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Regulatory risk – does the National Energy Regulator of South Africa correctly price the cost of equity?

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A research project submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfilment of the requirements for the degree of Masters of Business Administration.

10 November 2014

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Abstract

This research investigates whether the South African Energy Regulator (NERSA) correctly prices the cost of equity, through looking at the petroleum storage sector.
A model is built to simulate the current methodology for tariff setting and historical data is used to estimate the returns a regulated firm would have earned over the past 25 years. In addition, a benchmark cost of equity is calculated through a sample of US firms. Integrated firms are then decomposed to their revenue generating segments and cost of equity per segment is then estimated.

The study finds that the methodology calculates a return lower than that earned by the market (measured through the J203). The study further finds that the risk to which the regulated company is exposed to, defined in terms of variability of retunes, is not significantly different than that of the market. Lastly, the study finds that the benchmark cost of equity is significantly higher than that calculated by the Regulator.
Recommendation for Regulator consideration as well as for further research are provided.

Key words: Total Beta, Cost of Equity, Petroleum Storage, NERSA

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements of the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Name: Ziv Ben-Ami

Signature:

Date: November 10th, 2014

Acknowledgements

I would like to thank my supervisor Mr. Mike Holland for his guidance during this research. Your insight and advice have been invaluable in developing the ideas on which this research is based.

To my colleagues for allowing me the time to focus on this research and supporting my efforts in completing this work.

Lastly, to my family - Leeati, Yehonatan and Auri, for supporting me throughout this journey. Your support, love and understanding have been instrumental in achieving this goal.

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1 Introduction

1.1 Title

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1.2 Introduction

Energy markets throughout the world have undergone substantial processes of privatisation and liberalisation over the past two decades (Cambini & Rondi, 2010; Heine, 2013; Schaeffler & Weber, 2013). Similarly, the goal of increasing competition in the liquid fuel energy sector set by the South African government ("Petroleum Piplines Act," 2003; *White Paper on the Energy Policy of the Republic of South Africa*, 1998), requires, by definition, that new participants enter the market.

Whilst in ordinary markets, competition itself ensures price efficiency, the energy sector often presents a market structure in which firms have substantial market power[1] (Heine, 2013). It is thus up to the Regulator to administer an industry in which correct pricing signals are critical as investments in the sector are large and are both irreversible and risky (Cambini & Rondi, 2010; Heine, 2013).

The resulting (natural) tension between regulators trying to create competitive equilibrium and the regulated spurred much debate amongst industry and academics

[1] While it is beyond the scope of this paper to determine if the Energy sector, and specifically the Liquid Fuels segment in South Africa are a Natural Monopoly in the physical sense, the risk of under investment will arise from applying the regulation, regardless of actual reality. For a some discussion see (Lambrechts, 2006; Pienaar, 2010) as well as (*White Paper on the Energy Policy of the Republic of South Africa*, 1998) for explicit definition (pp.66).

(Schaeffler & Weber, 2013). At the centre of this debate has been the application of the Capital Asset Pricing Model which is applied by most regulators (Schaeffler & Weber, 2013). Originally developed by Sharpe (Sharpe, 1964), the estimation of the risk adjusted return stand at the base of the model. In a competitive equilibrium market, with no limitation on entry and exit, firms will earn the Weighted Average Cost of Capital; Any deviation from this will result in over or under investment (Baye & Beil, 2006).

Thus, estimation of the WACC and specifically the assumptions used in determination of the cost of equity made by the regulator, is critical to creating correct investment incentives (Schaeffler & Weber, 2013; Schober, Schaeffler, & Weber, 2014). Economic regulation of (now) privately owned companies relies on the premise that equity holders are perfectly diversified (Dobbs, 2011; Schober et al., 2014). Competitive equilibrium outcome would, however, price these risks into the cost of equity and thus increase the required return (Schober et al., 2014). It follows that if the premise of perfect diversification is not met, regulators are at risk of creating underinvestment in new capacity, as the profit maximising firm, under capital rationing imperative, will invest in other avenues in which it can earn (at least) the WACC[2].

It follows that in the long run, if this under-pricing persists, firms will have limited equity raising possibilities, increasing the proportion of debt in the capital structure. As debt portion increases, so will the cost of debt (Damodaran, 2008, 2012), making new investments unfeasible, leading to underinvestment. The effect of such underinvestment on the overall economic welfare has been shown to be much greater than the impact of higher prices, due to the asymmetric nature of the welfare function in the countries studied (Dobbs, 2011).

[2] This goes to the heart of the CAPM – by mispricing the risk, the regulators creates a situation in which investors can face the same risk for a higher return (Sharpe, 1964).

In order to compensate owners for this under-pricing of equity, regulators have either allowed an *ex-post* pricing of these risks through loss recuperation in the following tariff period, or through allowing protective measures (e.g. hedging) as costs for which the firm is compensated (Schober et al., 2014). However, the imperfection of investor diversity as well as the inability of these measures to fully compensate investors have been some of the reasons for the extensive debate which is yet to be decided. Significant differences in the calculated required risk-adjusted return still exists, as a result of valuation approach, leverage, firm size and position in the value chain (Schaeffler & Weber, 2013).

1.3 Motivation for Sector Selection

Economic regulation in South Africa is mainly focused on energy, telecommunication water and transport (Steyn, 2011; van Basten, 2007). In the transport and telecommunication sector, economic regulation is manifested in the facilitating of general economic conditions, such as determining the number of operators through control and issuance of license, as opposed to approving a certain level profitability (van Basten, 2007). In the case of water services, the participation of the private sector has been limited as sovereign and sub-sovereign entities manage the infrastructure assets with private sector participation mainly contracted in, for provision of services (van Basten, 2007). We are thus left with the energy sector, which can be divided into electricity, gas and petroleum pipelines. Electricity production historically has been the sole responsibility of State Owned Company (SOC) Eskom Holdings Ltd., which is responsible for 95% of the electricity generation and almost all high voltage and long distance transmission (Steyn, 2011). As the government of South Africa is the only shareholder in Eskom, and further because Eskom is a natural monopoly, with different incentives and alternatives available to it as such (Baye & Beil, 2006), analysing how the price is determined and comparing it to alternatives will cloud the analysis seeking to determine options and value from a private sector perspective.

In the gas sector, prices are regulated by a more than one body – National Energy

Regulator of South Africa (NERSA) regulates the gas transmission and regulation but not the reticulation which is determined by the municipalities[3] (van Basten, 2007). This combination of price determinants could potentially cloud the analysis with different regulatory regimes in action.

The regulated Petroleum Pipelines industry, is comprised of petroleum pipelines, storage and loading facilities ("Petroleum Piplines Act," 2003). Of these components, the main assets that have private sector participation are the storage assets, through independent storage companies, while the pipelines and loading facilities are mainly state owned through Petronet originally, currently Transent SOC Ltd. (Steyn, 2011; van Basten, 2007). The regulation of prices for petroleum storage is done through a publicly available methodology and includes publicly available interactions between the market participants and the Regulator[4] (as opposed to a single entity). Further, companies operating in this sector are required to have their tariff approved at least every five years ("Petroleum Piplines Act," 2003). Thus, the availability of data and breadth of interactions in the petroleum storage industry offers the greatest analysis opportunity in terms of a private company operating in a regulated environment.

1.4 Research Scope

The scope of this research is to empirically analyse the approach taken by NERSA in terms of the shareholder returns it allows, and how that compares with the market return.

1.5 Research Motivation

The motivation for this research is twofold.

[3] Although this phenomena repeats itself in the electricity sector in some municipalities, the scale of it does not merit consideration nor will it change the point on clouding analysis.
[4] Throughout this paper the capitalised term shall refer to the South African National Energy Regulator (NERSA).

From an academic perspective, research has focussed on utilities, and mostly those operating in developed countries (Schaeffler & Weber, 2013). In addition, while there may be common principles amongst regulators, each regulator may consider its own methodology and determine its own data set for evaluating such equity returns. Thus, this research could offer both an emerging markets perspective as well as an analysis at a South African regulator level.

From a business perspective, economic incentive levels are critical to achieving the development objectives set by the South African government, which include increasing competition for the benefit of consumers (*White Paper on the Energy Policy of the Republic of South Africa*, 1998). Possible errors in estimating these returns can lead to welfare loss and under investment in infrastructure (Dobbs, 2011). In South Africa, investment in infrastructure has fallen to levels well below the international benchmark (2.4% and 3-6% respectively) and this has a negative effect on productivity (Fedderke & Bogetić, 2009). Thus, this study could assist the Regulator in ensuring correct pricing signals, which could minimise the welfare losses and increase infrastructure investment and related productivity.

1.6 Research Aim

The aim of this study is to empirically analyse the effect of the specific economic regulation on regulated firm returns (operating in the petroleum storage sector) compared to the market portfolio return. If an impact is found, the study will seek to explain the possible source for such differences as well as offer adjustments to current methodology to better capture the risk faced by the firm.

2 Literature Review

A central part of economic regulation is the methodology applied by the regulator in evaluating the equity return (Dobbs, 2011). It is thus no surprise that at the heart of the debate on the appropriate equity return that ensued the liberalisation of the energy markets globally, were two main issues (Schaeffler & Weber, 2013):

- Appropriate model to be used in evaluating the equity returns.
- Adequacy of specific components used by the regulator to evaluate the specific measures.

The following section will summarise the main points of the theoretical framework in the field.

2.1 Return on Equity Models

While there are several theoretical possibilities to determine the required return on an asset[5], the Capital Asset Pricing Model (CAPM) is the most widespread model and is considered one of the pillars of modern financial theory (Levy, 2010; Mabrouk & Bouri, 2010). It is thus no surprise that the regulators have relied on this model in estimating the required return. Schaeffler and Weber (2013) find that all of the 19 European countries surveyed apply this model.

The main application of the CAPM model for regulatory purposes is in the computation of the cost of equity for determination of the required return (Schaeffler & Weber, 2013). This is then applied in the calculation of the Weighted Average Cost of Capital (WACC) presented in *(1)* (Schaeffler & Weber, 2013):

$$WACC = \frac{E}{V} r_e + \frac{D}{V} r_d \qquad (1)$$

[5] See for example DGM (Gordon, 1959), APT (Ross, 1976).

Where:

$WACC = Weighted\ average\ cost\ of\ capital$

$D = Debt\ value;$

$V = firm\ value;$

$E = Equity\ value;$

$r_e = Cost\ of\ Equity;$

$r_d = \text{Post} - \text{ tax } cost\ of\ Debt;$

While the cost of debt is more easily observable, as it is related to the lenders estimation of the default risk and should be available empirically, the cost of equity requires indirect estimation as it may differ amongst equity holders (Damodaran, 2008, 2012).

At the base of the CAPM model is the notion that the expected return of an asset should compensate for the risk, but only the systematic portion of it (Galagedera, 2007; Schaeffler & Weber, 2013; Schober et al., 2014). Under this concept, cost of equity is given by *(2)*(Schaeffler & Weber, 2013):

$$r_e = r_f + \beta_e(r_m - r_f) \quad (2)$$

Where:

$r_e = Return\ on\ Equity;$

$r_f = risk\ free\ asset\ return;$

$r_m = market\ portfolio\ return;$

$\beta_e = \frac{\sigma_i r_{im}}{\sigma_m} = \frac{cov\ (R_i, R_m)}{\sigma_m^2}, a\ measure\ of\ the\ systematic\ risk\ of\ the\ asset;$

In *(2)* the measure of systematic risk captures both market risk (the degree in which an the return of the asset is dependent on market performance) as well as financial risk due to leverage (Schaeffler & Weber, 2013). The Harris-Pringle formula presented *(3)* is used to correct observed equity beta values for this effect and obtain the asset beta, as a function of the tax rate and the debt-to-equity ratio (Harris & Pringle, 1985):

$$\beta_e = \beta_a + (\beta_a - \beta_d)\frac{D}{E}) \quad (3)$$

Where:

β_a= *asset beta;*

β_e = *equity beta*;

β_d = *debt beta*;

This equation is based on the premise that the tax shield carries the same risk as the firm's assets (Harris & Pringle, 1985). This method is chosen as this is the method applied by the Regulator[6], although it has come under some criticism (Fernández, 2004).

The accuracy of the CAPM has been the subject of numerous studies which reveal that the theory predictions are inaccurate when tested empirically (Fama & French, 2004; Levy, 2010; Mabrouk & Bouri, 2010; Ward & Muller, 2012). Fama and French (1992) have presented a Three Factor Model (TFM) which has been shown to improve the predictions of *(2)* by incorporating firm size and book-to-market value effects (Fama & French, 1992) :

$$r_e = r_f + \beta_i(MRP) + s_i SMB + h_i HML \quad (4)$$

Where:

SMB – Small minus Big; a "Size Premium";

HML – High minus Low; a "Value Premium";

Although empirical studies have shown that the TFM and other Multifactor Models (MFM) such as APT substantially increase the predictive power of the theory and explained variance, a recent survey of European network and utility regulators has

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[6] The methodology is silent on the re-levering of the beta. This would require firms to estimate their debt betas, however the regulator assumes that value to be zero, resulting in the basic Hamada formula.

shown that the absolute majority of those used the Simple Form CAPM (SFM) model (Schaeffler & Weber, 2013). The differences between the two approaches can be significant. Table 1 summarises difference in the results computed for firm operating in the utility and network industries found in several studies. As shown, the difference can be as high as 5.2% between the SFM and MFM. These differences have lead researchers to recognise that although CAPM has been adopted as the preferred model, these differences between models mandate regulators to validate results obtained using the CAPM with other methods[7] (Schaeffler & Weber, 2013). In addition, while these models describe some of the options in determining the *cost of equity*, they do not deal with the appropriate *return on equity,* as they represent the minimum return (Kihm, 2007).

Table 1 - Differences between Multi Factor (MFM) and Single Factor Models (SFM)

Cost of Equity	**MFM-SFM**	**Comments**
(Bower, Bower, & Logue, 1984)	-2.30%	+1.9% for Gas Sector
(Conine Jr & Tamarkin, 1985)	1.40%	
(Fama & French, 2004)	2.00%	
(Cragg, Lehr, & Rudkin, 2001)	5.20%	

2.2 Equity Return in Emerging Markets

This view of requiring additional corroboration finds additional support in emerging markets, as research has shown that the CAPM model is generally not applicable to these environments (Donovan & Nuñez, 2012). Harvey (1995) has found that emerging markets, in general, presented very low betas than when applied to (1) result in a required return that that is "too low" (Harvey, 1995). Estrada (2000) finds that in emerging markets, systematic risk measured by beta has no explanatory power, and suggests that this may be the result of emerging markets not being fully integrated and the lack of explanatory variables in the theory amongst others. He concludes that estimation of the cost of equity in emerging markets should be done through a down-

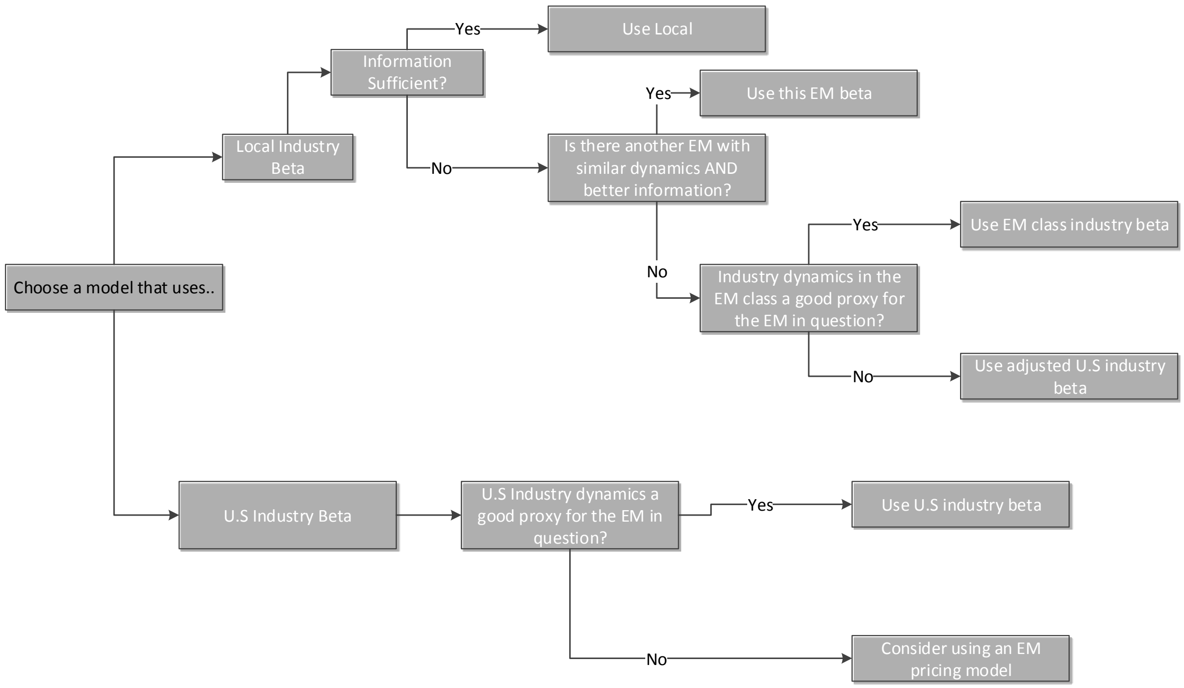
[7] Further developments in the CAPM model include amongst others, higher order co-moments which consider the non-normal distribution of the unconditional security return. For a good overview see (Galagedera, 2007). The discussion in the current scope is limited to the models widely applied by regulators.

side risk approach, which uses the semi deviation of returns with respect to the mean, as this more closely reflects the cost of equity in these markets (Estrada, 2000).

Further evidence of the required multidimensionality of (rational) stock returns is found in a series of studies conducted specifically on the JSE, which found evidence ranging from no to inverse relationship between beta and returns over specified time periods (Strugnell, Gilbert, & Kruger, 2011; Ward & Muller, 2012).

In an attempt to deal with this issue Pereiro (Pereiro, 2010) suggests a model for estimating in which a valuation approach taken, looking at emerging markets as a single asset class and adjusting for the beta for the total risk of the asset (Damodaran, 2008; Pereiro, 2010). This is presented in Figure 1.

Figure 1 - Choosing an asset pricing model (adapted from (Pereiro, 2010)).



