment for the period 2019/20. I declare that I have fully read the contents of the candidate's report and acquiesce the decision for it to be submitted to the University.*

Parktown, Johannesburg, April 2020.

Prof. Christopher Malikane

School of Economics and Finance, Wits University.

DEDICATIONS

To my late grandparents, Julia (1933 – 2011) and Job Manana (1914 – 2018), may you continue to rest in everlasting peace. I will never forget your tender and loving embrace.

To my lovely mother, Monica Sizakele Manana, thank you for taking care of my health and for bearing with me at my worst. I know this was not a comfortable journey for both of us – from the hospital visits to the emotional setbacks.

In the end, you guided me and taught me to persevere during this seemingly impossible and arduous journey. Thank you for raising me to be the man I am today. Thank you for never forsaking me. The bulk of this thesis is dedicated to you. I love you dearly.

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LIST OF ACRONYMS AND ABBREVIATIONS

COAL	Growth rate of the relative global coal price
CPI	Consumer Price Index
Eskom	Eskom SOC Ltd Holdings
GDP	Gross Domestic Product
GMTN	Global Medium-Term Note
GW	Gigawatt
kWh	Kilowatt-hour
MW	Megawatt
NERSA	National Energy Regulator of South Africa
NPM	Net Profit Margin
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
PREM	Eskom Default Risk Premium
R	South African 10-year Government Bond yield
ROA	Return on Assets
SA	South Africa
SARB	South African Reserve Bank
TRF	Growth rate of the relative electricity price
USDZAR	Rand to Dollar Exchange rate
US	United States of America
XR	USDZAR Exchange rate

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CHAPTER 1: INTRODUCTION

1.1 Background of the study

> *"Eskom's contribution to the health of our economy is too great for it to be allowed to fail. It is too important and too big to fail. And we will not allow it to fail. Restoring and securing energy security for the country is an absolute imperative."*
>
> - **President Cyril Ramaphosa, 2019**

Eskom Holdings SOC Ltd, widely known as Eskom and established initially as the Electricity Supply Commission (ESC) in 1923, is the leading electricity producer in Africa. According to Jaglin and Dubresson (2016), it is a vertically integrated state monopoly that is not listed on the stock market and is the sixth-largest African company spanning across all sectors. Eskom is responsible for a mammoth 95 percent of the electricity used throughout South Africa, and some 38 percent used in the rest of Africa. According to Eskom (2019a), the national power utility, to date, operates 30 power stations (including a nuclear power station) with a total generational capacity of 44 172 MW.

The composition is as follows; 36 479 MW account for coal-fired stations, 1 860 MW account for nuclear power, 600 MW account for hydro stations, 2 724 MW account for pumped storage, 2 409 MW account for gas-fired stations and 100 MW account for the sere wind farm. According to Eskom (n.d.), the firm currently operates sixteen coal-powered stations and has plans to build two more stations that will come on stream by 2021, namely Medupi and Kusile. The new plants feature in what is called the *New Build Infrastructure Program.*

The infrastructure program was introduced in 2005 when Eskom had reached the supply limit of its power generation facilities. In 2005, the firm had a generation capacity of 36 208 MW. With the implementation of the above program, the firm has reported increasing the generation capacity to 17 384 GW by 2019/20 (Eskom, 2018). Medupi consists of six 794 MW generation units, an implied gross capacity of 4 764 MW with a direct cost of 3.80 percent of South African Gross Domestic Product (GDP) (2014 terms). Kusile consists of six 800 MW generating units, which are an estimated gross capacity of 4 800 MW with a direct cost of 3.50 percent of South Africa's GDP (2015 terms).

At the helm of this capital budgeting decision are the several cost implications which continue to mar the productivity and quality of the firm. The plants are currently behind schedule and are extremely over their initial investment budget. Hitherto, the power utility has had to contend with several fundamental issues. The firm faces structural, operational, and organizational problems that have hindered the firm from operating efficiently. In 2019, Eskom reported having amassed a record loss in net profit to the amount of US$ 1.4 billion, a sizeable increase of approximately 833 percent from the 2018/19 financial year. This is, to date, the most-substantial loss recorded in corporate South Africa (Eskom, 2019a).

According to Eskom (2019a), the current debt-laden position of the firm has not improved and continues to be worsened each year. Other financial constraints are facing the firm, such as the runaway municipal debt. As a result of its stifled financial position, the firm does not pay dividends to the shareholder, which is the government. Over time, the firm has lost a significant amount of investor confidence in the financial markets, which has subsequently led to a lack of access to funding. In 2009, the powerhouse was obliged to perform a series of blackouts in what became infamously known as *load shedding.*

This was implemented to stabilize the grid line. This has, over time, led to a debilitated and sluggish economy. According to Eskom (2019a), the firm is in what is called a *utility death spiral*. Currently, Eskom does not generate enough revenue relative to its expenditures. As a result, there is a reduced demand for electricity due to the decision of Eskom to increase tariffs to cover the revenue shortfall. With the lack of cash injection from taxpayer money and stagnant revenue, it cannot continue to operate efficiently – subsequently impacting the economy negatively (Jaglin & Dubresson, 2016).

Presently, Eskom is currently inundated with debt and is financially incapacitated. The bulk of the issues of the power utility culminated in 2007, with the initiation of the new build infrastructure program. Medupi, for example, was forecasted to be operational by 2012 at an initial investment of 2.34 percent of GDP but delayed being functional to 2019. According to Jaglin and Dubresson (2016), the problems of Eskom were further exacerbated during their tariff application for the periods between the periods 2013/14 to 2017/18. The energy regulators, NERSA, only granted Eskom an impinging and meagre 9.4 percent over their desired 16.6 percent. The firm had reportedly applied for this to account for overruns and revenue shortfalls.