2.3 Cost of Equity in Privately Owned Firms

In estimating the appropriate equity return for a private firm, we have to acknowledge that one of the basic assumptions of the CAPM model (including the later developed versions of it) is not satisfied. While these models rely on the fact the marginal investor in the firm has is able to invest in the market portfolio, he enjoys the benefit of diversification and should thus only be compensated for the systematic risk (Butler & Pinkerton, 2006; Damodaran, 2012). In a private firm this assumption of (near) perfect diversification cannot be applied as the marginal investor is in most cases the owner and is likely not diversified (Cotner & Fletcher, 2000; Pereiro, 2010; Schober et al., 2014).

From the eyes of owners, managers and lenders the relevant factor in determination of the cost of capital is the Total Risk (i.e. both systematic and unsystematic) embedded in the firm and its cash flows (Cotner & Fletcher, 2000; Damodaran, 2012).

Several methods and approaches have been offered in estimating this cost, as it is not observed directly (Cotner & Fletcher, 2000). The main models used can be classified broadly into Proxy models (including "Pure Play" and accounting betas) and Build-up methods[8] (e.g. Analytical Hierarchy Model suggested by (Cotner & Fletcher, 2000)).

One of the methods developed builds upon the use of proxies but makes an adjustment to the observed data in order to reflect the full risk. While the beta applied in (2) uses the covariance of the asset with the market as the measure of systematic risk, by dividing this beta by the correlation coefficient of the asset with the market, we can gauge the full risk faced by the investor and not just the portion explained by the market (Butler & Pinkerton, 2006; Damodaran, 2012; Pereiro, 2010).
The Total Beta is thus given by:

$$\beta_{Total} = \beta_e / \rho_{i,m} \quad (5)$$

Where:
$\beta_e = equity\ beta$;
$\rho_{i,m} = correlation\ coeficient\ of\ teh\ asset\ with\ the\ market$.

Note that in order to eliminate the financial risk element, we apply this adjustment to the unlevered beta as detailed in *(3)* (Damodaran, 2012; Pereiro, 2010).

2.4 Estimating the Cost of Capital for a Non-listed Asset

The problem of estimating the cost of capital for a non-traded asset (e.g. a segment) comes from the need for market data, which is often not available on a stand-alone basis (Hann, Ogneva, & Ozbas, 2013). Although some studies have dealt with this issue on its own merit (Damodaran, 2008; Gordon & Halpern, 1974; Weston & Lee, 1977), most of

[8] While other models exist (e.g. APT, DGM, etc.) these are not widespread in practice. See (Schaeffler & Weber, 2013).

the more recent developments seem to have been made as research was confronted by the need to estimate the cost of capital for a (non-traded) segment of a publicly-traded firm mainly in the endeavour to estimate the impacts of diversification on the cost of capital (Berger & Ofek, 1995; Hann et al., 2013).

The method developed by (Berger & Ofek, 1995) seems to have been applied vastly (Campa & Kedia, 2002; Damodaran, 2012; Graham, Lemmon, & Wolf, 2002; Hann et al., 2013). This method is explained in detail in (Berger & Ofek, 1995), but briefly, this method utilises the median of industry ratios to determine the contribution of a segment to the firm's value[9].

2.5 Regulation and Risk

A vast branch of literature has been devoted to the relationship between regulation and risk, and specifically how regulation influences systematic risk (see Schaeffler & Weber (2013) for a good summary of this).

Peltzman put forward the concept that regulators buffer shocks. As a result, profits are more predictable and thus the systematic risk should be smaller for these firms (Peltzman, 1976). This notion has been examined empirically, with conflicting results. Riddick (1992) confirms the effect on a simple form CAPM, and finds reduced correlations between market return and regulated firms' returns (Riddick, 1992). Binder and Norton (1999) confirm this effect in the US (Binder & Norton, 1999).

In contrast, (Paleari & Redondi, 2005) find that regulatory events effect both overall market risk and correlation in the same (negative) direction. Barcelos (Barcelos, 2010) offers a particularly relevant view point by analysing several industries in Brazil. He shows that regulated industries betas are higher than non-regulated ones, by analysing

[9] See (Damodaran, 2012) for a practical example on applying this. The same methodology is applied in this paper.

10 years' information. This contradicts Peltzman's buffering hypothesis.

A regulator allocates the risk between shareholders and consumers; a regulator that shifts more risk to the consumer will lead to a lower cost of capital and vice versa (Guthrie, 2006). If a regulator indeed affects the systematic risk of the firm, it cannot be diversified away; investors should be compensated for it (Bishop, Kay, & Mayer, 1995).

Different types of regulation have varying effects on risk (Alexander, Mayer, & Weeds, 1996; Guthrie, 2006; Paleari & Redondi, 2005). For example, Rate of Return regulation[10], immunises shareholders from long term shocks to the cash flows as the prices will be adjusted in the next regulatory time interval in order to ensure a certain return. In the case of Price Cap regulation, the increased degree of flexibility during the regulatory interval has conflicting effects: on the one hand, this increased pricing flexibility reduces the cost of capital; on the other hand, the greater uncertainty regarding the future cash flows (determined by the return approved by the regulator) increases the cost of capital. Thus, the net effect is very much an empirical question (Guthrie, 2006).

In this context, it is important to note how different stages in the investment lifecycle could lead to different regulatory incentives. The very existence of regulatory intervals which set a tariff for period shorter than the economic life of the asset and the nature of (incomplete) contracts introduce the so called *hold-up* problem - a possible incentive for the regulator to transfer surplus from the producer to the consumer once the firm has sunk costs into the asset[11] (Besanko & Spulber, 1992; Cambini & Rondi, 2012). This opportunism is mitigated if a longer term, game-theoretic view is taken on the regulator-market interactions, but is likely to lead to investors requiring mechanisms

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[10] Guthrie characterises regulation on three variables, being the price flexibility, the regulatory time unit and treatment of costs. For a thorough analysis see (Guthrie, 2006).

[11] This is because once the investment is made the owner has incentive to continue operating the asset as long as the revenue is greater than the operating costs.

to protect them against such potential opportunism (Besanko & Spulber, 1992; Joskow, 2013; Spiller, 2013).

The impact of regulation can be summarised by using the formula *(6)* and explanation presented in Table 2 (Alexander et al., 1996):

(6) $$\pi = PQ - C_x(Q) - C_n(Q)$$

$where$:

$\pi = Total\ profit$

P= unit price;

Q= quantity sold;

$C_x = exogenous\ costs\ (uncontrollable);$

$C_n = endogenous\ costs\ (controllable);$

Table 2 - Profit parameters covered by different regimes (pure cases, hybrids possible) (Alexander et al., 1996)

Regulatory System	**Covered by Regulator**	**Ignored by Regulator**
Price cap	P	Q, C_x, C_n
Price cap with cost pass through	P, C_x	$Q, C_n,$
Revenue Cap	PQ	C_x, C_n
Rate of Return	P, C_x, C_n	

Elements not "covered" by the regulator are not recovered by the firm, thus create incentive for operating efficiently (Alexander et al., 1996). When dealing with public companies, however, this estimation of the relationship is more complicated as the result of the lengthy hearing process is anticipated by the market (Guthrie, 2006). For instance, a significant beta drop has been found in the UK, when a newly elected government was considering the move from Price Cap Regulation to Total Revenue Cap (Grout & Zalewska, 2006).

2.6 South Africa's Petroleum Storage Tariff Setting Methodology

Based on the analysis framework proposed by Alexander (1996) and Guthrie (2006), the South African regulatory regime can be classified as a hybrid between Total

Revenue Cap and Rate of Return, with a regulatory interval of three to five years (Alexander et al., 1996; Guthrie, 2006).

In determination of the Allowable Revenue the Regulator specifies that:

> *"The cost of equity must be determined by the Capital Asset Pricing Model (CAPM) in real terms by applying the following formula"* ("Tariff setting methodology," 2011):

(7) $$r_e = r_f + CRA + \beta MRP + SSP + \alpha + LP$$

Where[12]:

CRA = country risk adjustment;

MRP = post-tax, real market risk premium;

SSP = Size premium;

α = project specific risk if applicable;

LP = liquidity premium;

In relation to MRP, the Regulator clarifies that it is:

> *"The proxy used for the market is the Johannesburg Stock Exchange (JSE) All Share Total Return Index (ALSI) for the preceding 300 months as at twelve months before the commencement of the tariff period under review"("Tariff setting methodology," 2011).*

In relation to beta, the Regulator clarifies that it is:

> *"Systematic risk parameter for regulated entities providing pipeline, storage and loading facility services" ("Tariff setting methodology," 2011).*

Table 3 summarises the proxy companies used by the Regulator in estimating the appropriate beta.

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[12] Details and methods used to estimate proxies are given in the methodology pp. 14-15.

Table 3 - Proxies used by NERSA ("Proxies and Beta Values," 2014)

Country	N	USD '000	Market Cap. Weighted %	β_a Contribution
US	14	85 205 857	43.30%	0.13
CZ	1	1 782 830	0.91%	0.00
IN	1	5 909 385	3.00%	0.06
RM	1	97 212 342	49.40%	0.29
CN	1	6 664 252	3.39%	0.01
Total	18	196 774 668	100%	0.49

It is evident that heavy weighting is given to the developed US economy followed by the Russian emerging economy.

There is limited evidence to suggest consideration being given to factors that have been identified to create a difference in cost of equity, such as place in the value chain and regulatory scheme and regulatory events (Schaeffler & Weber, 2013). As an example, no evident consideration has been found to be given to the type of regulation that is applied in these jurisdictions from which the list of proxies is compiled. Guthrie (2006) summarises different findings that have shown that the different characteristics of regulation will impact the cost of capital (Guthrie, 2006). For instance, Fuel Adjustment Clauses (allowing the utility to increase its rate in response to fuel price increase) introduced in US electric utilities regulation during the 1970's have been shown to reduce the cost of capital (Clarke, 1980). Frequency of regulatory hearings has also been shown to impact the cost of capital (Evans & Guthrie, 2006, 2012). In addition, no evidence has been found of why the proxies used are a good comparison to the South African situation and market dynamics as suggested by (Pereiro, 2010), or the reasoning behind using a single a firm in a weighted proportion of 49.4% or mitigation of the risks introduced by such selection (Damodaran, 2008).

3 Research Hypotheses

In light of the literature review, there is merit in evaluating the potential impact of the methodology set by the Regulator and assess whether it is conducive to new investments and new entrants.

3.1 Definitions

Let:

- r_R equal the return approved by the Regulator;
- r_M equal the return earned by the Market Portfolio;
- r_B equal the risk-adjusted return for an independent storage asset;
- r_A equal the actual return earned by the regulated firm;

Then:

3.2 Hypothesis **A**: a private regulated firm has achieved equal returns than those of the market portfolio.

H0A: $r_R = r_M$

H1A: $r_R \neq r_M$

3.3 Hypothesis **A1**: the regulated firm will earn different returns that those predicted by the Regulator due to actual utilization differences.

H0A1: $r_R = r_A$

H1A1: $r_R \neq r_A$

3.4 Hypothesis **B**: a private regulated firm has returns as variable as those of the market portfolio.

H0B: $\sigma_{r_R} \neq \sigma_{r_{RM}}$

H1B: $\sigma_{r_R} = \sigma_{r_{RM}}$

3.5 Hypothesis **C**: A private regulated firm operating in a South African liquid fuel storage industry is earns less than the calculated risk adjusted rerun:

H0C: $r_R \geq r_B$

H1C: $r_R < r_B$

4 Research Method

This research was a descriptive quantitative research. This method is best suited to answer the research questions as they seek to describe the characteristics of a phenomena. Further, as there is a broad theoretical background on the impact of regulation, this research built upon previous understanding of the research problems.

4.1 Research Process

A computerised model, which reflects the current regulatory regime was developed. This model was validated against the current methodology through replication of the Regulator published model and test case. The model is sufficiently detailed to cover the timeframe as well as different aspects of the tariff setting process, including operating expenses.

Using the data available and published by the Regulator, the model simulated the return that the regulated firm would have earned over the analysis timeline. While several parameters are used to determine the actual value, the simulation was focused on *actual utilisation* in order to quantify the impact on revenue.

The model was built such that it is be able to generate random numbers (where required) as well as regular inputs to simulate the regulated company financial performance. This was then translated into cash flow and an IRR calculated. These results were analysed over the analysis timeline and compared with the market portfolio return and analysed for both actual differences as well as volatility (measured as standard deviation of returns of the regulated firm and the market portfolio) of returns. This addressed the examination of H_A, and H_B.

Examination oh H_C will was done in two ways. First, a theoretical analysis of the risk adjusted return was performed and calculation of the cost of equity is presented taking into consideration the various factors that affect the cost of equity (e.g. private firm). The model proposed by (Pereiro, 2010) and the Total Beta adjustment described in (5) were applied in this analysis. A comparison of the simulated results to the benchmark risk-adjusted return was performed and the results analysed.

4.1.1 Analysis Method

4.1.1.1 r_R

The return earned by the regulated firm was calculated through an index created.
The index was defined as:

$$Index_t = \frac{CFE_t}{Equity\ Invetsed} \quad (8)$$

Where:

$CFE_t = Cash\ Flow\ to\ Equity$[13] $in\ period\ t$;

This cash flow will change as the various scenarios are examined[14].

4.1.1.2 r_M

In order to estimate the returns earned by the market portfolio the compounded return earned by the market portfolio was calculated from information made available by the Regulator. The series of values was then transformed to create a yield estimate, similar to that described above, using the conversion:

$$Index_t = \frac{(ALSI_{t-1} - ALSI_t)}{ALSI_{t=0})} \quad (9)$$

Where:

$ALSI_t = Index\ Value\ at\ time\ t$;

[13] Dividends net of WHT plus Shareholders loans repayment.
[14] For case details see Table 11 - Examined Cases.

4.1.1.3 Examination of H_A

Examination of H_A was performed through a t-test for equality of means performed on an IBM SPSS® version 22 software package.

4.1.1.4 Examination of H_B

Examination of H_B was done through an Analysis of Variance (ANOVA) performed on the returns earned per annum. In this analysis for calculating the variance of, an index needed to be created in order to simulate the returns earned by the firm in relation to the previous period and make it comparable to the market portfolio performance. This has been done such that:

$$Index_t = \frac{CF_t}{CF_{t-1}} - 1 \quad (10)$$

Where:

$Index_t = index\ value\ at\ time\ t$;

$CF_t = cash\ flow\ to\ equity\ at\ time\ t$;

$CF_{t-1} = cash\ flow\ to\ equity\ at\ time\ t-1$;

4.1.1.5 H_C

While for the Pure Play companies, information is directly observable, for each of the integrated proxies, the following process, proposed by (Damodaran, 2012) and utilising the technique proposed by (Berger & Ofek, 1995) was implemented:

- Identification the segments the comparable company operated in, based on the Management Discussion and Analysis (MD&A) section in the latest audited financial statements.
- Each segment was given a classification to an industry sector, and these industry sector medians were used to estimate the benchmark statistic.
- Total Enterprise Value (TEV) for the company was estimated, where

$$TEV = MV\ of\ \ Equity + MV\ of\ Debt - Cash\ and\ Cash\ Equivalents + Preferred\ Stock + Minority\ Interests \quad (11)$$

This was estimated using ("DataStream," 2014).

- Market value of common and preferred equity (if any) was obtained from reported values.
- Industry median for TEV/EBITDA were applied to each segment the comparable company operates in, and were obtained from (Damodaran, 2014).
- The ratio obtained was applied to the latest annual reported segment EBITDA to obtain a segment EV.
- A proportion was calculated for each segment representing the segment proportion in the company's EV (i.e. Segment EV/TEV).
- Median unlevered beta for each segment the company operates in was obtained from publicly available information. (Damodaran, 2014). Company unlevered beta can be observed directly.
- The unlevered beta contribution of each segment was estimated as the proportion of the segment to the TEV (i.e. EV/TEV) multiplied by the industry sector median unlevered beta as detailed in 8.
- The storage segment's beta and EV/EBITDA multiples can then be derived:
    - EBITDA multiple such that when applied to the storage segment EBITDA, the total company EBITDA is equal to the latest reported.
    - Storage sector unlevered beta such that when applied to the storage segment proportion, company unlevered beta is equal to observed value.
- A Total Beta for the petroleum storage business was calculated using the estimated segment unlevered beta and the firm's beta correlation to market.
- The Total Beta described was then re-levered at the median Debt-to-Equity

("D/E") ratio for the proxies[15].

4.2 Unit of Analysis

The unit of analysis was the return earned by the firm in a specified time period.

4.3 Population

The population of the study is the economically regulated companies in the petroleum storage industry in South Africa. As most companies are under some form of regulation, this is bounded by those firms over which the Regulator has control over the one or more of the elements presented in (6).

4.4 Sampling

The sampling in this research project can be divided into two main categories as described below.

4.4.1.1 Industry

Firstly, the research focused on the petroleum industry, and specifically on the petroleum storage sector. This selection has several reasons. First, this industry has a significant presence of privately owned companies operating under regulation. Second, the methodology is well established and publicly available as are regulatory interactions in the industry. The population is defined as the companies dealing only in petroleum storage and listed on the NYSE. Because for two of the companies listed no financial data is reported on Datastream®, the sample consisted of the firms for which information was available.

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[15] The median D/E for the sample was preferred to that of the oil and gas industry. The re-levering done was in order to give an indication of value. Actual model utilised assumed (changing) gearing ratios as per the methodology.

4.4.1.2 Time

The other sampling element related to the period of time used to compare market portfolio returns to regulated returns. This period was selected according to the availability of public information. Specifically, this period was the one correlating to the Regulator published information with regard to market returns (1985-2013).

In terms of the operational information (such as cost of the assets, operating expenditure, borrowing rate etc.), benchmark data is used, extracted from the range made available through the public versions. We note that as a result of the unit of analysis being return earned, absolute numbers in this context were deemed to be of little significance. In addition, the methodology allows the operator to:

> *"Recover the reasonable operational and maintenance expenses of the storage and Loading facility in the year in which they are incurred" ("Tariff setting methodology," 2011).*

Thus, these expenses have minimal impact on the shareholder return (to the extent these are reasonable in the eyes of the Regulator, which is a basic assumption made).

4.4.1.3 Market Portfolio

The market portfolio applied was the Regulator published data, comprised of the Johannesburg Stock Exchange (JSE) J203 ALSI Total Return. The Regulator provides this index for the analysis time frame.

4.5 Limitations

The very nature of the study imposes significant limitations:

- The study constructed a computerised model to simulate reality, and as such made some simplifying assumptions. The resulting data series was then used to compare the regulated company performance to the historic performance. Both of these elements limit the generality of the inferences made.

- It has long been established that creating the theoretical market portfolio is unobservable in practice (Thomson & Reddy, 2013). The use of (incomplete) estimation through proxies may lead to an incorrect conclusion.
- In estimating the risk adjusted return, certain aspects required judgment based estimation (For example, which companies business' is closest to that of an independent storage operator in South Africa, in order to estimate the beta, i.e. which firms are considered to be the "Pure Play"). It is conceivable that another reasonably constructed proxy list could lead to different conclusions. Thus, inference can be made with limited certainty.
- The inference will be limited by the very nature of the study which deals with the South African regulation in the petroleum storage sector. South Africa as an emerging market will have different circumstances than other countries and indeed other emerging markets.
- Some part of the analysis utilises what is considered to be the mature risk premiums and other cost of equity components (i.e. MRP, Risk Free Rate) averages calculated by the Regulator over the past 25 years. This is then used in comparison to historical performance. This limits the generality of results as the assumption was made that the average obtained over the past 25 years is close to the "true" value for the South African economy.

5 Results

5.1 Model Validation

The Regulator defines:

$$AR = (RAB \times WACC) + E + D \pm C + T \quad (12)$$

Where:
$AR = Allowable\ revenue$;
$RAB = Regulatory\ Asset\ Base$;
$WACC = Weighted\ Average\ Cost\ of\ Capital$;
$E = Expenses: operating\ and\ maintanence$;
$D = Depreciation\ and\ amortization$;
$C = Clawback\ adjustment$;
$T = Tax$;

The model[16] was built using Microsoft Excel® 2013 software and in a Windows 8.1® operating system environment, which calculates the AR given the parameters required[17]. In the validation process results of the Regulator published model are compared against the model generated results, on key parameters. Table 4 displays the results obtained in the model developed in the Trended Original Cost parameter. It is noted that the model developed applies a different method for debt repayment calculation which causes minor differences between the two models. These are considered immaterial to the questions at hand (a difference of ZAR 790 thousand over a 25 year period, in which the developed model is higher than the regulator model). To illustrate this difference Table 5 displays the comparison in which the model Developed applies the Regulator debt repayment method.

[16] The model manual is submitted under Annexure 2 – Model Manual. The electronic model is submitted separately.
[17] Some parameters (e.g. tax) are calculated. See ("Tariff setting methodology," 2011) for the full methodology.

Table 4 - TOC Validation (ZAR '000'000) First Ten Years

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6	Yr. 7	Yr. 8	Yr. 9	Yr.10
Trended Operating Cost C/f										
Model	100.80	101.43	101.88	102.12	102.12	101.86	101.34	100.49	99.31	97.76
Regulator Model	100.80	101.43	101.87	102.10	102.10	101.85	101.31	100.47	99.29	97.73
Inflation Write Up										
Model	5.00	5.04	5.09	5.09	5.11	5.11	5.11	5.07	5.02	4.97
Regulator Model	5.00	5.04	5.07	5.09	5.11	5.11	5.09	5.07	5.02	4.96

Table 5 - Allowable Revenue ZAR '000'000 –New model developed utilising Regulator debt repayment method.

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6	Yr. 7	Yr. 8	Yr. 9	Yr.10
Model	14.46	14.71	14.97	15.18	15.38	15.57	15.76	16.17	16.70	17.25
Regulator Model	14.46	14.71	14.95	15.17	15.38	15.57	15.74	16.16	16.70	17.24

Table 6 shows the WACC calculation applied in the model developed, demonstrating identical results to the Regulator model, while Table 7 shows the difference in the Allowable Revenue calculation (the difference as a result of the debt repayment, as previously discussed).

Table 6 - Year 1 WACC Comparison

Year 1 WACC		
	Regulator	Model
Assume Return on Equity post tax [Nominal]	13.37%	13.37%
Cost of Debt pre-tax	12.00%	12.00%
tax rate	28.00%	28.00%
WACC Nominal post tax	10.53%	10.53%
Real WACC	5.27%	5.27%

Table 7 - Allowable Revenue ZAR '000'000 New model developed utilising applied debt repayment method

	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6	Yr. 7	Yr. 8	Yr. 9	Yr.10
Model	14.46	14.84	15.08	15.26	15.45	15.62	15.79	16.17	16.70	17.25
Regulator Model	14.46	14.71	14.95	15.17	15.38	15.57	15.74	16.16	16.70	17.24

Lastly, Table 8 displays the resultant IRR, which is the more notable difference between the two models, as a result of the way the equity return is calculated. While the regulator model makes use of the cash flow available for equity, the model developed utilises the *actual shareholder cash flow* to calculate this IRR. The difference results from applying "real world" funding considerations, which limit the actual distributions to shareholders if certain debt covenants are not met (see (Esty, 2007) for general principals of project finance). This, in addition to the model utilising a Notional Tax calculation (as opposed to the Actual Tax in the calculation) results in a difference between the calculated IRRs of the two models. When applying the IRR calculation on the Cash Flow Available for Equity in the developed model, this results in a 0.3% difference, in which the developed model understates the regulator calculated IRR.

Table 8 - IRR Calculated on Cash Flow Available for Equity

Model	9.90%
Regulator Model	10.20%

5.2 Simulation Module

Figure 2 presents the simulation module programmed into the model using Excel Visual Basic for Applications (VBA). The actual code applied is presented in Table 3.
The model tolerance allowed has been set at ZAR 1[18].

5.3 Model Inputs

In order to simulate the inputs required in (12), public versions of tariff applications have been used. As some firms require the values to remain confidential, the Regulator publishes a range for the key values in certain applications. These assumptions are summarised in Table 9.

[18] As an example, if total assets on the balance sheet are different from the total liabilities by less than ZAR 1, the model will not indicate an error. See Annexure 2 – Model Manual for a full list of integrity checks. performed by the model.

Figure 2 - Simulation process logical flow

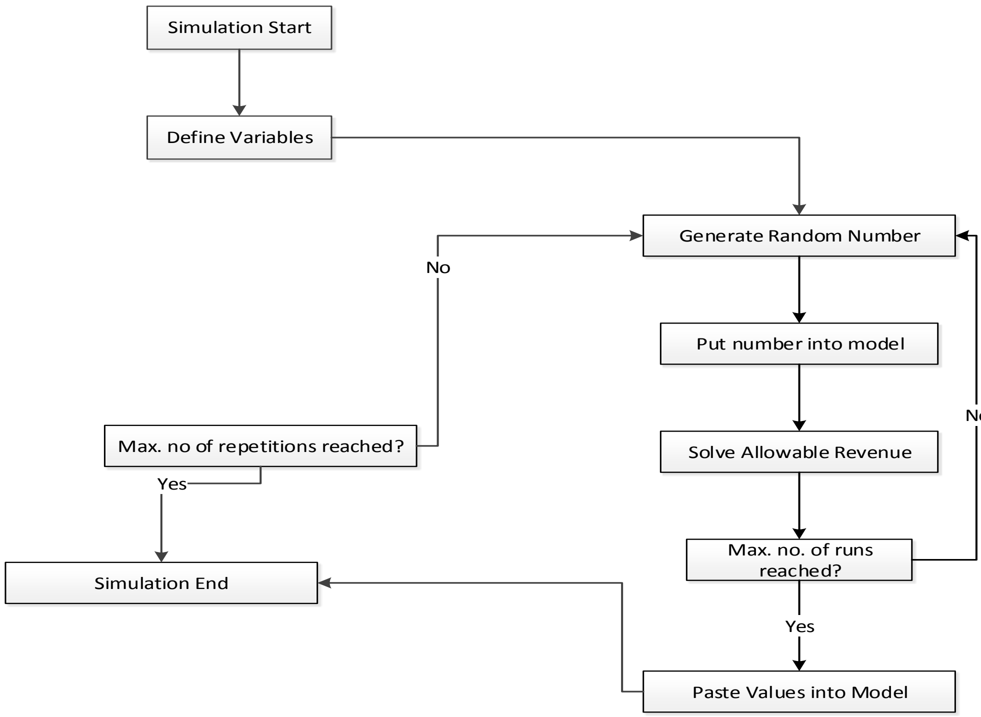


Table 9 - Inputs (Vopak RfD, 2012)

Item	Vopak Application (ZAR '000'000)	% of Asset Value
Net Working Capital	22.70	37%
Asset Value	61.5	100%
Operating Expenses	60.45	98%

The various other values required are summarised in Table 10 and are provided by the Regulator.

Table 10 – Base Case Regulated Assumptions

Assumption	Value	Source
Real Risk Free Rate	4.08%	(*Economic Data 2014*, 2014)
Real MRP	6.39%	(*Economic Data 2014*, 2014)
Starting CPI	6.10%	(*CPI Forecast 2014*, 2014)
Beta (unlevered)	0.49	(*"Proxies and Beta Values," 2014)*

In addition to these regulated assumptions, an assumption has to be made on the variability of quantity demanded year-on-year. In order to estimate these changes, historical fluctuations in consumption were used as the base case variability, as displayed in Figure 4.

Figure 3 - Actual Simulation Code

```
Option Explicit
Public Sub RunSimulation()

   Application.EnableEvents = False                          'prevent event triggers
   'Application.ScreenUpdating = False                        'disable screen update
   Dim i As Integer, j As Integer, k As Integer, Repetitions As Integer         'define integer variables
   Dim counter As Integer
      j = Range("Operation_Duration").Value2                   'number of times to run equals number of operating years
   Dim ActualUtilisation As Double, StartingUtil As Double                       'Actual Utilisation is a % of expected
   Dim UpperLimit As Integer, LowerLimit As Integer              'define limits of forecast (read from "Simulation"
sheet)
   Dim StartingUpperLimit As Integer, StartingLowerLimit As Integer   'Starting point random
   StartingLowerLimit = Range("StartingMin").Value2       'read value
   StartingUpperLimit = Range("StartingMax").Value2       'read value
   UpperLimit = Range("Ubound").Value2                     'read value
   LowerLimit = Range("Lbound").Value2                     'read value
   Repetitions = Range("Repetitions").Value2                'read number of times to run simulation cases

 For k = 1 To Repetitions

      'random starting point

     StartingUtil = Application.WorksheetFunction.RandBetween(StartingLowerLimit, StartingUpperLimit)
      Range("Starting_Util") = StartingUtil / 100

   For i = 1 To j

           'generate random number

           ActualUtilisation = Application.WorksheetFunction.RandBetween(LowerLimit, UpperLimit)
           Range("Utilisation")(i) = ActualUtilisation / 100           'put random number into model

              Do

                    Range("AR")(i).Copy                                        'eliminate differences
                    Range("Nersa_Paste")(i).PasteSpecial xlPasteValuesAndNumberFormats        'eliminate
differences
                    counter = counter + 1

              Loop Until Abs(Range("Nersa_Delta")(1, i).Value2) <= Range("Tolerance").Value2        'until no
difference

      Next i                                                     'next operating year

              Range("Live_Results").Copy                             'copy live results
              Range("Paste_Results")(k, 1).PasteSpecial xlPasteValuesAndNumberFormats      'paste results into table
              Range("Live_Utilisation").Copy                         'copy utilisation values
              Range("Utilisation_Paste")(k, 1).PasteSpecial xlPasteValuesAndNumberFormats 'paste into table

   Next k                                                     'next case iteration

   Application.EnableEvents = True                          'enable event triggers on procedure exit
   Application.ScreenUpdating = True                          'enable screen update on procedure exit
End Sub
```

5.4 Simulated Scenarios

Several scenarios have been created in order to test the hypotheses. The assumptions used in each of these scenarios are summarised in Table 11.

For each of the cases, the following is defined as the main case parameters:

- Risk Free – a choice between actual (historical) rates and the regulated (current) rate.
- Volume Utilisation – a choice between the actual (historical) changes in quantity demanded year-on-year as displayed in Figure 4, and a random number generated by the simulation module.
- MRP – a choice between the value know at the time (defined in the methodology as the minimal of 300 months, or available data ("Tariff setting methodology," 2011), and the regulated (current) number. Figure 5 displays the relationship between the compounded values applied in the model. These are based on the Regulator used data (*Economic Data 2014*, 2014).
- Beta – value applied varies between value calculated in section 5.6 and displayed Table 13, and the current regulated value.
- CPI – a choice between the actual (historical) value and the current regulated value.
- Debt to Capital – input value in order to analyse the impact of gearing on equity return.
- Operating expenditure - input value in order to analyse the impact of operating expenditure on equity return.
- Interval Method – a choice between setting up the interval length to manual or the calculated.
- Interval length – for the calculated method above, how long is in the interval applied.

Figure 6 displays the relationships between some of the key parameters applied in the model.

Table 11 - Examined Cases

Component/Case	Base	Base Utilisation	Historical Utilisation	Analysed Beta	Total Beta	Opportunistic	MRP as known	Increased Opex	Increased Gearing
Risk Free	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated
MRP	Regulated	Regulated	Regulated	Regulated	Regulated	As Known	As Known	Regulated	As Known
Beta	0.49	0.49	0.49	0.62	1.17	0.49	0.49	0.62	1.17
CPI	Regulated	Simulated	Historical	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated
Volume Utilisation	Regulated	Simulated	Historical	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated
Debt to Total Capital	60.00%	60.00%	60.00%	0.00%	0.00%	0.00%	0.00%	0.00%	80.00%
Operating Expenditure Increase	0%	0%	0%	0%	0%	0%	0%	20%	0%
Interval Method	Regulated	Regulated	Regulated	0	0	Manual	Regulated	0	0
MRP Interval	5	5	5	0	0	5	1	0	0

The case described are analysed on several parameters:

a. Comparison between Base and Base Utilisation and Historical Utilisation will quantify the impact of achieved utilisation and its impact on the achieved return.
b. Comparison between Base and Analysed Beta and Total Beta will quantify the impact of beta applied.
c. Comparison between Base and Opportunistic and MRP as known will quantify the impact of the length of the interval.
d. Comparison between Base and Opex proportion will quantify the impact of increased operating expenditure.
e. Comparison between Base and Increased Gearing will quantify the impact of the increased leverage.

Figure 4 - South Africa Change in Fuel Consumption YOY (μ=3.34%, σ=3.92%)

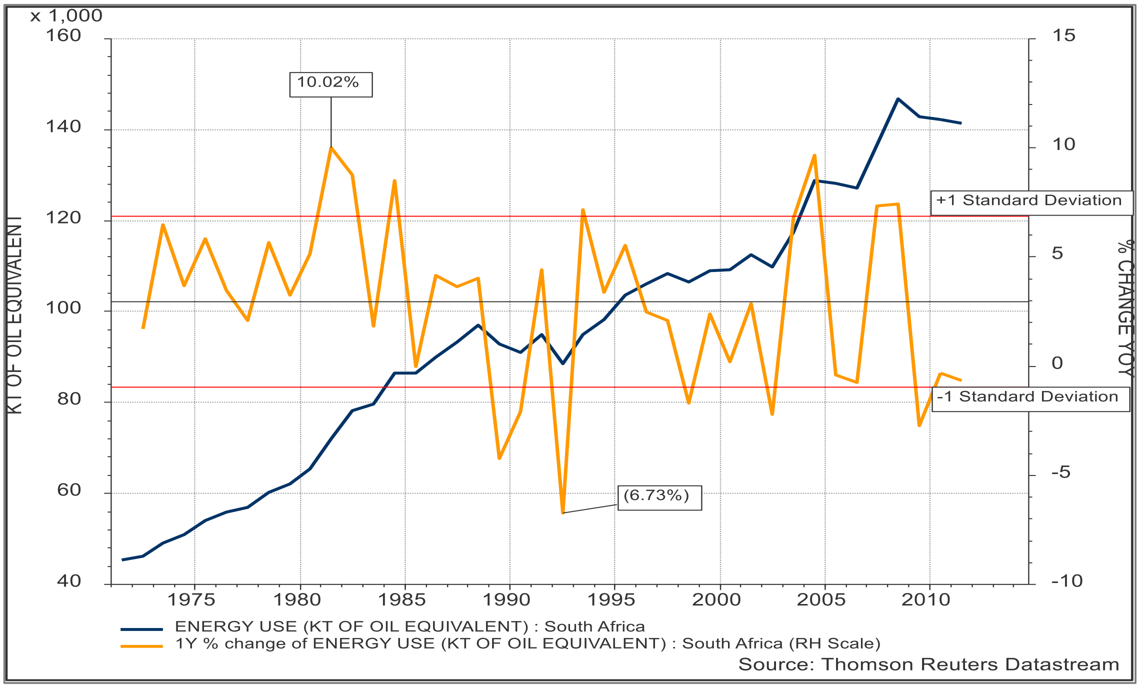


Figure 5 - Risk Free, Market Return and MRP as known

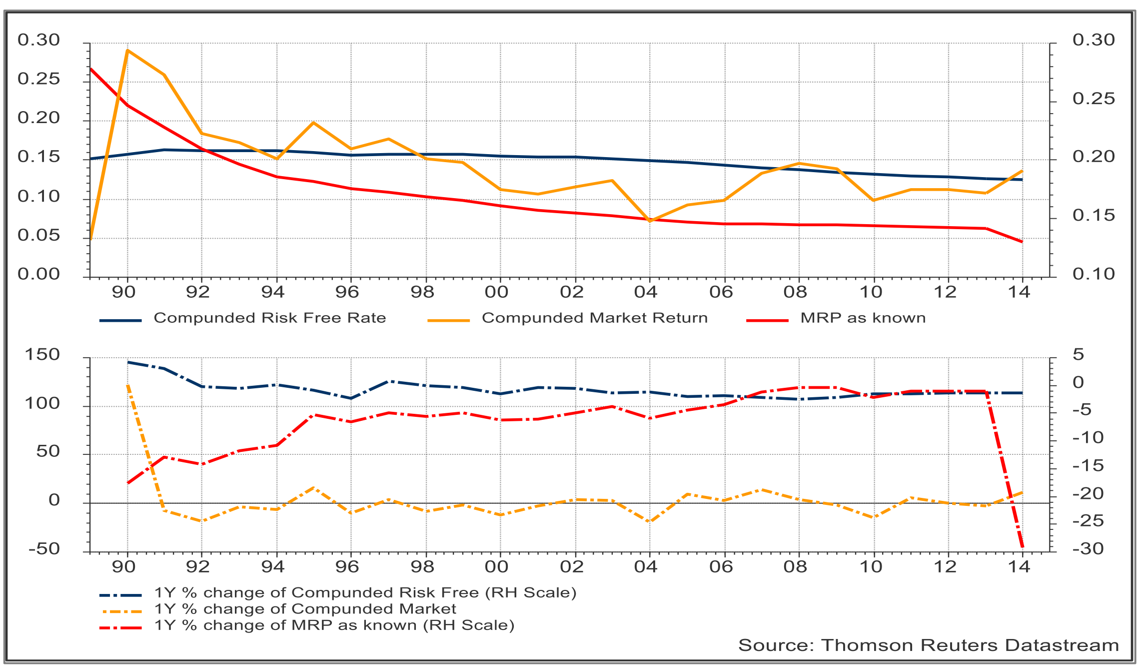


Figure 7 displays a (simplified) potential regulated entity opportunistic behaviour under which the entity would approach the Regulator every time Equity Risk Premium exceeds the (then) current value, subject to the maximum time interval of five years. This would result in seven tariff settings throughout the 25 year period.