According to Eskom (2014), this resulted in a significant funding shortfall of US$ 19.48 billion. According to Eskom (2015), the firm lost around US$ 371 million in revenue from a drop in sales in the year 2015 alone. In addition to the existing problems of the firm, its credit rating has not been stable over the past few years. In 2014, Moody's infamously reduced the credit rating of the firm to non-investment grade or junk status. Following this, Standard & Poor's followed suit in 2015 following the exodus of senior executives from the firm (Eskom, 2019b). Medupi and Kusile are not the only frustrations the firm face. The *Ingula Pumped Storage Scheme* is another financial burden for the firm.

According to Eskom (2017), this new power station will consist of four units with a total generational capacity of 1 332 MW. It is located near Ladysmith, within Little Drakensburg. This will be the third pumped storage scheme from the firm. The only significant difference between Ingula and the other two mega plants is that the former plant does not rely on coal; it relies on hydroelectricity instead. In 2006, the cost of the project was 0.46 percent of GDP, with a projected completion date of 2012. In 2015, the completion date was projected to be 2017, with costs increasing to 0.60 percent of GDP.

1.2 Research problem

Over time, the financial position of Eskom has dramatically faltered rather than improved. There have been various attempts to improve the precarious position of the firm through financial largesse from institutions (including the government), both local and international, with no realized success. With no firm economic understanding of the root causes of the woes of Eskom, these attempts continue to be futile and costly. According to Ross, Westerfield, and Jordan (2015), the Return on Assets (ROA) and Net Profit Margin (NPM) measures are the most widely used measures of the efficiency of operational performance. They are indicators of the profitability of a firm. This is the key motivator for selecting these two ratios in analyzing the profitability of Eskom. Therefore, this research seeks to deduce the determinants of Eskom's key profitability ratios through statistical inference.

1.3 Purpose of the study

According to Nanda and Panda (2017), the long-term survival of an organization is determined by the maximization of the wealth of the shareholders, in the case of Eskom, the government. It is vital, therefore, to understand the core drivers of profitability for the firm, given the scale of the debt crisis. Any effort made to pump funds through mechanisms such as government-backed guarantees can ultimately lead to a substantial fiscal drain. The purpose of this quantitative study, therefore, is to develop an empirical model to determine the key drivers of Eskom's profitability measures.

1.4 Significance of the study

Eskom accounts for 95 percent of the electricity used throughout South Africa and, as such, is the primary source of energy for many households and businesses in South Africa (Jaglin & Dubresson, 2016). Electricity is one of the most demanded necessities globally. In South Africa alone, the total consumption of energy per capita was 18 273 kWh in 1965, which has, over time, increased considerably to 25 620 kWh in 2019, an implied increase of 40.21 percent (Ritchie, 2014). Jahed, Amra, Mnguni, and Mohammed (2017) note that between 1970 and 1994 Eskom embarked on a massive build programme adding 33 910 MW of new generation capacity to its fleet.

In the South African health care sector, where 80 percent of South Africans rely on public health, there exists socio-economic deficits brought about by poor governance and corruption nationwide. Power failure can thus become overbearing for clinics and hospitals where there is poor financing for generators. For example, if the power fails (i.e. if there is load shedding) in a delipidated clinic or hospital, healthcare staff may be required to intervene manually, thereby decreasing the availability of staff for other essential duties (Laher et al., 2019).

Another pivotal sector that relies on electricity supply is the trade sector (wholesale, retail, and motor trade). The ability of South African retailers to provide goods and services to South African consumers at affordable prices depends partly on Eskom's performance (including the cost of supply chain and logistic systems). If load shedding persists in the economy, it implies that such businesses are producing less and incur revenue shortfalls. This means that fixed and variable costs such as overhead costs; in particular, salaries and operating costs cannot be met leading to profit loss. This leads to economic contraction and may even lead to the slumping of the South African economy into recessionary periods (Goldberg, 2015).

According to Ateba, Prinsloo, and Gawlik (2019), industrial electricity supply and consumption is recognized as an instantaneous indicator of a bolstered economy. According to Ateba et al. (2019, p. 1324), *"South Africa's industrial decline and falling economic growth is directly associated with unstable electricity supply, as the industrial sector is the main economic contributor to South Africa's GDP".* Ateba et al. (2019) state that there exists a significant relationship between electricity supply and economic growth in South Africa. With electricity being the source of energy for production in South Africa, it serves as an important input for the competitiveness of the industrial sector.

There is a nexus between electricity supply and economic growth which is underpinned by profitability. The lack of electricity has a negative rippling effect throughout the economy, especially in sectors where the demand for electricity is high (Ateba et al., 2019). Therefore, understanding how a utility such as Eskom can be made profitable is pertinent to put to rout issues such as load shedding as this interrupts business activity. The electricity grid would require enough capacity to accommodate production to grow the economy. Individuals and businesses would need access to electricity at a reasonable cost. When productivity increases, load shedding occurs and restricts pivotal industries and thus leads to the plummeting of the South African economy financially (Goldberg, 2015).

Eskom has a developmental mandate to provide power to the entire country and is historically the largest provider of electricity in South Africa. With few alternatives for consumers, the lack of profitability of Eskom implies that they will not produce and supply electricity at affordable rates, subsequently implying higher tariffs for businesses in various sectors and individuals. This would result in less demand for the firm's energy and subsequent profit loss. The dwindling performance of Eskom presents an opportunity for the conduction of research in this area. This study will, therefore, be beneficial to policymakers, the energy sector, the government, key industry stakeholders, researchers, and Eskom.