Figure 6 - Main Indicators and Relationships applied in Case Construction

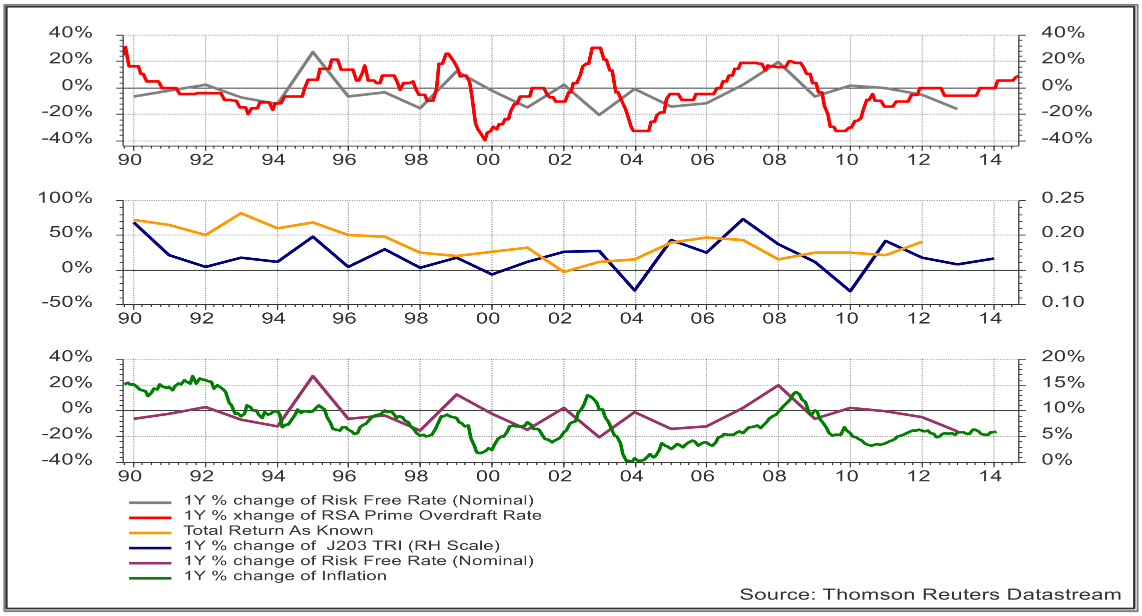
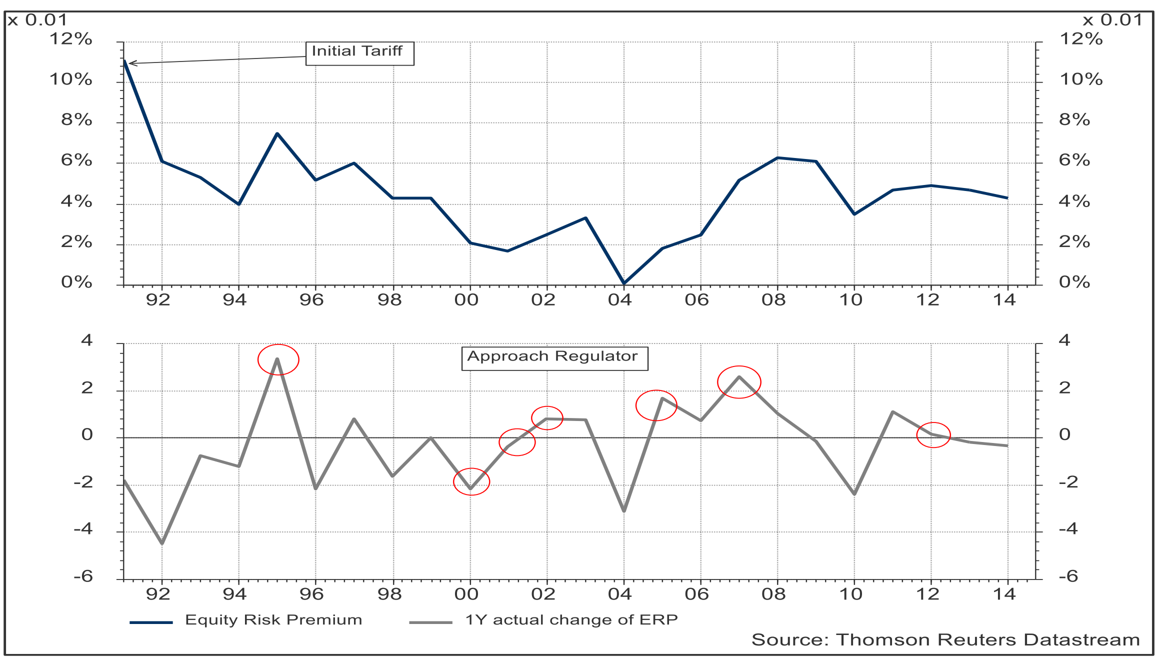


Figure 7 - Simplified opportunistic behaviour of the regulated firm



5.5 Descriptive Case Results

Figure 8 shows the achieved equity IRRS for the cases modelled. The highest return is achieved when applying the Total Beta calculated. The second highest return is then achieved through the simplified demonstration of the opportunistic behaviour. As expected, no impact is found for increasing the operating expenditure.

Figure 8 - Achieved Equity IRRs

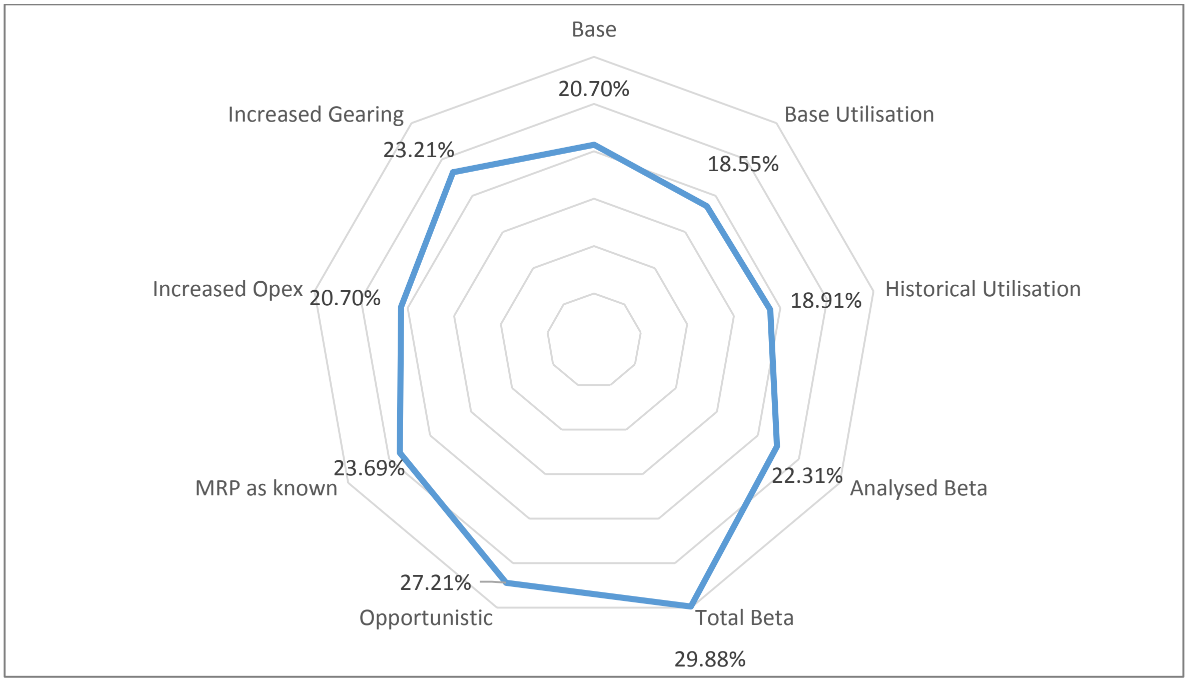


Figure 9 - Average WACC and Standard Deviation

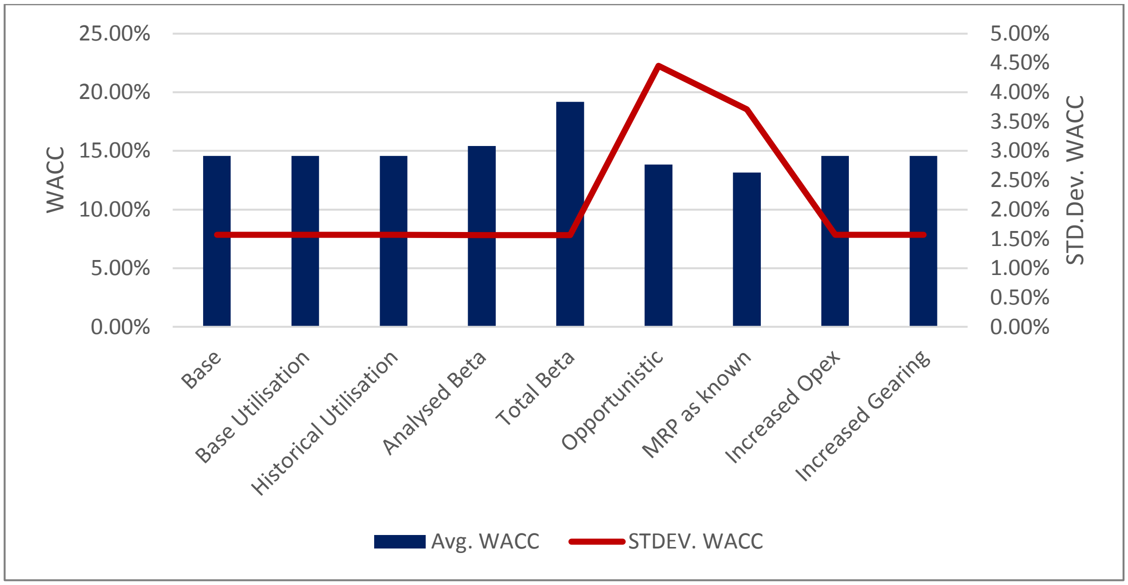


Figure 9 displays the average WACC and standard deviation. Total Beta displays the highest WACC (19.17%) followed by the analysed Beta scenario (15.42%). Increased Opex seems to have no effect on the WACC, and the Increased Gearing scenario, has limited effect. This is due to the short term impact of the increased gearing, effectively closed out by year seven, as displayed in Figure 10.

Actual utilisation has an effect on the actual IRR achieved, as can be seen through the differences in the Equity IRR between Base, Base Utilisation and Historical Utilisation cases, note that although the average WACC is identical in all cases, difference between the Base Case (assuming 100% utilisation) to other ones can reach as much as 4.57%. These differences are displayed in Figure 11. In these cases the average share of the Claw-back component in the allowable revenue ranges between 18-21%, as displayed in Figure 12.

Figure 10 - Base Case vs. Increased Gearing WACC per Annum

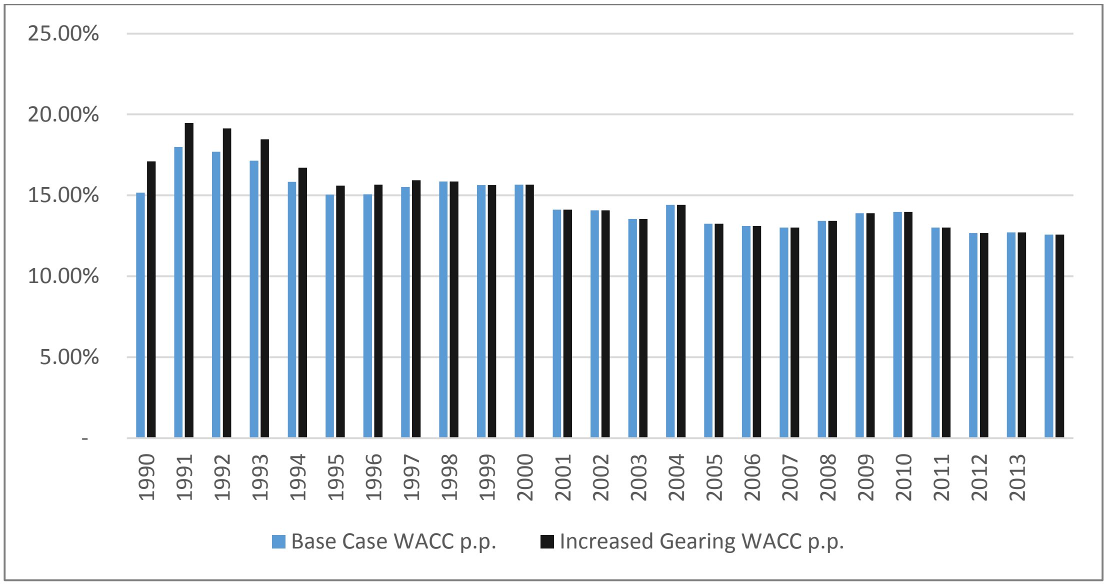


Figure 11 - Allowable vs. Achieved Revenue (ZAR '000)

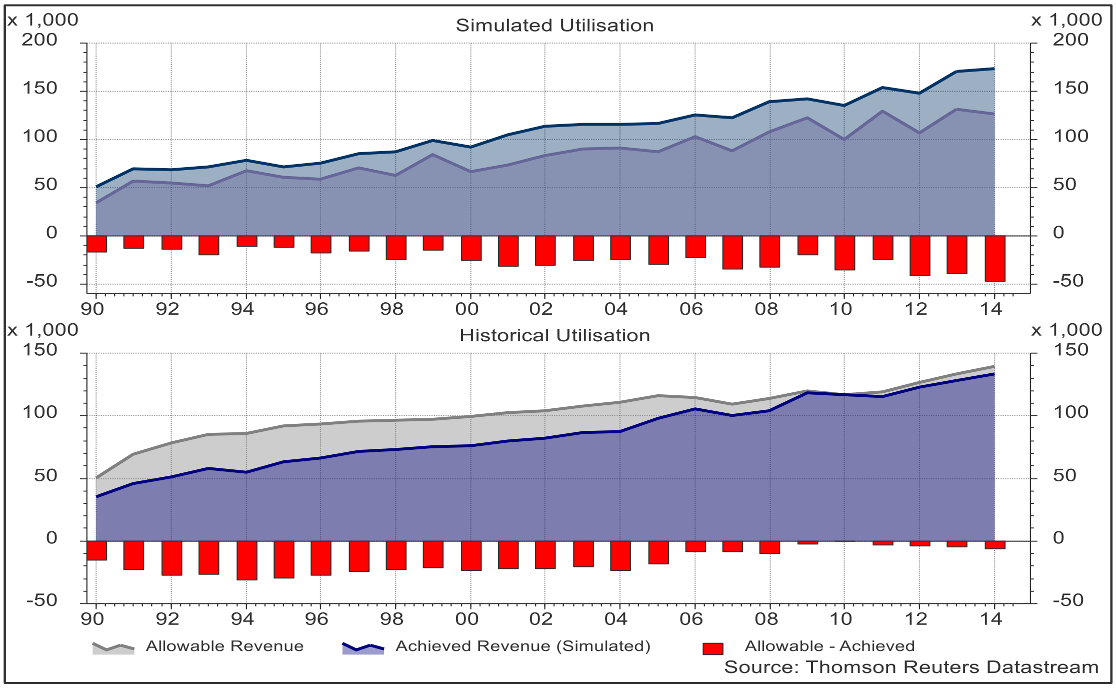
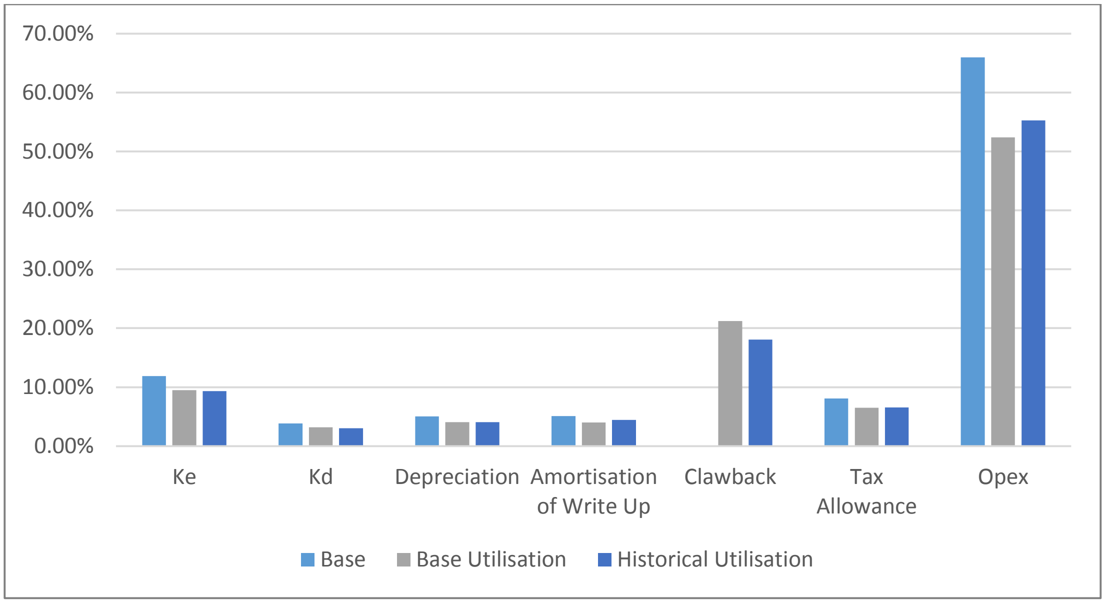


Figure 12 - Allowable Revenue Composition



5.6 Calculated Cost of Equity

The following section deals with the calculation of the required equity return. This is done through the application of the model suggested by (Pereiro, 2010) and presented in Figure 1. Following the decision tree ends at a dilemma at the final branch, of choosing between whether the Emerging Market class is good representative of the local market dynamics[19]. We therefore choose not to limit the sample based on this classification.

5.6.1 Data

Initial screening of firms was done through the DataStream® database, and included firms operating in the oil & gas sector, in the services sub-category[20]. The list, comprised

[19]As the regulator uses a mix of emerging and US firms, this seems to suggest that market dynamics are not fully understood by the regulator itself. While such determination is beyond the scope of this paper, some evidence may be found in the vastly different number of firms with market cap greater than USD 5bn between the emerging markets class and the US.
[20] The following is a "Search Ref" that if pasted into the Navigator screen, will yield the initial list identified:

of 198 global equities, was then screened to identify firms which could be considered Pure Play, through the database-provided description of the firms' business and the number of segments in which the firm operates in. We note that as limited number of firms operate in a single storage segment, the proxies chosen represent close comparable firms to the (single storage segment) Pure Play firm. In addition, two additional integrated firms were selected, for which the storage sector represented significant portion of the firm's business.

5.6.2 Proxies

The list of the proxies chosen is displayed in Table 12[21]. For convenience, the narrative description of the firms' business is provided under Annexure 1 ("DataStream," 2014). Of the shortlisted firms, two of the firms (ARCX, WPT) were excluded as no data was available (firms trading for less than 12 months). One other company (ENGY-5) was excluded because the firm was declared bankrupt and another (OIL) because of its small size which could introduce liquidity biases. The ending proxy list was comprised of 6 Pure Play companies for which sufficient data can be found, and additional 2 integrated firms (U:ETP, U:GEL).

5.6.3 Pure Play Result

The results for the remaining firms are detailed in Table 13, derived using a marginal tax rate of 40%. The weighting factor is based on the relative market cap of the firm in comparison to the sample. The observed beta was unlevered using (3), and assuming a debt beta of zero[22].

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cz1OJnN1YnNldD1tZXgxJTdjMy0yMzg2MzFEU0FMTCU3YzMtMjM4NjMwRFNBTEw1.

[21] While we acknowledge different regulatory regimes might have an impact on the proxies' performance, correcting for such distortions is impossible given the lack of information. This is discussed in the Chapter 6.
[22] See (Damodaran, 2012)

Table 12 - US Proxies (USD '000'000)

Symbol	Company Name	Country of Trade	Status
TLP-N	TRANSMONTAIGNE PARTNERS LP	US	Included
U:MMP	MAGELLAN MIDSTREAM PARTNERS LP	US	Included
ENGY-5	CENTRAL ENERGY PARTNERS LP	US	Default
U:ARCX	ARC LOGISTICS PARTNERS LP	US	No Data
U:TLLP	TESORO LOGISTICS LP	US	Included
U:OILT	OILTANKING PARTNERS, L.P.	US	Included
OIL-RO	OIL TERMINAL SA	RO	Excluded
U:NKA	NISKA GAS STORAGE PARTNERS LLC	US	Included
U:HEP	HOLLY ENERGY PARTNERS, L.P.	US	Included
U:WPT	WORLD POINT TERMINALS	US	No Data
U:ETP	ENERGY TRANSFER PARTNERS LP	US	Included
U:GEL	GENESIS ENERGY PARTNERS LP	US	Included

Table 13 - Pure Play Firms

Firm	Beta (Levered)	Weighting	D/E	Unlevered	Correlation To Market	Total Beta
TRANSMONTAIGNE PARTNERS LP	0.51	4%	34.21%	0.42	39.9%	1.05
MAGELLAN MIDSTREAM PARTNERS LP	0.70	46%	15.72%	0.64	54.4%	1.17
TESORO LOGISTICS LP	0.82	22%	34.35%	0.68	35.6%	1.91
OILTANKING PARTNERS, L.P.	0.73	3%	4.19%	0.72	37.5%	1.91
NISKA GAS STORAGE PARTNERS LLC	0.71	12%	159.27%	0.36	35.2%	1.03
HOLLY ENERGY PARTNERS, L.P.	0.66	13%	39.95%	0.53	42.7%	1.25
Market Cap. Weighted Average	0.40		12%	0.62	26.9%	1.34

5.6.4 Integrated Firms Results

The analysis results are displayed in Table 14 -Table 15. The analysis implies an unlevered beta for the storage segment of 0.55 for U: ETP and 0.73 for U: GEL.

Table 14 - U: GEL Analysis

Business	EBITDA	Sector	EV/EBITDA	Implied EV	Proportion	Unlevered Beta
Pipeline Transportation	108	Oil/Gas Distribution	21.29	2 299	36.2%	0.19
Refinery Services	75	Oil/Gas Distribution	21.29	1 597	25.1%	0.13
Supply and Logistics	96	Storage	25.66	2 464	38.7%	0.28
Total	2744	Oil/Gas (Integrated)	14.70	6 360	100.0%	0.61

These results were then integrated with the Pure Play results to derive the various parameters as displayed in Table 16.

Table 15 - U: ETP Analysis

Business	EBITDA	Sector	EV/EBITDA	Implied EV	Proportion	Unlevered Beta
Intrastate Transportation and Storage	601	Storage	19.01	11 424	28.33%	0.16
Interstate Transportation and Storage	1013	Storage	19.01	19 256	47.75%	0.26
Midstream	438	Oilfield Svcs/Equip.	9.42	4 128	10.24%	0.05
NGL	209	Oil/Gas (Integrated)	5.49	1 148	2.85%	0.02
Sunnoco Logistics	219	Oil/Gas (Integrated)	5.49	1 203	2.98%	0.02
Retail Marketing	109	Oil/Gas Distribution	21.29	2 321	5.75%	0.03
Other	155	Oil/Gas (Integrated)	5.49	851	2.11%	0.02
Total	2744	Oil/Gas (Integrated)	14.70	40 328	100.00%	0.56

The market cap weighted average of 1.17 was then used in estimating the levered total beta, which resulted in a levered total beta of 1.41.

Table 16 - Combined Results

Firm	Weighting	D/E	Unlevered	Corr.to Market	Total Beta
TRANSMONTAIGNE PARTNERS LP	1.27%	34.21%	0.42	39.89%	1.05
MAGELLAN MIDSTREAM PARTNERS LP	34.27%	15.72%	0.64	54.40%	1.17
TESORO LOGISTICS LP	7.50%	34.35%	0.68	35.60%	1.91
OILTANKING PARTNERS, L.P.	8.27%	4.19%	0.72	37.50%	1.91
NISKA GAS STORAGE PARTNERS LLC	0.91%	159.27%	0.36	35.20%	1.03
HOLLY ENERGY PARTNERS, L.P.	3.89%	39.95%	0.53	42.70%	1.25
ENERGY TRANSFER PARTNERS LP	34.95%	93.06%	0.55	69.00%	0.80
GENESIS ENERGY PARTNERS LP	8.95%	31.94%	0.73	55.60%	1.31
Median		34.28%	0.58	38.70%	1.21
Market Cap. Weighted Average		11.75%	0.62	26.90%	1.17

5.6.5 Calculated WACC

Table 17 details the components and the resulting Cost of Equity calculated according to (2)).

Table 17 - Calculated WACC

Component/Case	Estimation	Case: Analysed Beta	Case: Total Beta
Risk Free	R209	8.76%	8.76%
Beta	Calculated	0.83	1.42
MRP	Calculated	7.86%	7.86%
Cost of Equity	Calculated	15.25%	19.89%

MRP was estimated using the Regulator published data, as the compounded MRP over the period. This resulted in an estimation of the nominal, levered (benchmark) cost of equity of 19.89%. For diversified investors, the same assumptions (other than the beta) would result in a cost of equity of 15.25%. In both cases, the beta calculated was re-levered using the industry median debt-to-equity ratio (34.28%).

5.7 Hypotheses Testing

5.7.1 H_A

Table 20 details the descriptive statistics for the cases considered in the examination of H_A, based on the index calculated for each of the cases (as detailed in 4.1.1.1).

The compounded return for the J203 was calculated to be 15.2%. This result is in line with the estimate generated by (Ward & Muller, 2012).This was then translated to the index (as detailed in 4.1.1.3) and an IRR calculated which yielded a value of 27.1%.

Table 18 – H_A Descriptive Statistics

	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
H1_Base_Yield	25	.45	.12	.56	.3458	.03026	.15132	.023
H1_ALSI_Yield	25	16.11	-8.22	7.89	1.3247	.64003	3.20015	10.241
Valid N	25							

Figure 13 displays the indices used in the assessment of H_A. The Base average was compared to that of the ALSI, at a significance level of 5%. The results are displayed in Table 19 which have been found to be significant at the defined level, and therefore H_A0 is rejected, and we conclude that the Base case generated returns are different to those of the J203 index created. The analysis further shows that the base results are lower than those of the J203.

Table 19 - H_A Single Sample t-test

	Test Value = 1.3247					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
H1_Base_Yield	-32.345	24	.000	-.97890	-1.0414	-.9164

In order to test HA1, the simulation was run with number of repetitions set at 50. The resulting IRRs were used in single sample t-test against the Base case IRR (20.7%).

Figure 13 - Calculated Index Performance

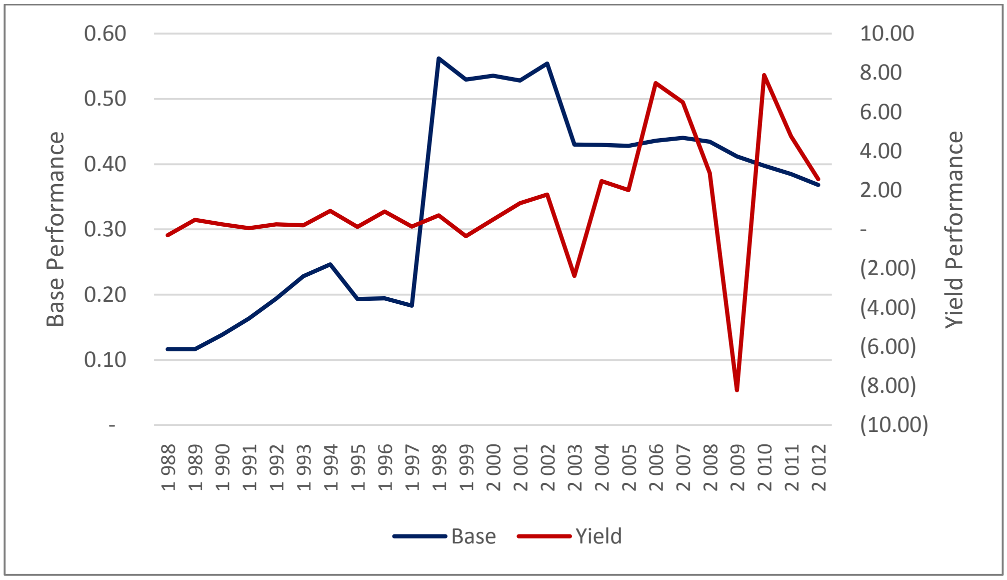


Table 20 details the results of the analysis performed, which was found to be significant. We thus reject the null hypothesis and conclude that the mean return generated by the simulation is different to that generated by the Base case.

Table 20 - Simulation IRR test against Base Case

	Test Value = 0.207					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Simulation_IRR	-7.914	50	.000	-.09223	-.1156	-.0688

5.7.2 H_B

Examination of H_B was done through an Analysis of Variance (ANOVA) performed on a series created as detailed in 4.1.1.4. The descriptive results are displayed in Table 21, with actual analysis performed results displayed in Table 22.

Table 21 – H_B Sample Descriptive

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Base	23	.0989	.44315	.09240	-.0927	.2905	-.22	2.07
ALSI	26	.1806	.25730	.05046	.0767	.2845	-.30	.73
Total	49	.1423	.35522	.05075	.0402	.2443	-.30	2.07

Table 22 - ANOVA between Base and ALSI

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.081	1	.081	.641	.427
Within Groups	5.975	47	.127		
Total	6.057	48			

Levene's test for Homogeneity of Variances was performed in order to verify that the market return component in the Regulator's estimate of the WACC does not preclude the analysis. These results as well as the correlation matrix are presented in Table 23 and Table 24, with the results showing no significant effects.

Table 23 - Levene's Test for Homogeneity of Variance

Levene Statistic	df1	df2	Sig.
.031	1	47	.860

The result shows no significant difference between the variance of the series measured. We therefore reject the null hypothesis and have to conclude that there is no significant difference in the variability of the expected returns earned year-on-year, between a regulated return and the market return.

Table 24 - Correlation

		Base	ALSI
Base	Pearson Correlation	1	-.271
	Sig. (2-tailed)		.200
	Sum of Squares and Cross-products	4.340	-.613
	Covariance	.189	-.027
	N	24	24
ALSI	Pearson Correlation	-.271	1
	Sig. (2-tailed)	.200	
	Sum of Squares and Cross-products	-.613	1.176
	Covariance	-.027	.051
	N	24	24

5.7.3 H_C

Table 25 details the components used to determine the cost of equity against which the Base case cost of equity was compared, in order to test H_C. The gearing ratio used in order to relever the beta was derived in the model on a periodic basis, as detailed in the methodology. This resulted in a nominal cost of equity value of 22.7%. Table 26 and Table 27 detail the results of the t-test for difference in means performed.

Table 25 - Cost of Equity Components

Component	Value
Risk Free	4.08%
Total Beta (Unlevered)	1.17
MRP	6.39%

Table 26 - Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Base_COE	25	.1548	.00807	.00161

Table 27 - Sample T-Test for difference in means

	Test Value = 0.227					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Base_COE	-44.739	24	.000	-.07222	-.0756	-.0689

The test is significant at required level. As can be seen from the t-value sign, the base case results in a lower IRR than the calculated risk-adjusted cost, and we therefore reject H_C0 and conclude that the regulated company would have earned less that its risk-adjusted cost.

6 Discussion

We now turn to analyse the results obtained and detailed in chapter 5. We start with a brief summary of the actions performed, after which, the discussion is presented in terms of the hypotheses tested.

6.1 Summary of Actions Performed

6.1.1 Simulation

A model, reflecting the current methodology was developed. This was done in order to allow analysis of various interactions between the various components used in the tariff determination by the Regulator. A critical component in this model, was the simulation module created, which simulates actual utilisation rates that could be experienced by an independent storage firm in South Africa. Several cases were developed and modelled in order to compare specific components of the tariff and returns. For all scenarios created, the model calculates a series of values, from the cost of equity, to utilisation rates and equity IRR. These series were then used in the analysis of the various hypotheses examined.

6.1.2 Cost of Equity Analysis

In the analysis of the cost of equity, the model offered by (Pereiro, 2010) was adopted in determining the appropriate universe to follow. By sampling a universe based on sector, we were able to cover a wide range of firms operating in the sector. However, as the analysis became more granular, it became apparent that limited information is available on emerging markets firms, and the resulting sample focused more on the US market. In addition as limited number of firms could be considered Pure Play additional, integrated companies were added and their balance sheet decomposed to derive the storage information, according to the principals developed by (Berger & Ofek, 1995; Damodaran, 2012). Two betas were estimated, a the Analysed beta, reflective of the diversified marginal investor as is the premise of the CAPM (Dobbs, 2011; Schober et al., 2014), and the Total beta, reflective of the non-diversified marginal investor, as is the case in many privately owned businesses (Damodaran, 2012). The resulting estimates were then used to test the applied cost of equity be the regulator in comparison to the market return.

6.1.3 Hypotheses Tested

Three main hypotheses were tested. The first stated that there is a difference between the return earned by the regulated firm and the return earned by the market. The second assumed there is no significant difference between variability in returns earned by the regulated firm and the market (defined as the J203 ALSI index). Lastly, the third hypothesis argued that the regulated firm earned less than the risk adjusted return as measured by the calculated cost of equity. All three hypotheses were found to be significant.

6.2 Analysis

6.2.1 H_A – The regulated firm earns less than the market portfolio return.

The results show that regulated firms operating in the petroleum storage sector in South Africa would have earned less than the market performance over the past twenty years. These firms would have faced the same level of risk, (defined as variance in returns) suggesting that the cost of equity, as priced by the Regulator, is understated. This conclusion is suggested in several other studies dealing with different jurisdictions, which have offered several reasons for this underestimation, ranging from different regulatory regimes (Alexander & Irwin, 1996) to underestimation of firm specific risk (Schober et al., 2014) and inherent deficiencies in applied model (Schaeffler & Weber, 2013).

One major difference identified is the pricing of equity applied by the Regulator. This is derived mainly from the choice of proxies applied (for convenience Table 3 is replicated below in Table 28). While it is evident that Regulator attempts to provide broad coverage, information derived from a single company sample (i.e. using a single company from geographic region) contributes seventy three percent, with one

(Russian) company contributing sixty percent to the applied unlevered beta. Other firms considered, mainly the US firms, seem to be taken at face value, arguably on the basis of broad sector participation as opposed to being an Independent Storage operator.

This approach is flawed for two main reasons. First, allowing a single firm to take such a large share in the calculated beta, introduces (unnecessary) risk. (Strobl, 2013) finds that earnings manipulation influences the cost of capital of the firm, and specifically the beta, despite the effects of diversification. On the opposite, we can predict that in certain countries, companies operating in a sector which represents a large part of the economy will have a beta closer to one, because of the likely high correlation between firm performance and (local) market performance. Thus, the reliance on a single company in a single economy, exposes the estimation to biases of different sources and in opposite directions.