1.5 Research Objectives

Hitherto, very few studies have evaluated the impact of the financial and economic determinants on the profitability of Eskom. In his 2019 Presidential Inaugural Address, President Cyril Ramaphosa committed to providing ten-year fiscal support to Eskom (Ramaphosa, 2019). However, the idea that financial aid can keep Eskom operational is inadequate and could lead to further financial difficulties for the state. Although Eskom is state-owned and has a developmental mandate, corporate profitability remains the goal of the organization as this determines whether it will remain financially afloat in the economy. The research objective, therefore, is to estimate the effects that each of the selected determinants from relevant literature have on the profitability of Eskom.

CHAPTER 2: LITERATURE REVIEW

The profitability of firms is a widely studied and researched area. However, studies which explore the determinants of the profitability of power utilities globally are scant. Therefore, the bulk of this research relies on literature from the banking sector. The theoretical nexus that exists between these studies and Eskom is that of the financial and economic determinants which drive profitability. Therefore, as a priori, a critique of the studies would not contribute to the understanding of the problem at hand. This section thus provides a summary of the studies and discusses the findings which will serve as a buttress for the study.

There is a plethora of literature that investigates the nexus between profitability and firm efficiency in various sectors. According to Karimzadeh, Akhtar, and Karimzadeh (2013), firms that operate more efficiently naturally attract more funds and, by that, generate more profit. This section explores various studies that employ methodologies and statistical techniques that are relevant to the study of Eskom's profitability. Karimzadeh et al. (2013) use panel regression to study the internal and external factors which impact a firm in India's banking sector.

A study was conducted within the bank sector in Togo using the Pool Mean Group estimator technique by Combey and Togbenou (2017). They observed that firms' profitability is impacted by inflation through fixed and variable costs such as overhead costs; in particular, salaries and operating costs. If inflation increases, then wages and operational costs increase, which in turn reduces the profitability of firms. The exchange rate affects firms with foreign-denominated transactions or operations. The depreciation of the exchange rate impairs a firm's profitability, as this leads to a decrease in its domestic purchasing power.

According to Combey and Togbenou (2017), the macroeconomic environment does not impact short-run profitability. In the long run, however, it is found that GDP and the exchange rate have an inverse relationship with ROA. Robin, Salim, and Bloch (2018) employ a panel data regression technique using data from the banking sector in Bangladesh. It is found that ROA has a significant inverse relationship with GDP, while inflation has a positive relationship. Sheefeni (2015) focuses on the macroeconomic determinants of bank profitability in Namibia using unit root, cointegration, and impulse response functions. According to Sheefeni (2015), a booming economy bolsters the performance of a firm and leads to a lower rate of default since the disposable income of households increases.

The study finds that the macroeconomic environment does not affect profitability. According to Egbunike and Okerekeoti (2018), the interest rate is the cost of capital and affects a firm's capital structure. Egbunike and Okerekeoti (2018) argue that high interests curb inflation but can also lead to a slow-going economy. The presence of lower interest rates stimulates investment spending, which stimulates economic growth and can subsequently lead to inflation. Interest rates are vital since they control the flow of money in the economy. The study is conducted in the manufacturing sector in Nigeria. It finds that there is no significant effect on the interest rate and the exchange rate but a significate effect on GDP and inflation.

Messai, Gallali, and Jouini (2015) use the GMM estimator to investigate the profitability of countries in Western Europe. The study observed that the GDP growth rate has a positive effect on the distribution of goods and services sold. According to Messai et al. (2015), the GDP growth rate has a positive relationship with firm profitability since it directly impacts the incomes of households and businesses. This, in turn, leads to economic stability and firm profitability. Messai et al. (2015) find that the effect of inflation is ambiguous and is dependent on whether a firm's costs are growing at a rate faster than inflation or not.

Dewi, Tan Lian Soei, and Surjoko (2019) conduct their study on the Indonesian Stock Exchange using multiple regression. According to Dewi et al. (2019), decreasing GDP growth impacts consumer purchasing power and can diminish the profitability of firms. They found that only GDP growth has a significant influence on profitability. The exchange rate and inflation rate are found to be insignificant. Nanda and Panda (2018) studied corporate profitability in the Indian Manufacturing sector using panel generalized least square and panel vector autoregression.

According to Nanda and Panda (2018), the exchange rate has a positive and negative impact on corporate profitability, depending on whether the firm is an exporter or importer. When the domestic currency depreciates, exports become cheaper and imports become costlier. Also, it is found that the exchange rate and interest rate are not significant. The macroeconomic factors positively and significantly affect profitability. Concerning ROA, the interest rate positively and substantially affects ROA. Tuncay and Cengiz (2017) study corporate profitability in the Industrial sector in Turkey using the Arellano-Bond generalized methodology of moments.

Tuncay and Cengiz (2017) posit that the increase in GDP in each period will lead to a rise in the profitability of a corporation due to product expansion. They observe that enterprises with an external input will be adversely impacted in the event of a depreciation of a domestic currency because enterprises using these inputs will increase their costs. They find that GDP, interest rate, and the inflation rate have a direct relationship with corporate performance. Sufian and Habibullah (2009) studied bank profitability in China using multivariate regression analysis, where it is found that there exists a positive relationship between profitability and the macroeconomic variables considered, which were inflation and GDP.

Similarly, Matar, Al-Shannag, and Odeh (2018) utilize panel regression in the banking sector. They find that GDP and interest rates have a positive influence on firm performance, whereas inflation has a negatively correlated relationship. Based on a study done by Masood and Ashraf (2012) using panel data regression in the banking sector, it is found that the real GDP is statistically insignificant and negatively affects ROA. The inflation rate impacts ROA positively and is also statistically insignificant. The macroeconomic environment plays a significant role in firm performance. The understanding of corporate performance necessitates an understanding of a firm's profitability before and after the financial crisis.