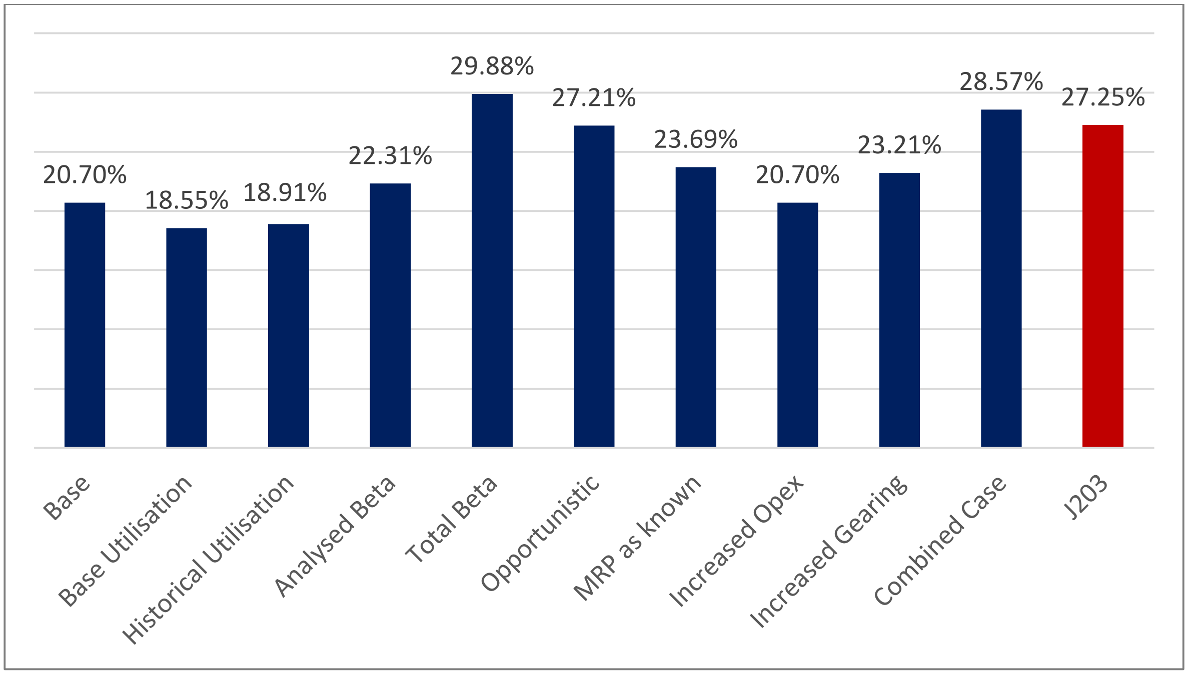
Second, applying a "broad-brush" approach to a specific sector creates additional, well documented difficulties in estimating the "true" value (Berger & Ofek, 1995; Damodaran, 2012; Kaplan & Peterson, 1998). Techniques developed in literature offer a solution to the issue of the limited universe, and these have been applied in the analysis performed.

These factors, contribute to a significant underestimation of the equity (unlevered) beta and the resulting cost of equity estimation by the Regulator.

Table 28 - Proxies used by the Regulator

Country	N	USD '000	Market Cap. Weighted %	β_a Contribution
US	14	85 205 857	43.30%	0.13
CZ	1	1 782 830	0.91%	0.00
IN	1	5 909 385	3.00%	0.06
RM	1	97 212 342	49.40%	0.29
CN	1	6 664 252	3.39%	0.01
Total	18	196 774 668	100%	0.49

Figure 14 - Achieved Equity IRR (nominal)



This underestimation is aggravated if we assume utilisation rates vary year-on-year[23], and results in underperformance of the achieved return compared to the regulated return (Hypothesis A1).

While the methodology allows for adjustments to the cost of equity in the form of size, risk and liquidity premium, no clear methodology on how the Regulator determines the value of these adjustments is available. Therefore, the study had not included any adjustment in the base case, against which the results were compared. A difference is therefore to be expected between the index and the regulated results (Fama & French, 1992; Ward & Muller, 2012). If the adjusted cost of equity included a premium, an additional six percent would be required to achieve the index calculated return.

[23] To understand how a situation like this scan happen in a capacity constrained industry: assume an integrated firm owns certain volume of storage capacity. In economic boom times, it will need to source storage capacity in the market, while in slower economic environment it may use its own capacity. From an independent storage owner perspective, the variance year on year can be significant.

The sample used consisted of firms from the United States of America (US). Guthrie (Guthrie, 2006) suggested that the type of regulation a firm is subject to, will impact the cost of capital. In order to eliminate this "noise", one needs to create a sample of like-regulated firms. As detailed in Chapter 5, no such sample is available. Although several studies have suggested that comparisons should be made to the US market, as it represents a liquid enough market and can serve a benchmark for many industries. (Godfrey & Espinosa, 1996). This remains a source of discrepancy which further limits the results of this study. Finally, the difference in returns calculated in the model validation (model created is 0.3% lower than what the Regulator terms IRR) is not material, as it represents less than thirty percent of the standard error, and would not impact the conclusion.

6.2.2 H_B – the regulated firm's returns are as variable as those of the market portfolio.

This hypothesis goes to the heart of the CAPM model, which dictates a link between risk and return. In this study, the simulated cash flows generated by the regulated firm were tested for year-on-year variance, and the differences have been found to be insignificant. This would suggest (in terms of the CAPM) that the return calculated by the regulator is not efficient, and could impact investment incentives perceived by potential new (rational) entrants.

One way to examine if the regulated returns are mean-variance efficient is to use a variant of the Sharpe ratio (Sharpe, 1966), utilising the compounded growth rate calculated:

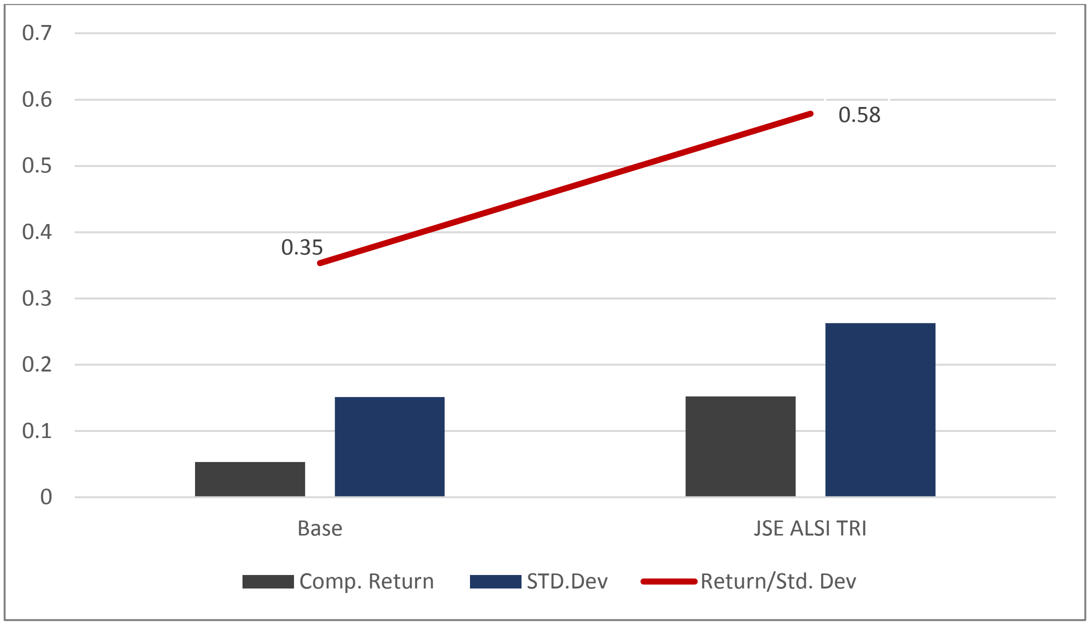
$$MS = \frac{GM_r}{\sigma_r} \tag{13}$$

Where:

$MS = Modified\ Sharpe\ ratio;$
$GM_r = geometric\ mean\ of\ the\ yield\ (compunded\ growth\ rate);$
$\sigma_r = standard\ deviation\ of\ the\ yiled;$

Using this analysis will allow us a comparison between the compounded returns generated per a unit of standard deviation, in absolute terms. These results are displayed in Figure 15 – Modified Sharpe ratio

Figure 15 – Modified Sharpe ratio (return per standard deviation)



This analysis demonstrates that returns generated by the Regulator model generate a lower amount per unit of standard deviation when compared to the J203.

One possible explanation to this phenomena has been documented in the past in several studies that showed that emerging markets show relatively uncorrelated betas and returns (Estrada, 2000; Harvey, 1995; Pereiro, 2010). This difficulty is especially relevant if we apply the various cost of equity parameters derived using proxies from developed market (where the correlation is clearer) to the South African (emerging) market. Thus, if the regulator applies these metrics to generate a return, such a foreign based beta, without making the adjustments required e.g. (Pereiro, 2010) it will understate the emerging business environment and opportunity cost.

6.2.3 H_C – A private regulated firm operating in a South African liquid fuel storage industry is less than the calculated risk adjusted rerun.

This hypothesis was aimed at calculating the appropriate equity return for an independent storage business in South Africa. In this analysis the scope was widened beyond that of the Regulator and included two main influences:

- Firm position in the value chain.
- Firm specific equity considerations.

The firm position in the value chain effect has long been documented in the regulatory context and found to have an impact on returns (Schaeffler & Weber, 2013). The impact of taking this into account was measured through the analysis of Pure Play firms and the decomposing of the observed betas to their segmental components. This impact was found to be significant as the calculated Pure Play unlevered beta was approx. 25% bigger than the Regulator (non-specific) beta. Additional tests were performed on the Analysed Beta case cost of equity, utilising the same parameters as assumed for the Base case save for the beta which was assumed at 0.62. These results are presented below in Table 29, in which and have been found to be significant.

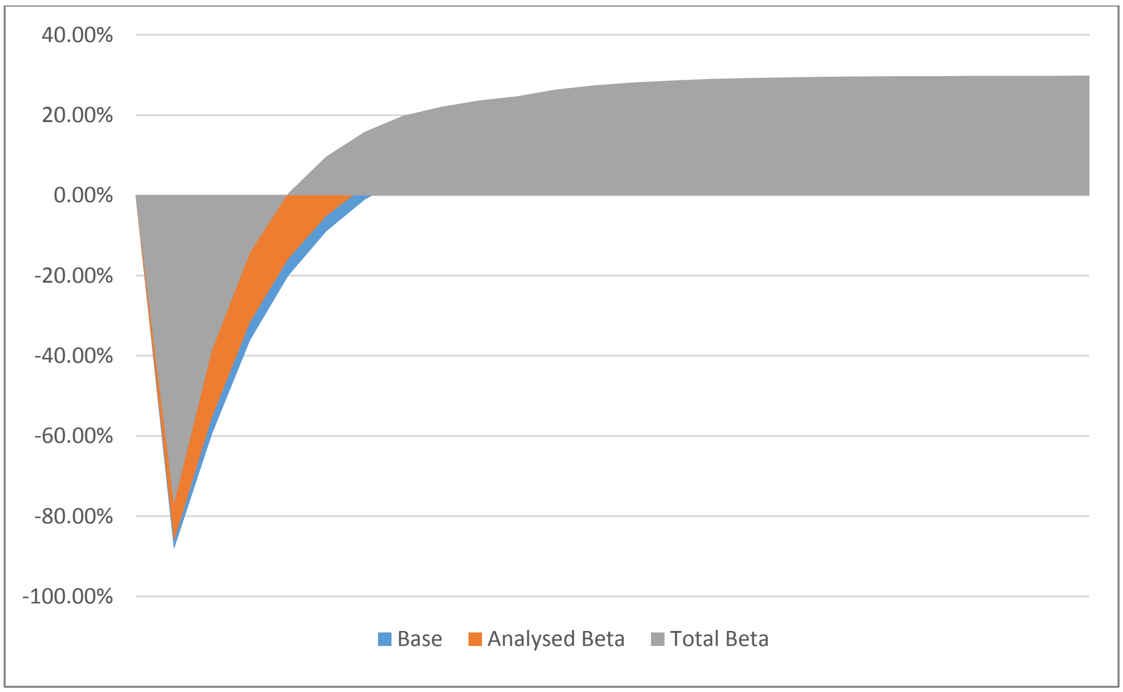
Table 29 - Analysed Beta single sample t-test

	Test Value = 0.168					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Base_COE	-8.190	24	.000	-.01322	-.0166	-.0099

Firm specific equity considerations relate to the basic assumption of the CAPM model that the marginal is fully diversified, and should only be compensated for the systematic risk components. The applicability of this assumption to privately held businesses and even at the household level have been shown to be questionable by several studies. (Moskowitz & Vissing-Jorgensen, 2002) find that lack of diversification at the household level in the US exists on both the asset class (e.g. Private Equity) and the asset level (e.g. a single firm), with the latter representing thirty eight percent of the household net worth. Other studies show a similar phenomenon at the firm level

(Müller, 2004). Other studies quantifying the impact of this un-diversification have found that opportunity cost for the non-diversified investor to be as much as four times that of the diversified investor (Kerins, Smith, & Smith, 2004). The current study applied a Total Beta approach to quantifying this effect of under diversification and the impact estimated to be 2.39 times (impact on beta applied). The impact on returns offers not only a return closer to that would be expected by undiversified investors, but it would also shorten the period required for the return to be realised, as displayed in Figure 16 - IRR development overtime, making it suitable for investors with different time horizons.

Figure 16 - IRR development overtime



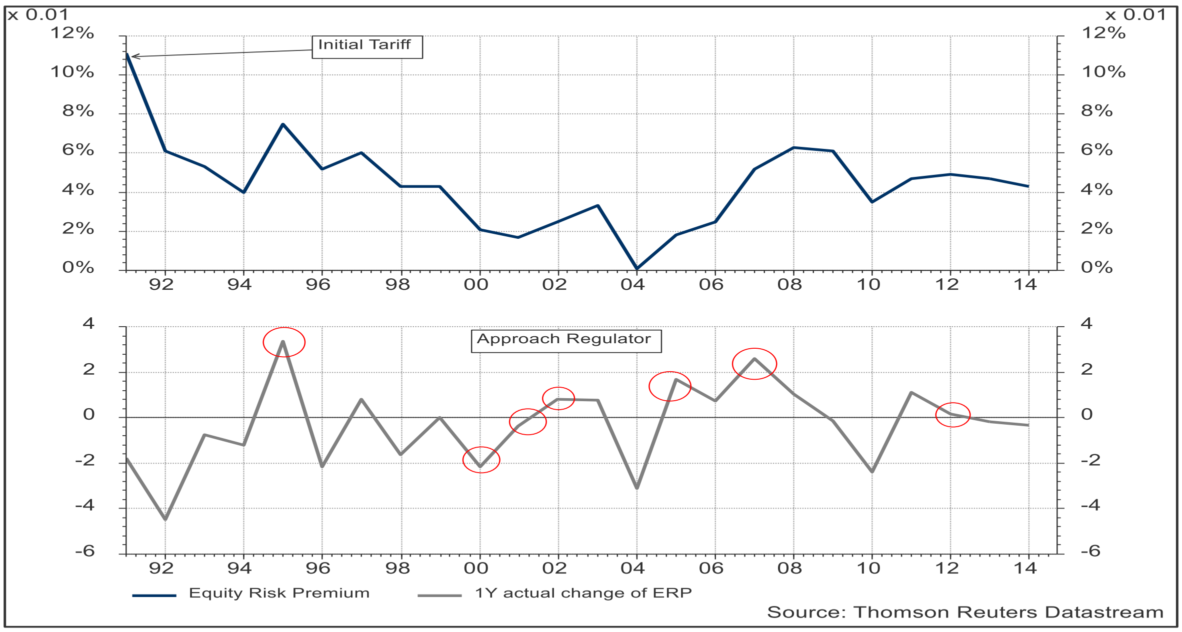
6.3 Common Observations

This situation caused by all there phenomena examined by the hypotheses, in which the regulated firm earns less than its risk adjusted return has several effects on the sector.

The first and obvious one is potential underinvestment in the sector. But a second, more critical problem is the creation of perverse incentives for the regulated firms.

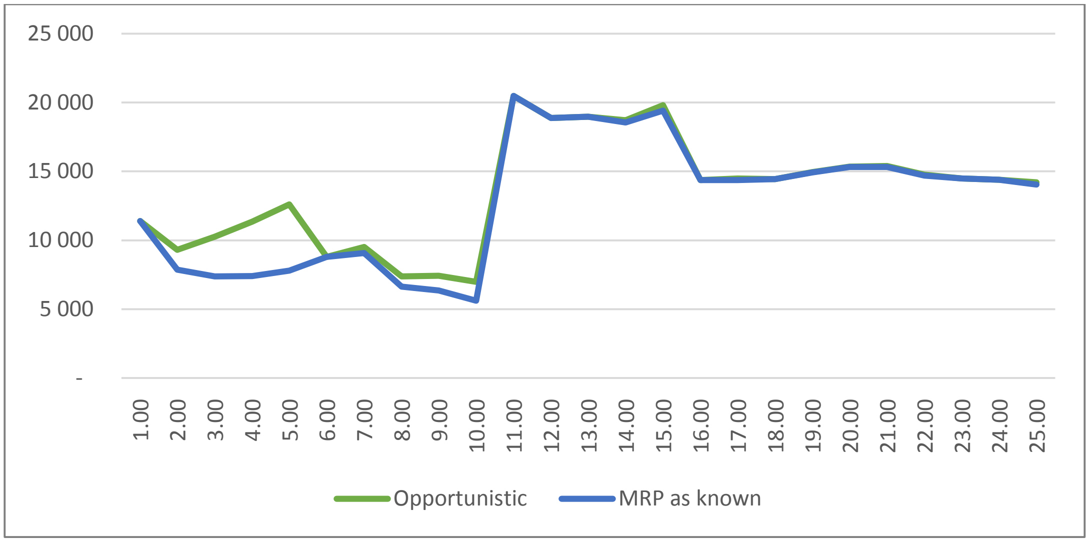
To illustrate this, a scenario termed Opportunistic was developed. This scenario is a simplified implementation of the how a firm seeing to maxims its profits could improve its earnings position simply by exploiting the methodology applied. They decision rule applied to the model simulates a firm approaching the Regulator every time the current MRP is higher than the one used to determine its cost of equity, subject to a maximum period of five years (as instructed in the methodology). The tariff setting points are illustrated in below in Figure 17 - Opportunistic Manipulation These results reinforce the analysis summarised in (Guthrie, 2006) which suggested a key impact of the length of the regulatory interval on the resulting regulated return.