The South African GDP growth rate has been continuously dwindling over the years. Overall, this has resulted in firms in most industries experiencing faltering profitability and growth. Bischof-Niemz and Creamer (2018) state that there has also been a shift in consumer spending which has resulted in the growth of some sectors such as restaurants and hotels, alcohol beverages, tobacco, and narcotics, among other things, at the expense of other areas such as, housing, water, electricity, gas, and other fuels. Eskom has been a victim of declining GDP growth and the shift in industry growth, which has negatively affected its operation.

Jahed et al. (2017) add that this has resulted in low profitability because of increased operating costs due to a substantial increase in the primary energy cost and the real increase in labor costs. Jahed et al. (2017) further expand by stating that in trying to increase production, Eskom has also incurred debt, which resulted from expansions on property plant and equipment (PPE). As a result, the firm has not had enough revenue to cover costs. Eskom's tariff increases have steadily led to a decline in customers, shutting others down. As a result, their sales have been declining due to lower demand.

3.1 Sample period and Variable description

Time series data from the year 2000 to 2018 was used to analyze the relationship between Eskom's profitability measures, ROA and NPM (i.e. the dependent variables), and various economic and financial variables and indicators. Macroeconomic variables were selected according to literature. However, only the nominal USDZAR exchange rate (XR) and real GDP growth (GDP) at constant prices were considered. Eskom's profitability measures were taken from their Annual Financial Reports. The 10-year South African Government Bond yield was used as the cost of Eskom's debt (R). The Eskom Default Risk Premium (PREM) is the differential of Eskom's Zero-Coupon Eurobond yield and South Africa's Government bond yield (the risk-free rate). The global price of coal was used and is denominated in US$ (COAL). Eskom's average electricity price was used and is denominated in ZAR (TRF)

3.2 Theoretical framework

According to Brooks (2019), there are two most used metrics of profitability, and these are the ROA and NPM. The ROA ratio indicates how profitable a company is relative to the value of its total assets. This gives an insight into the efficiency at which the company utilises its assets. The second measure of profitability is the NPM, which represents the ratio of a company's net profits after tax to its total revenue, indicating the company's financial health. In this study, these two variables were used as indicators of Eskom's financial performance, and the factors that influence them were investigated. The ROA and NPM are, therefore, the dependent variables.

The six independent variables that were used to explain changes in ROA and NPM were as follows: the real GDP growth rate; the growth rate of relative coal prices; the growth rate of relative electricity prices imposed by Eskom; the USDZAR exchange rate; the long-term 10-year government interest rate; and lastly, Eskom's default risk premium. These six explanatory variables were included in this study as they measure the demand for electricity produced by Eskom, the cost of the factors of production, and the price at which Eskom sells its electricity. These were carefully selected in line with reasoning that is further explained in the following paragraphs.

An increase in the economy's GDP means that firms are producing more and have higher levels of disposable income. This leads to an increase in the demand for electricity and improves Eskom's efficiency because existing capacity will be fully used. After the above, this will, in turn, increase electricity sales and boost Eskom's revenue and cash-flows. The increased use of installed capacity due to higher demand will lower unit costs of production. Eskom is currently the largest consumer of coal. According to the Department of Mineral Resources, Eskom accounts for 66 percent of energy consumption in South Africa (Eberhard, 2011).

With coal being an essential raw material required to produce electricity, changes in the real coal price should negatively affect the profitability of Eskom because coal is a significant cost input in Eskom. All else being equal, an increase in the real coal price will increase the initial costs of electricity production, and this will decrease the rate of return for Eskom. Therefore, a negative relationship is expected. Rising interest rates affect a firm's capital structure and impede capital budgeting decisions (Matar et al., 2018). Eskom's default risk premium exists as an additional fee to compensate investors for the likelihood of default on debt repayments.

According to Brealey, Myers, and Marcus (2012), the default premium is the resulting differential between a company's promised yield and a risk-free treasury bond. Companies do this by promising a higher rate of interest payments on their bonds. Therefore, it is not desirable that this fee should increase for Eskom during any period. An increase in the risk premium is indicative of a firm's low creditworthiness. Therefore, a negative relationship between the default risk premium and profitability is expected.

According to literature, the depreciation of the exchange rate is expected to impact the profitability of a domestic firm adversely. Eskom issued a total of US$ 2.25 billion bonds in international bonds under the Global Medium-Term Note (GMTN) program registered in 2013. The GMTN program is registered with the Luxembourg Stock Exchange (Eskom, 2019). However, Eskom uses forward exchange contracts to hedge currency and commodity exposures. If these contracts are sufficient, then the effect of the exchange rate on Eskom's profitability should not be significant. This research will test this.

According to Kwon, Cho, Roberts, Kim, and Yu (2015), an increase in the tariff price leads to a decrease in consumer demand, which, in turn, affects the manufacturing output. Therefore, it is expected that tariff prices will have an adverse impact on Eskom's profitability because of lower demand.

The table below provides a summary of all the expected relationships between the two dependent variables and each of the explanatory variables discussed above.

Table 1: Summary of expected relationships

Variable	Description	Expected Sign
Independent variables		
ROA	Return on Assets	
NPM	Net Profit Margin	
Dependent variables		
GDP	Real GDP	+
COAL	Coal Price	-
TRF	Eskom Average Electricity Price	-
XR	USDZAR Exchange Rate	+ or -
R	SA Government Bond yield	-
PREM	Eskom Default Risk Premium	-

3.3. Model specification

According to Brooks (2019), multivariate regression pertains to a model with multiple independent variables. The model seeks to explain the relationship between a dependent variable and multiple independent variables using statistical inference. The model is stated as follows:

$$Y_t = \beta_0 + \beta_1 COAL_t + \beta_2 GDP_t + \beta_3 TRF_t + \beta_4 XR_t + \beta_5 R_t + \beta_6 PREM_t + \varepsilon_t \quad (1)$$

where Y_t is either the ROA or the NPM, $COAL_t$ is the actual price of coal, GDP_t is real GDP growth, TRF_t is the real electricity tariff, XR_t is the nominal USDZAR exchange rate, R_t is the long term interest rate and $PREM_t$ is Eskom's default risk premium, and the idiosyncratic term $\varepsilon_t \sim N(0, \sigma^2)$. Since Eskom relies on the 10-year government bond which contains a contracted coupon rate, a contemporaneous relationship between the independent and dependent variables cannot be assumed. Therefore, a one-year lag of the differenced R variable was included to capture the lagged behaviour between Eskom's profitability measures and R (shown later in Chapter 4, pp. 21 – 23).