Figure 17 - Opportunistic Manipulation



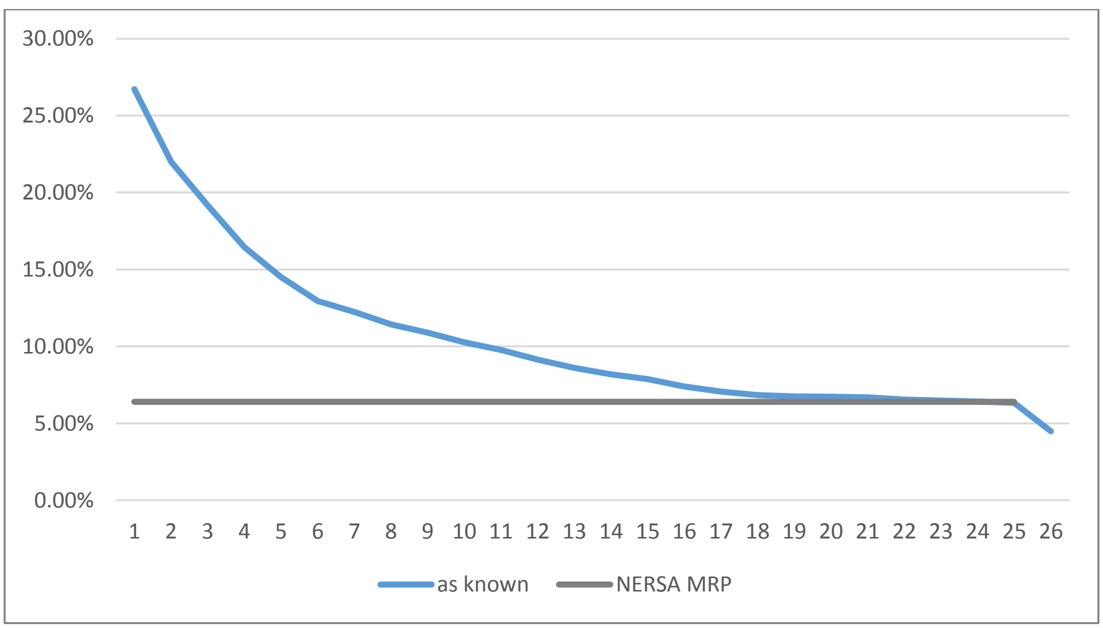
Utilising this strategy the regulated firm would have been able to earn a return seven percent higher than the Base case simulated, and four percent higher than the “MRP as known” case, mainly because of being able to maintain a higher return in early years, as displayed in Figure 18 and Figure 19.

Figure 18 - Allowable Revenue



Although the MRP seems to have stabilised over past ten years, possibly preventing such situations

Figure 19 - MRP as known

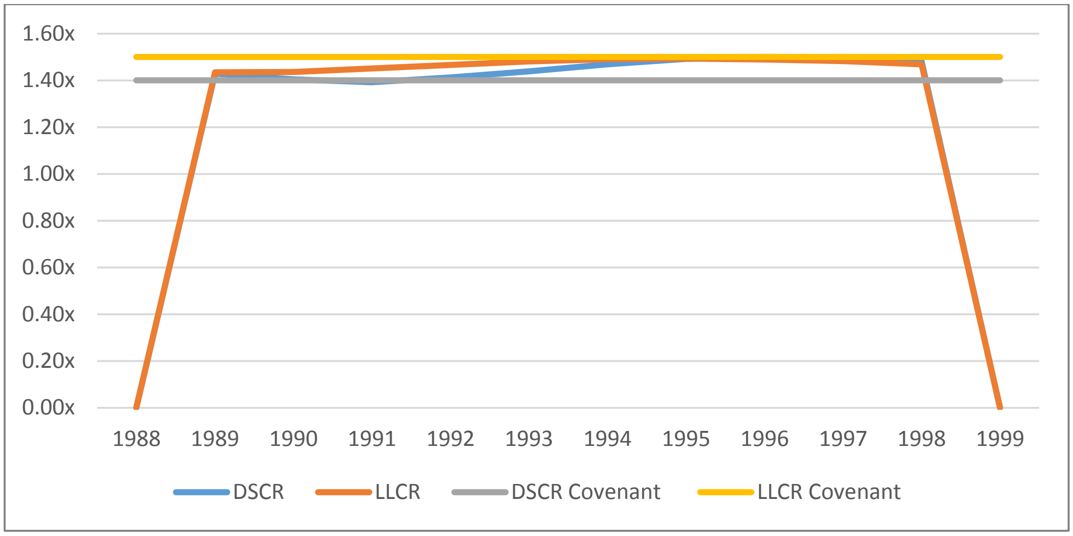


Additional incentives (or lack thereof) are evident in both the zero impact of leverage on achieved returns and the lack of impact of increased operational expenditure. The (expected) impact of leverage on return (as seen in case "Increased Gearing"), especially in light of the lower in-comparison returns, could influence firms in the industry to raise gearing levels. This effect is compounded by the methodology directive to re-lever the beta based on actual leverage in a period (with a minimum of 30% debt). While on the one hand, this is designed to lower cost of capital by introducing debt, the incentive to minimise the equity invested in the project. In the case analysed, a ten percent increase in overall debt levels led to a 3.7% increase in overall return.

The "Increased Opex" case reflects an increase of twenty percent in the operating expenditure incurred by the firm every year. As these are a pass-through in the methodology, as expected, these would not have caused and impact on the return earned by the firm. However, this also provides no incentive for improvement, to the extent these costs are reasonable in the eyes of the Regulator. This again is in line with the analysis performed in (Guthrie, 2006).

Lastly, the risk of underinvestment is created by this regulation at the practical level. Figure 20 displays typical funding covenants. As can be seen the Base case fails to meet covenants in several (consecutive) years. (Esty, 2007) shows that lenders to infrastructure projects require both certainty and in some cases guarantees for projects ability to generate cash flow, with sufficient "headroom" to cover unexpected events. In other words, Lenders seldom take what is termed "Market Risk", which the risk either demand for the product or the price for the product will negatively impact the minimal cash flow expected (Yescombe, 2013).

Figure 20 - Base case Breach vs. Actual Ratios



This inability would create risk of underinvestment as assets if this nature are usually very large and require Project Finance to be materialised. This situation, has a relatively simple solution through an allowance being allowed for debt service, as is the practice in other sectors regulated by the Regulator (e.g. pipelines and gas).

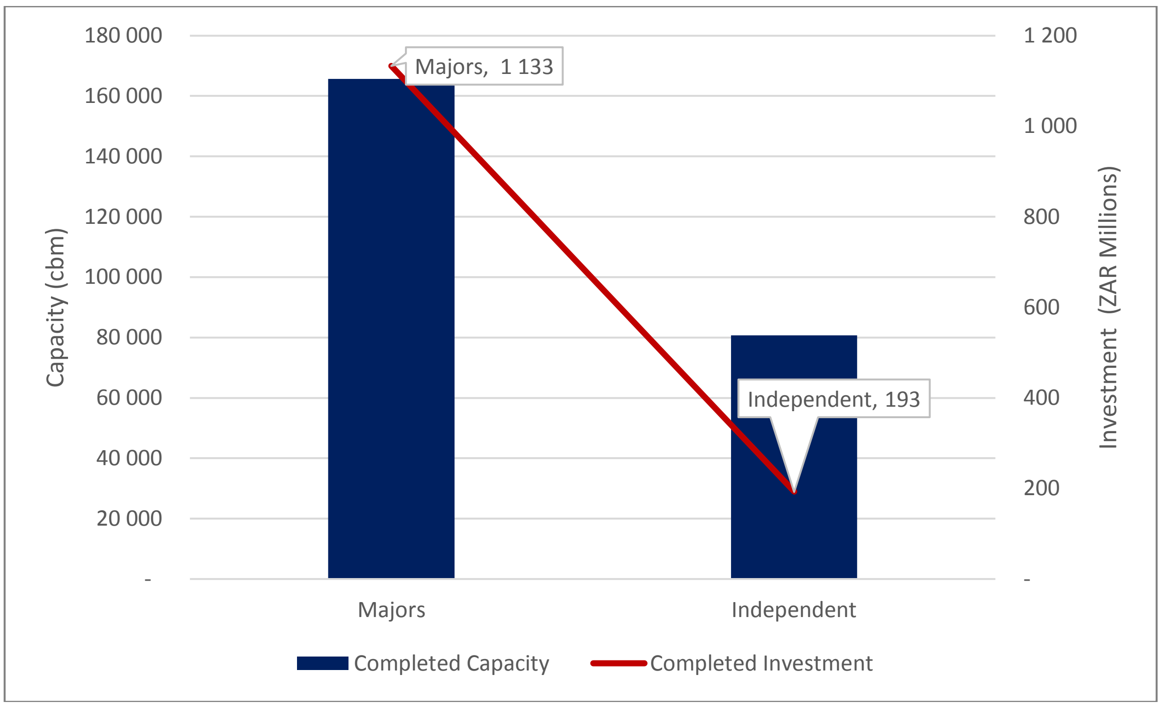
6.4 Indications of Actual Impact

By now, it has been established that Regulator offers lower returns, both when compared to the market as well as when estimating the required return for this asset class. The Regulator offers no benefit in exchange for this lower return allowed, as the year-on-year variance of the allowable revenue is similar to that of the J203 market index. The CAPM would predict that under such conditions, no (rational) investor would pursue such assets, as these are not risk-return efficient.

In trying to estimate this impact, limited information is available as most of this information is private, and public documented information only covers such investments that have gone sufficiently ahead to apply for license application (i.e. akin to a survivorship bias). However, some (anecdotal) evidence could be derived from license applications.

In May, 2014 the Regulator published an invitation to comment, in which the public is invited to offer views on some of the cost of equity components considered and methods applied by the Regulator ("Invitation to Comment," 2014). Figure 21 displays completed capacity in terms of storage volume as well as investment value, adapted from data provided by the Regulator ("Invitation to Comment," 2014).

Figure 21 - Completed Capacity

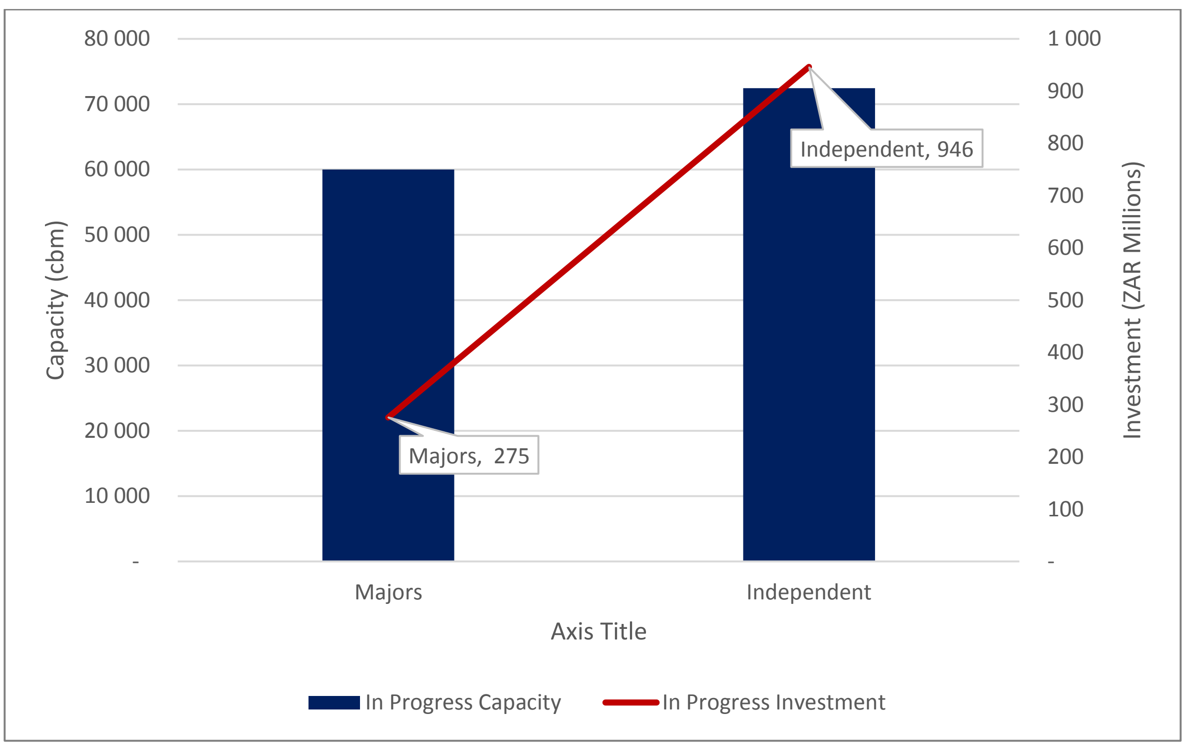


While capacity completed by Independents comprises roughly a third of all capacity installed, investment represent roughly fifteen percent. This is arguably the effect of Independents being made up of a lot of small operators, normally operating facilities of limited sophistication in non-strategic geographic locations, compared to the Oil and Gas Integrated Companies ("Majors"), which represent the opposite.

A further trend can be observed in Figure 22 . While the above is true for Completed facilities, those in progress demonstrate almost an opposite picture, as majors have invested in developing almost an identical volume capacity to that of the Independents. However, the worrying aspect is that while cost per cubic meter installed has decreased between completed and in-progress for majors (ZAR 6.84 to ZAR 4.58 million per cbm respectively), Independents have seen these costs increase between the completed and in-progress (ZAR 2.39 to ZAR 13.06 million per cbm respectively). This might indicate significant barriers to entry exist as economies of scale seem to be readily observable.

As mentioned, it is difficult to estimate these numbers in the context of demand or of potential for independent storage participation and this analysis is anecdotal.
Further research is required in order to estimate better the actual impact of this under-pricing.

Figure 22 - In Progress Capacity



Some support for the actual impact can be found in a relatively recent study. (Adendorf, Emuze, & Khulu, 2012)find that 94% of the respondents to the survey were of the opinion that storage capacity was the major challenge in the petroleum supply chain. They further find that the current storage capacity is utilised to full capacity. While no direct link has been made in the study as to why there is a shortage of new investments, the persistence of undersupply could (anecdotally) imply inadequate pricing signals are being sent in the market.

7 Conclusion

This research set out to evaluate whether the South African Regulator correctly prices the cost of equity. Subject to the limitations described, this goal has been achieved and it has been demonstrated that the Regulator indeed misprices this cost and exposes the industry to underinvestment.

The most substantial contribution of this study is that it seems to be the first to deal with the regulatory practice in South Africa in comparison to the local market. Another unique aspect is the simulation methodology applied and used to analyse regulatory results and in comparison to market performance.

The main finding of this research is that the Regulator underestimates the cost of equity and opportunity cost of investment into the independent petroleum storage sector.

Strong evidence is found that for the same level of risk, a firm operating in this sector would have underperformed the market and would have earned a lower return.

The study also calculates the benchmark cost of equity for an independent storage firm and finds that the Regulator applies a list of proxy companies that introduces unnecessary risk and is not representative of the independent storage operators. In this respect the study applies techniques developed to deal with estimating cost of equity and other components based on integrated companies.

The study shows that the current methodology is not conducive to development of new assets, as practical considerations limit borrowing capabilities of firms, as it does not mitigate any market risk an unregulated firm is exposed to.

Some evidence of this underinvestment can be found in the persistence of under supply in the Storage sector. Additional evidence of the structural imbalance and the need to promote Independent Storage, can be found in the disparity between Majors and independent storage owners in costs per cubic meter, suggesting significant economies of scale could be present, aggravating the competition problem.

In May, 2014 (well after this research was underway) the Regulator published an invitation to comment on proposed changes to the calculation of the cost of equity ("Invitation to Comment," 2014). The nature of questions posed in that document seems to suggest that the Regulator recognises some of the issues discussed. In the document the Regulator recognises that:

- Some firms are not integrated;
- Variability of actual storage volumes achieved;
- Practical funding implications;
- Potential under-pricing of equity returns.

It is thus fortunate that this study can further inform the process and provide an academic perspective for the ongoing debate.

7.1 Recommendations to Stake Holders

The findings of this research and gravity of implications for erroneous pricing suggest that a few actions could be considered by the Regulator:

- Review proxy list composition and weighting – it is proposed that the Regulator ensures representativeness of the list to the sector. Utilizing integrated firms may cause an underestimate of the risk facing the Independent operator. It is further proposed that the list be reviewed regularly to ensure continued alignment. As shown in the study, a significant portion of the beta calculated by the Regulator relies on a single firm. It is proposed that the Regulator restricts the weighting of any single firm on the list.

- Consider applicant specific circumstances – as shown in the study, firms operating in the same sector can face different levels of risk, as a result of diversification position of the shareholders. Failing to consider these differences this may result in concentration of assets in a single (diversified) investor group and contrary to the regulatory mandate. It is therefore recommended that the Regulator takes such consideration s into account when determining the appropriate return.

- Reward improvement – as shown, no incentive for efficiency gains exists, as the regulated company's returns will not change. It is proposed that the Regulator crates a base line for efficiency for each company, as is implemented by other Regulators. By sharing the efficiency gains with the company (i.e. rewarding it through allowing higher or constant revenue despite the efficiency gains) sector innovation will be encouraged.

- Ensure fundability –as shown, the current methodology does not mitigate any market risk for the firms involved. It is recommended that the Regulator considers allowance for practical borrowing requirements and allows these into the methodology.

7.2 Further Research Recommendations

This research focused on comparing the cost of equity and the current methodology to market performance, in order to determine the appropriate return.

As noted, limited resources are available on estimating the actual impact on the industry as well as the impact on the Regulator's ability to achieve its mandate (of ensuring participation and increasing competition).

Future research could seek to create empirical evidence of the decisions taken by potential participants and their views on the market. This could allow some insight as to market perceptions and whether investors take into account global diversification options when deciding on such investment.

In addition, research into the actual capacities and utilization of existing infrastructure could indicate the severity of this problem and provide insight (hopefully on an on-going basis) of market developments.