3.4 Methodology

The data consists of variables with different frequencies (daily, monthly, and annual). The daily and monthly variables were transformed into annual variables. The Augmented Dickey-Fuller test was used to test the variables for stationarity. Descriptive statistics was performed to summarize variables and gain insights into each variable. Correlation tests were performed to determine the level of correlation between the dependent variables and each of the explanatory variables. The correlations were used as the first indication of the nature of the relationship between the dependent variables and the explanatory variables. Lastly, two Ordinary Least Squares (OLS) regression models were generated. The first model used the ROA as the dependent variable, while the second model used the NPM as the dependent variable. A threshold of 10% was used for the statistical significance level in this study.

4.1 Data and Sources

Secondary data for the variables specified in the model in equation 1 was collected for the period spanning from January 2000 to December 2018. Data of all variables were obtained from various reliable sources such as Annual Financial Statements from Eskom SOC Ltd, OECD Economic Outlook, Reuters Financial Data, and Fitch Solutions Financial Data.

4.1.1 Transformation of data

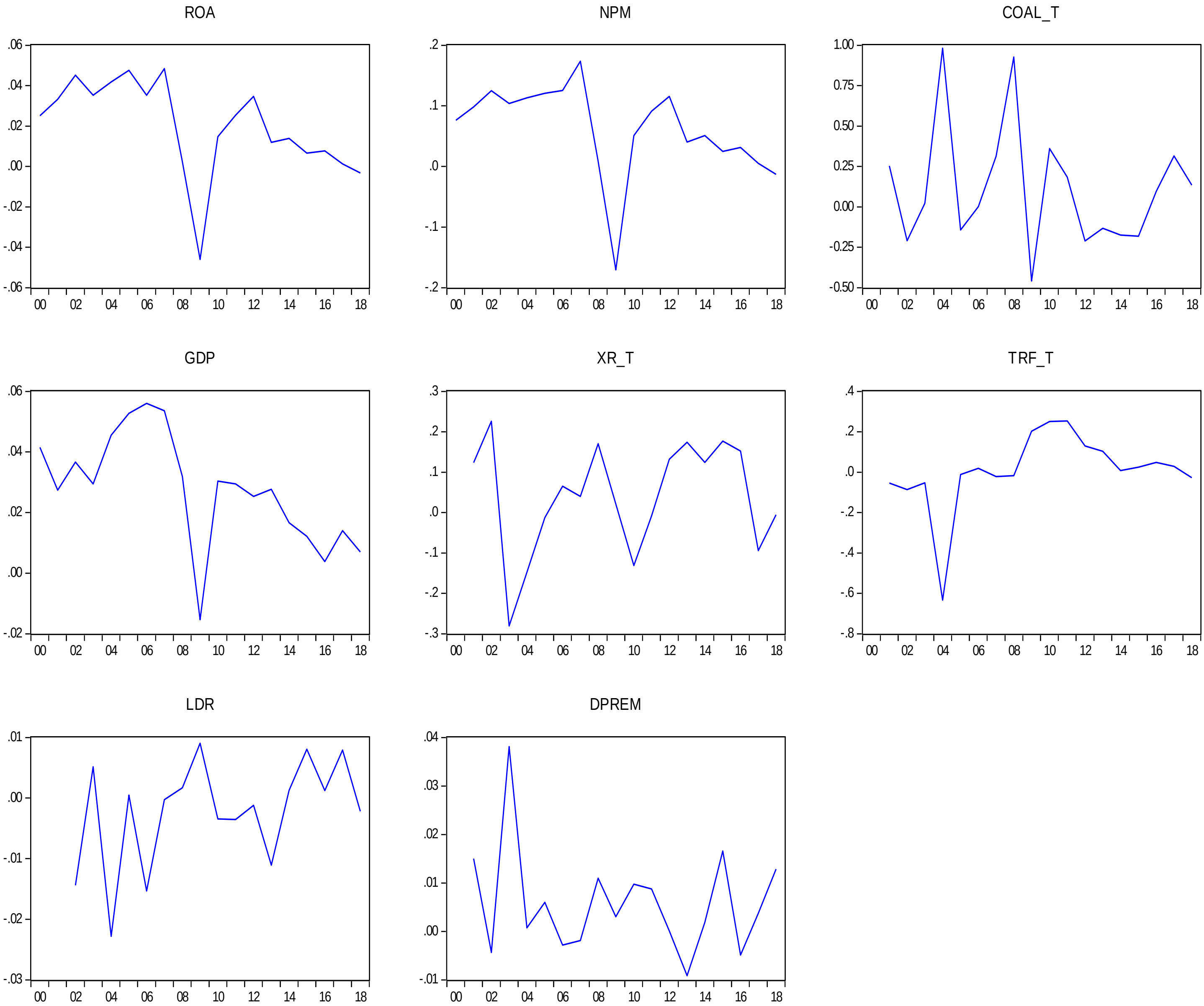
Monthly data with missing periods were interpolated to fill the missing data using linear interpolation. Monthly data was converted to annual data using the monthly data averages. Daily data was converted to annual data using the average of monthly data. The annual data were transformed into percentages to record the annual rate of change. The relative coal price and relative electricity price were adjusted with US CPI and SA CPI, respectively. Data collation and cleaning were performed in Microsoft (MS) Excel. All statistical analysis was conducted on EViews Software. Changes to the data are shown below:

Table 2: Summary of data transformations

Variable	Frequency	Conversion	Percentage change transformation
ROA	Annual	No	No
NPM	Annual	No	No
ΔTRF	Annual	No	Yes
GDP	Annual	No	No
ΔCOAL	Annual	No	Yes
ΔXR	Daily	Converted to annual data using the average of monthly data	Yes
R	Monthly	Converted to annual data using the average of monthly data	No
PREM	Monthly	Converted to annual data using the average of monthly data	No

Source: Author, EViews/MS Excel

Figure 1: Line plots of transformed time-series data



Source: Author, EViews Software

4.1.2. Descriptive statistics

The annual data spanning from the year 2000 to 2018 yielded 19 data points for each of the eight variables included in this study. The growth rates ΔCOAL, ΔXR, and ΔTRF, yielded 18 data points after transformation. The ROA variable had a minimum of -4.61% and a maximum of 4.84% over the 18 years of analysis with a mean of 2.01%. The ROA data is negatively skewed, as indicated by the skewness value of -1.10. The NPM variable had a minimum of -17.06%, a maximum of 17.36%, with a mean of 6.16%. The NPM variable is highly negatively skewed with a skewness value of -1.43. The ΔTRF variable had a minimum of -63.43% and a maximum of 25.31% with a mean of 0.89%. The ΔTRF variable is highly negatively skewed with a skewness value of -2.01.

The ΔGDP variable had a minimum of -1.54%, a maximum of 5.60%, and a mean value of 2.77%. The ΔGDP variable had a skewness value of -0.41, which is indicative of moderate skewness. The ΔCOAL variable had a minimum of -45.89%, a maximum of 98.10%, a mean of 11.53% with a skewness of 0.97 indicative of a moderately positively skewed distribution. The ΔXR variable had a minimum of -28.07%, a maximum of 22.59%, a mean of 4.02%, and a skewness coefficient of -0.73, indicating moderate negative skewness. The R variable has a minimum of 7.15%, a maximum of 12.73%, and skewness of 1.28, which indicates that the variable is positively skewed. The PREM variable has a minimum of -5.03%, a maximum of 5.41%, a mean of 1.16%, and a skewness value of -0.73, which suggests that the variable is moderately negatively skewed.

The table below shows the incorporation of two additional transformed variables which were used in the model. The first variable, ΔR (1-year lag), is the first difference of the R variable, lagged by 1-year. The second variable, ΔPREM, is the first difference of the PREM variable. The ΔR (1-year lag) variable has a minimum of 2.3%, a maximum of 0.9%, and a skewness of -0.82, which indicates that the variable highly negatively skewed. The ΔPREM variable has a minimum value of 0.9%, a maximum value of 3.8%, and a skewness of 1.55 which indicates that it is positively skewed. It should be noted that two (2) degrees of freedom were lost from 19 observations due to the data transformations.

Table 3: Summary of statistics

	ROA	NPM	ΔCOAL	GDP	ΔXR	ΔTRF	R	PREM	ΔR (1-year lag)	ΔPREM
Obs.	17	17	17	17	17	17	17	17	17	17
Mean	0.020	0.062	0.115	0.028	0.040	0.009	0.090	0.012	-0.002	0.005
Std. Dev.	0.023	0.075	0.378	0.018	0.137	0.190	0.015	0.029	0.009	0.011
Minimum	-0.046	-0.171	-0.459	-0.015	-0.281	-0.634	0.072	-0.050	-0.023	-0.009
Maximum	0.048	0.174	0.981	0.056	0.226	0.253	0.127	0.054	0.009	0.038
Skewness	-1.095	-1.435	0.975	-0.407	-0.728	-2.013	1.276	-0.735	-0.820	1.550
Kurtosis	4.465	5.765	3.511	2.874	2.782	8.558	3.838	2.751	2.914	5.812

Source: Author, EViews Software

4.1.3 Correlation

The table below is a correlation matrix showing the correlation coefficients between the dependent and independent variables. Analysis was done by the Author on EViews ROA is correlated to GDP (0.87) and ΔR (1-year lag) (-0.53) with the correlations being statistically significant at a 1% and 5% level, respectively. The NPM variable is correlated to GDP (0.87) and ΔR (1-year lag) (-0.51) which are all statistically significant at a 1% and 5% level, respectively. ΔCOAL is negatively correlated with ΔTRF (-0.53) at a significance level of 5%. GDP is negatively correlated to ΔR (1-year lag) (-0.59) is statistically significant at a 5% level. ΔTRF is positively correlated with ΔR (1-year lag) (0.54) at a significance level of 5%. ΔXR is negatively correlated with ΔPREM (-0.59) at a significance level of 5%. ΔR (1-year lag) is positively correlated with ΔPREM (0.46) at a 10% statistically significant level.

Table 4: Correlation matrix

Correlation Probability	ROA	NPM	ΔCOAL	GDP	ΔTRF	ΔXR	ΔR (1-year lag)	ΔPREM
ROA	1.000 -----							
NPM	0.985 0.000*	1.000 -----						
ΔCOAL	0.183 0.483	0.200 0.441	1.000 -----					
GDP	0.874 0.000*	0.865 0.000*	0.356 0.161	1.000 -----				
ΔTRF	-0.396 0.116	-0.324 0.205	-0.529 0.029**	-0.361 0.154	1.000 -----			
ΔXR	-0.106 0.685	-0.065 0.803	-0.312 0.223	-0.123 0.638	0.215 0.408	1.000 -----		
ΔR (1-year lag)	-0.532 0.028**	-0.505 0.039**	-0.313 0.221	-0.589 0.013**	0.537 0.026**	-0.052 0.843	1.000 -----	
ΔPREM	-0.052 0.843	-0.071 0.786	0.082 0.754	-0.115 0.661	0.022 0.933	-0.587 0.013**	0.456 0.066***	1.000 -----

Notes: *denotes 1% statistical significance, **denotes 5% statistical significance, ***denotes 10% statistical significance

Source: Author, EViews Software

4.1.4 Stationary tests

The ADF test was used to test the stationarity of each variable used in the specified model, before running the OLS regression using the Akaike Information Criterion (AIC). Stationarity means that the statistical properties of a time-series, i.e. mean, variance and covariance, do not vary over time (Brooks, 2019). For this study, a statistical significance at the 5% level will be used to reject the null hypothesis, indicating that the data being tested is stationary (i.e. devoid of a unit root) on EViews Software. Generally, a p-value of less than 5% means the null hypothesis can be rejected that there exists a unit root. A threshold of 10% was used for the statistical significance level. Since there was no presence of mean reversion in the R and PREM data, the variables were differenced before the analysis. The results are indicated in the table below:

Table 5: Results of the ADF test

Variables	ADF t-stat.	Prob	Test type	Interpretation
ROA	-1.79	0.07***	Level	Reject null hypothesis. Series is stationary
NPM	-3.65	0.06***	Level	Reject null hypothesis. Series is stationary
ΔTRF	-2.73	0.09***	Level	Reject null hypothesis. Series is stationary
GDP	-3.52	0.07***	Level	Reject null hypothesis. Series is stationary
ΔCOAL	-4.83	0.00*	Level	Reject null hypothesis. Series is stationary
ΔXR	-3.10	0.05**	Level	Reject null hypothesis. Series is stationary
ΔR (1-year lag)	-4.90	0.002*	Level	Reject null hypothesis. Series is stationary
ΔPREM	-5.38	0.00*	Level	Reject null hypothesis. Series is stationary

Notes: *denotes 1% statistical significance, **denotes 5% statistical significance, ***denotes 10% statistical significance

Source: Author, EViews Software

4.2 Results

Two models were run using OLS regression with a 1-year lag of the ΔR variable. The models incorporated Newey-West standard errors. The reported results below must be interpreted as indicative and therefore with caution:

4.2.1 Model 1: ROA

$$ROA_t = \beta_0 + \beta_1 \Delta COAL_t + \beta_2 GDP_t + \beta_3 \Delta TRF_t + \beta_4 \Delta XR_t + \beta_5 \Delta R_{t-1} + \beta_6 \Delta PREM_t + \varepsilon_t \ (2)$$

The first model that was run is defined by equation 2, and it indicates the relationship between ROA and the dependent variables. The results of the OLS regression indicate that there are only two statistically significant explanatory variables in explaining the changes in ROA, and these are ΔCOAL and GDP. The R^2 value of 82% and an adjusted R^2 value of 71% are indicative of a model with good explanatory power. The GDP variable is statistically significant at a 1% level and has a positive coefficient of 1.12. This indicates that a 1% change in GDP growth would result in a 1.12% increase in ROA. The ΔCOAL variable is also statistically significant at a 10% level and has a negative coefficient of -0.02. This indicates that a 1% change in COAL would result in a 0.02% decrease in ROA.

The ΔR (1-year lag) variable yielded expected results displaying a negative coefficient but was however statistically insignificant. It is worth mentioning that the ΔTRF variable was close to 10% level of significance but was however statistically insignificant but yielded an expected negative coefficient. Overall, the bulk of the desired directional relationships were attained. The Durbin-Watson test statistic has a value of 1.66, indicative of the absence of autocorrelation. Results are shown in the table below:

Table 6: Results for the ROA model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔCOAL	-0.015	0.008	-1.871	0.091***
GDP	1.122	0.223	5.025	0.001*
ΔTRF	-0.025	0.016	-1.583	0.145
ΔXR	0.005	0.017	0.288	0.780
ΔR (1-year lag)	-0.055	0.385	-0.142	0.890
ΔPREM	0.223	0.346	0.646	0.533
C	-0.011	0.009	-1.164	0.272
R-squared	0.817	Mean dependent var		0.019
Adjusted R-squared	0.707	S.D. dependent var		0.024
S.E. of regression	0.013	Akaike info criterion		-5.537
Sum squared resid.	0.002	Schwarz criterion		-5.194
Log likelihood	54.065	Hannan-Quinn criter.		-5.503
F-statistic	7.434	Durbin-Watson stat		1.657
Prob(F-statistic)	0.003	Wald F-statistic		9.298
Prob (Wald F-statistic)	0.001			

Notes: *denotes 1% statistical significance, **denotes 5% statistical significance, ***denotes 10% statistical significance

Source: Author, EViews Software

4.2.2 Model 2: NPM

$$NPM_t = \alpha_0 + \alpha_1 \Delta COAL_t + \alpha_2 GDP_t + \alpha_3 \Delta TRF_t + \alpha_4 \Delta XR_t + \alpha_5 \Delta R_{t-1} + \alpha_6 \Delta PREM_t + \varepsilon_t \quad (3)$$

The second model that was run is defined by equation 3, and it indicates the relationship between NPM and the dependent variables. The results of the OLS regression indicate that there is only one statistically significant explanatory variable in explaining the changes in NPM, and it is GDP. The R^2 value of 77% and an adjusted R^2 value of 63% are indicative of a model with good explanatory power. The GDP variable is statistically significant at a 1% level and has a positive coefficient of 3.70. This indicates that a 1% change in GDP growth would result in a 3.70% increase in NPM. Overall, the bulk of the desired directional relationships were attained The Durbin-Watson test statistic has a value of 1.61, indicative of the absence of autocorrelation. Results are shown in the table below:

Table 7: Results for the NPM model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔCOAL	-0.032	0.034	-0.943	0.368
GDP	3.703	0.956	3.874	0.003*
ΔTRF	-0.037	0.052	-0.725	0.485
ΔXR	0.040	0.072	0.560	0.588
ΔR (1-year lag)	-0.130	1.328	-0.098	0.924
ΔPREM	0.688	1.319	0.522	0.613
C	-0.042	0.036	-1.186	0.263
R-squared	0.771	Mean dependent var		0.059
Adjusted R-squared	0.634	S.D. dependent var		0.079
S.E. of regression	0.048	Akaike info criterion		-2.941
Sum squared resid.	0.023	Schwarz criterion		-2.598
Log likelihood	32.002	Hannan-Quinn criter.		-2.907
F-statistic	5.613	Durbin-Watson stat		1.607
Prob(F-statistic)	0.009	Wald F-statistic		3.817
Prob (Wald F-statistic)	0.030			
Notes: *denotes 1% statistical significance, **denotes 5% statistical significance, ***denotes 10% statistical significance				

Source: Author, EViews Software

CHAPTER 5: CONCLUSION, LIMITATIONS, AND FUTURE WORK

This study set out to determine the key drivers of Eskom's profitability by developing a regression model and quantifying the effect that changes in the real GDP growth, relative coal prices, relative electricity prices, Rand to US Dollar exchange rate, SA government 10-year bond yield, and the Eskom default risk premium have on Eskom's ROA and NPM using two separate models. The study finds that the key drivers of Eskom's ROA are real GDP growth and the growth rate of relative coal prices. The GDP ultimately shows an indication of the demand for electricity, and it, therefore, does not come as a surprise that it is the strongest driver in the ROA model.

The growth rate of relative coal prices was found to have a negative impact on ROA. The negative impact that the relative coal price has on ROA is expected because an increase in coal prices would increase the cost of production of electricity for Eskom. The interest rate is the cost of capital for Eskom and thus its increase would imply the increased cost of borrowing for the firm which would subsequently impact profitability. The ΔR (1-year lag) variable yielded expected results showing a negative coefficient but was however statistically insignificant. The ΔTRF variable was close to 10% level of significance but was however statistically insignificant but yielded an expected negative coefficient.

The second model investigated in this study focused on the drivers of Eskom's NPM. Of the six independent variables tested in this study, only one of the variables was found to have a statistically significant impact on Eskom's NPM, and the variable was the growth rate of GDP. As previously mentioned, the real GDP measures the economy's production levels, and growth in the GDP is expected to be coupled with an increase in demand for electricity by industry, which in this case also increases the NPM. The real GDP growth has a greater impact on Eskom's NPM than it has on the ROA. Similarly, the relationship between the ΔR (1-year lag) variable and the NPM is negative as expected and aligned with literature but is also statistically insignificant.

The findings of this study reiterate the extent to which changes in the real GDP growth represent changes in demand for electricity and that Eskom's profitability is primarily driven by demand for electricity generated by a growing economy. The results indicated that Model 1 is more statistically robust as a profitability model. Overall, the desired results and directional relationships were obtained for the variables although there were several statistically insignificant variables in Model 2. Hence the specification of the models may need to be improved. The exchange rate variable was statistically insignificant, indicating that Eskom's forward exchange contracts are indeed effective at hedging against currency risk and commodity exposures.

The research's main limitation was that of Eskom's data points or sample size, with the study comprising of a meagre 19 data points and 17 data points following data transformation. It would be interesting to see, perhaps in future studies, how the model behaves with a larger sample size and how the ΔR (1-year lag) variable interacts with the profitability measures. For future work, the two models can be sectioned into different periods of Eskom's corporate years: these being, Post-1994 Era, Pre-Financial Crisis, Mid-Financial Crisis, and Post-Financial Crisis of 2008.

This would give a holistic view of how Eskom performed during these specific periods. Also, it would provide the work with more data. The Models can be further broken down into specific sectors of the South African economy so that we identify which sectors of the economy will have the largest impact on Eskom's performance. The research was also narrow in that it used the average electricity price in the analysis. Eskom has different tariff structures for rural and suburban areas. Therefore, to view how these economic and financial drivers vary over time, an extensive analysis of the tariff structure can be conducted in addition to the sectoral analysis.

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APPENDIX: ETHICAL CLEARANCE CONFIRMATION

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

Registration number: REC-101114-044

SCHOOL OF GRADUATE SCHOOL OF BUSINESS ADMINISTRATION ETHICS COMMITTEE

Ethics clearance / waiver number: WWBS/FI717411/290 - W

17 February 2020

Re: Mr Senzesihle Ndlovu (717411)

To whom it may concern,

Senzesihle Ndlovu (717411) is currently registered as a MM (Finance and Investment) student at the School of Graduate School of Business Administration, University of the Witwatersrand, Johannesburg. This letter is to confirm that, at the time of writing, Senzesihle Ndlovu does not need ethical clearance for his study entitled '***Determinants of Eskom`s key financial ratios'***. This decision has been reached based upon a description of the project supplied by Senzesihle Ndlovu to the **Graduate School Of Business Administration** Ethics Committee, constituted as a subcommittee of the University Human Research Ethics Committee (Non-Medical), which has been evaluated by the subcommittee chair. This decision has then been ratified by the University Human Research Ethics Committee (Non-Medical). If, however, Senzesihle Ndlovu changes the methods of data collection and analysis for this project, this decision may no longer be valid. If such changes take place, this should be communicated to the **Graduate School of Business Administration** Ethics Committee.

Please feel free to contact me should you require any further information.

Thank you.

Yours sincerely,

Matshabaphala

Dr MDJ Matshabaphala

Shaun Schoeman (Senior Administrative Officer)

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