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9 Annexure 1 – Narrative Description of Proxies' Business[24]

9.1 TransMontaigne Partners

TransMontaigne Partners - TransMontaigne Partners L.P. (TransMontaigne Partners) is a terminaling and transportation company with operations in the United States along the Gulf Coast, in the Midwest, in Brownsville, Texas, along the Mississippi and Ohio Rivers, and in the Southeast. It provides integrated terminaling, storage and transportation for customers engaged in the distribution and marketing of light refined petroleum products, heavy refined petroleum products, crude oil, chemicals, fertilizers and other liquid products. Light refined products include gasolines, diesel fuels, heating oil and jet fuels. Heavy refined products include residual fuel oils and asphalt. Effective March 1, 2011, the Company acquired from TransMontaigne Inc. its Pensacola, Florida refined petroleum products terminal with approximately 270,000 barrels of aggregate active storage capacity. Effective October 18, 2011, it sold a 50% interest in the BOSTCO project to a subsidiary of Kinder Morgan Energy Partners, L.P.

9.2 Magellan Midstream Partners, L.P

Magellan Midstream Partners, L.P. is engaged in the transportation, storage and distribution of refined petroleum products. The Company operates in three segments: petroleum pipeline system, petroleum terminals and ammonia pipeline system. Its petroleum pipeline system, consists of approximately 9,600 miles of pipeline and 50 terminals. Petroleum terminals include storage terminal facilities (consisting of six marine terminals located along coastal waterways and crude oil storage in Cushing, Oklahoma) and 27 inland terminals. Its ammonia pipeline system is representing 1,100-mile ammonia pipeline and six associated terminals. In July 2013, Magellan Midstream Partners LP announced that it has closed on its previously-announced acquisition of pipeline assets in Texas and New Mexico from Plains All American Pipeline LP. In November 2013, the Company acquired Rocky Mountain pipeline assets from Plains All American Pipeline, L.P.

[24] These descriptions are as they appear on Datastream.

9.3 Tesoro Logistics L.P

Tesoro Logistics LP (TLLP) owns, operates, develops and acquires crude oil and refined products logistics assets. TLLP's logistics assets are integral to the success of Tesoro Corporation's (Tesoro's) refining and marketing operations and are used to gather, transport and store crude oil and to distribute, transport and store refined products. The Company operates in two segments: Crude Oil Gathering and Terminalling, Transportation and Storage. Its assets consist of a crude oil gathering system in the Bakken Shale/Williston Basin area of North Dakota and Montana, eight refined products terminals in the midwestern and western United States, a crude oil and refined products storage facility and five related short-haul pipelines.It generates revenue by charging fees for gathering, transporting and storing crude oil and for terminalling, transporting and storing refined products. Tesoro Logistics GP, LLC is its general partner.

9.4 Oiltanking Partners L.P.

Oiltanking Partners, L.P. (OTLT) is engaged in the terminaling, storage and transportation of crude oil, refined petroleum products and liquefied petroleum gas. Through its wholly owned subsidiaries, Oiltanking Houston, L.P. (OTH) and Oiltanking Beaumont Partners, L.P. (OTB), the Company owns and operates storage and terminaling assets located along the Gulf Coast of the United States on the Houston, Texas Ship Channel and in Beaumont, Texas. Its Houston and Beaumont terminals provides deep-water access and interconnectivity to refineries, chemical and petrochemical companies, carrier and pipelines and production facilities and have international distribution capabilities. Its facilities are directly connected to 18 refineries, storage facilities and production facilities along the Gulf Coast area through pipelines and common carrier pipelines, to end markets along the Gulf Coast and to the Cushing, Oklahoma storage interchange.

9.5 Niska Gas Storage Partners LLC (Niska Partners)

Niska Gas Storage Partners LLC (Niska Partners) owns and operates natural gas storage assets. The Company owns or contracts for approximately 225.5 billion cubic feet of total natural gas storage capacity. The Company stores natural gas for a broad range of customers, including financial institutions, marketers, pipelines, power generators, utilities and producers of natural gas. The Company provides multi-year, multi-cycle storage services to its customers under long-term firm(LTF) contracts.

Under its LTF contracts the Company's customers are obligated to pay them monthly reservation fees in exchange for the right to inject, store and withdraw volumes of natural gas on days and for periods selected by them at injection or withdrawal rates up to maximums specified in the contract.

9.6 Holly Energy Partners, L.P. (HEP)

Holly Energy Partners, L.P. (HEP) is engaged in the business of operating a system of petroleum product and crude pipelines, storage tanks, distribution terminals and loading rack facilities in west Texas, New Mexico, Utah, Oklahoma, Wyoming, Kansas, Arizona, Idaho and Washington. HEP owns and operates petroleum product and crude pipelines and terminal, tankage and loading rack facilities that support HollyFrontier Corporation (HFC) refining and marketing operations in the Mid-Continent, Southwest and Rocky Mountain regions of the United States and Alon USA, Inc.'s refinery in Big Spring, Texas. As of December 31, 2011, HFC owned a 42% interest in it, including the 2% general partner interest. It also owns a 25% joint venture interest in a 95-mile intrastate crude oil pipeline system that serves refineries in the Salt Lake City area. On November 9, 2011, it acquired from HFC certain tankage, loading rack and crude receiving assets located at HFC's El Dorado and Cheyenne refineries.

9.7 Genesis Energy, L.P. (Genesis)

Genesis Energy, L.P. (Genesis) is a limited partnership focused on the midstream segment of the oil and gas industry in the Gulf Coast region of the United States, primarily Texas, Louisiana, Arkansas, Mississippi, Alabama, Florida and in the Gulf of Mexico. The Company has a portfolio of customers, operations and assets, including pipelines, refinery-related plants, storage tanks and terminals, barges and trucks. Genesis provides an integrated range of services to refineries, oil, natural gas and carbon dioxide (CO2) producers, industrial and commercial enterprises that use sodium hydrosulfide (NaHS) and caustic soda, and businesses that use CO2 and other industrial gases. The Company operates in three segments: Pipeline Transportation, Refinery Services, and Supply and Logistics. In August 2013, the Company announced that it has completed the acquisition of all the assets of the downstream transportation business of Hornbeck Offshore Transportation, LLC (Hornbeck).

9.8 Energy Transfer Partners, L.P. (ETP)

Energy Transfer Partners, L.P. (ETP) is a limited partnership in the United States engaged in natural gas operations. ETP is managed by its general partner, Energy Transfer Partners GP, L.P. (General Partner or ETP GP), and ETP GP is managed by its general partner, Energy Transfer Partners, L.L.C. (ETP LLC), which is owned by Energy Transfer Equity, L.P., another publicly traded master limited partnership (ETE). The activities in which the Company is engaged all of which are in the United States and the wholly owned operating subsidiaries. The Company's business segments are: intrastate transportation and storage; interstate transportation; midstream, and retail propane, NGL Transportation and Services Segment and other retail propane related operations. In August 2014, Energy Transfer Partners LP completed the merger of indirect wholly owned subsidiary of ETP, with and into Susser Holdings Corporation.

Ziv Ben-Ami
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10 Annexure 2 – Model Manual

Financial Model

User Manual

July, 2014

v.1.0

10.1 General

This document is intended to provide an overview of the financial model ("the Model") developed by The Author. The user manual will cover key attributes of the model and should be read before accessing the model.

Specifically, the following should be noted:

- All sheets save for the input ones (as explained below) are locked for editing. This is done in order to prevent unauthorised users from effecting the model's logical flow and calculation procedures.
- The model was developed using Microsoft Excel 2013 and using Microsoft Windows 8 operating system.

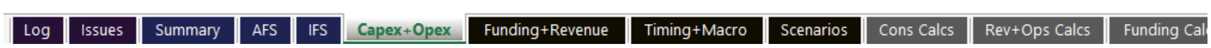
10.2 Model Formatting

The model contains specific formats for different objects. This is done in order to make model navigation and interpretation easier for the user. Please refer to the model "Contents" sheet for specific information.

10.3 Worksheet Tab Color

Figure 1 shows the different colours used for the different work sheets.

Figure 23 - Work sheet Colours



- Purple - infrastructure sheets. Used for administration purposes.
- Blue – output sheets. Contain the model outputs including AFS and returns.
- Black – input sheets. Used to enter the specific model values such as capital cost, interest rate operating expenditure etc.
- Grey – calculation sheets. Not intended for user manipulation and reflect the model logic.
- Red – NERSA calculation sheets.

10.4 Cell Formatting

10.4.1 Timeline

The model time lines can be divided into specific functions. Each of these functions has a specific format which will be reflected in the "in-sheet" time line, which appears on the calculation sheets lines 2 and 3:

- Blue – construction period active.
- Yellow – delay period active.
- Pink – pre operations period active.
- Grey – operations period active.
- White – outside of project timeline (i.e. before construction begins or after operations have ended).

10.4.2 Other cells

Other cells are formatted depending on their functions:

- User input cells (text or numbers)
- Selection (Currency, Index etc.)
- Reference
- Switch (Yes, No)

xxx
xxx
xxx
Yes

- Flag (Active)
- Macro Paste
- Off sheet (calculation sheets)
- Off sheet (input sheets)
- Constants (days in a year etc.)

xxx
xxx
xxx
xxx

It should be noted that the user is intended to change values only on the "User Input Cells". All other cells are either selections or automatically generated values and should not be changed manually.

Please note, "Reference" cells will not affect any calculations – they are there to be used as a record of the source of an input or other related comment.

10.4.3 Integrity checks

The model performs several integrity checks, to ensure results are reliable and signal the user if there is a problem, as detailed in section 7. These cells are found in different areas of the model and have the following possible formatting:

- Check is ok
- Check failed

XXX
Ok

XXX
Fail

10.4.4 Active selection

For certain inputs, the model allows the user to choose between different 'paths', to test results under different possible scenarios. This selection is done from the "Scenarios" worksheet as is explained in section 4.6. In order to make it easier for the user to know which 'path' is active the following format, would indicate that the "Base Case" option has been applied to the specific input (**Note:** this does not mean that the 'Base Case' Scenario is active, it means the 'base case' path for this input is active). Similarly, if the high case had been chosen, the blue square would appear next to it, while the base case square would be empty.

Figure 24 – Active path demonstration

1	Base Case
	High Case
	Low Case

10.5 Work Sheets

Work sheets are distinguished according to their functionality.

10.6 Infrastructure Sheets

- Cover – cover sheet.
- Contents – model contents (hyperlinks) and formatting overview.
- Log – model log to record model changes.
- Issues – development issues and user requests.

10.7 Outputs

- Summary – key model outputs and results.
- AFS – annual financial statements, including Cash Flow, Income Statement and Balance Sheet.
- IFS – Integrated Financial Statements, including Cash Flow, Income Statement and Balance Sheet. These statements reflect the model time line (monthly and semi-annual).
- JB# - REIPPPP bid requirement appendices.

10.8 Inputs

- Timing+ Macro – timing and macro-economic inputs.
- Capex +Opex – capital and operating expenditure inputs.

- Funding + Revenue – funding and revenue inputs.
- Scenarios – key inputs (can be either of the above parameters) which may change with the applicable scenario.

10.9 Calculations

- Cons calcs – construction period calculations.
- Rev+Ops Calcs – operation period calculations.
- Funding Calcs – funding calculations.
- Tax+Dep Calcs – tax and depreciation calculations.
- Timing Calcs – timing and macroeconomic calculations (including indices).
- Pref # – preference Share funding calculations.

10.10 Inputs

The model's logical structure is displayed in appendix 2. The following section will describe key model attributes and inputs contained in each section.

10.10.1 Worksheet: Timing+ Macro

10.10.1.1 General Indexation

Throughout the model, in certain line items the user is required to choose the applicable index, what percentage of costs is escalated, the start date and on what year-on-year basis the index is computed (operational/calendar year). For each of these line items, a specific index is created reflecting the applicable conversion factor.

Figure 25 - Typical Indexation parameters

Escalation			
Index	%	Start	Escalation
No Inflation	100%	31-Mar-14	Opp. Year

10.10.1.2 Operational Funding Shortfalls

The model takes into account several expenditure items in order to arrive at the cash flow available for equity and distributions (see IFS/AFS sheets for full details of cash waterfall). Should insufficient cash be generated or insufficient reserves exist in a specific period, the model will fund that the shortfall out of equity ("Equity Plug during Operations"). The model will then show an indication that will be displayed in the Integrity Checks and indicated to the user.

10.10.1.3 Timing

In this sheet, the user is required to input the following information:

- Model start date.
- Duration of construction and operations period – the model can accommodate variable number of periods per year. Construction (including delays and pre-operations) will be monthly. Operation period can be either quarterly or semi-annually.
- Index percentage increase per annum – macro economic assumptions regarding different indices (CPI, PPI etc.).
- Exchange rates.
- Indexation base date (applied on selling tariff).

Please note, the user is able to apply variations to these inputs in the 'Scenarios' sheet in order to test a project's viability. In this respect, delays will always be modelled after the Construction is complete, and before the Operations phase commences.

10.10.2 Worksheet: Capex + Opex

This section covers the capital and operational expenditure of the project.

10.10.2.1 Capital Expenditure

Users are able to label / describe each line item according to the nature of the capital item for the project. The descriptions of line items should be considered with regard to the application of tax and accounting categories (discussed later). For each of the line items, the model allows the selection of the following parameters:

- Currency (selection).
- Amount ('000 of currency).
- Contingency (%).
- Does VAT apply to this item? (Yes/No).
- Technology Option (i.e. which capex line items are active in the current scenario).
- Percentage spend per construction month (%).

Figure 26 - Sample of Information per Capex Line Item

Currency	Amount	Contingency	VAT	Technology	Total	Con Mth 1
EURO	-	-	**Yes**	Base Case	100.0%	20%
EURO	-	-	**Yes**	Base Case	100.0%	20%

Capital costs are assumed to be escalated costs (i.e. no escalation during construction is calculated).

10.10.2.2 Land

The model allows for land to be purchased or leased. Each option is explained below:

Land Purchase
The model allows for the project site to be purchased. The user should indicate with the "Yes / No" switch if this is the case (if 'no', then rental is assumed), and the related inputs (the month of the construction phase in which the payment is made, the currency and the amount).

Site Rental
The model allows the user to separate land rental costs between the construction and operations periods. During the construction period, once-off amounts can be paid to the landowner at Financial Close and/or at the start of the construction period. If the user wishes to model a rental during construction, this should be included in the Capex section.
During the Operations period, several leasing options exist including:

- '000 currency p.a. (a real value per annum during the operations period)
- % of revenue. (a percentage of gross revenue during the operations period)

The model further allows for a series of special payments including financial close fee, once off construction and monthly payments during construction. The user is required to choose the date in which land lease payments will start escalating as well the applicable index.

10.10.2.3 Fixed Costs

Fixed costs are those cost elements that do not change with generation volume (such as management salary, insurance etc.). For each fixed cost, the user is required to choose to which technology selection it applies, the indexation mechanism and the currency. Further, for each line item the user is required to enter the real (i.e. in today's money) cost for each operating year. These costs will then be escalated by the model (as explained in 4.2 above).

10.10.2.4 Variable Costs

Variable costs are those cost elements that change as generation changes. Two types of costs are available in this section:

- Units of currency per cbm – the user is required to choose to which technology selection it applies, the indexation mechanism and the currency. Further, for each line item the user is required to enter the real (i.e. in today's money) cost for each operating year. These costs will then be escalated by the model (as explained in 4.2 above).
- % of Revenue – costs which represent a commitment depending the actual revenue in a year. For each year the user is required to enter the applicable percentage value.

10.10.2.5 Major Maintenance reserving

The model allows for specific maintenance reserving. For each line item the user is required to specify the indexation mechanism as well as the currency. Further, the user is required to specify the amounts required per annum on a real basis. The model further allows for a reserve mechanisms:

- Switch indicating whether an upfront amount should be considered.
- What is the initial amount that should be considered – this will be funded similarly to a capex line item (i.e. a mix of debt and equity).
- Number of periods to be used in the minimum balance calculation.

If no upfront contribution is made and the model is set to maintain a minimum cash balance for maintenance, this will be funded out of cash flow, built up over the number of periods input:

- Floating target amount – to be used when the user wishes to create a reserve, funded out of available cash of the number of period indicated, independent of the maintenance expenditure.
- Floating target reserving start – when should the floating target start accumulating from available cash.

10.10.2.6 Rehabilitation

Rehabilitation is the cost required to restore the project site to its pre project condition, once the project is exhausted its economic life. In order to activate this section the user is required to specify:

- The cost at the end of operations –this is a real cost. The model will escalate that with RSA CPI through the end of operation.
- Switch indicating whether a reserve account should be created – similar to maintenance reserve account described earlier.
- How long before the end of operation should this obligation be funded – this will funded out of cash generated in the period.

10.10.2.7 Depreciation

The model allows for three depreciation methods, for tax and accounting purposes to be applied on nine categories:

- Straight line
- Reducing balance
- 50/30/20 (50% first year etc.)

Each category shall receive a certain treatment for accounting purpose and tax purpose (i.e. a combination of tax and accounting treatment). A category must be assigned to each capex line item, funding item (Interest during Construction, funding fees) and maintenance capex.

10.10.2.8 Tax

Withholding tax represents SARS tax requirements in which the company is required to tax dividends before it pays it out to the shareholder. The model allows for different rates to be applied on specific groups such as BEE, Local and Foreign shareholders. The model further allows for different rates for each of these groups on the interest on shareholders' loans received ("Deemed tax on interest received").

Corporate tax should be specified. This rate will be applied throughout the model period. The model will take into account tax losses in deriving the taxable income. Two major deductions are allowed:

- Financing costs are costs are used to calculate an assessed loss used in the taxable income calculation (i.e. inherent mismatch between accounting and tax book values).
- Section 12i deduction – government support for Greenfield projects.

Although in some jurisdictions tax losses do not expire, the model allows for a limitation of the tax loss period. If the project is in non-expiring environment it is advised to set the tax loss expiry period to a number of years greater than the operational period (i.e. 30 years tax expiry for a 20 year project).

10.10.2.9 VAT

VAT is considered for construction and operations periods separately. The user is required to specify the applicable rate and duration of the refund period for both construction and operation.

10.10.3 Worksheet: Funding + Revenue

The following section details some of the inputs and functionality of the funding and revenue sheet in the model.

10.10.3.1 Storage Capacity

The user is required to detail the power plant capacity, by giving the number of units, capacity per unit.

10.10.3.2 Operation Phase

The model requires the user to specify the expected utilisation and the availability thereof. The simulation model will then generate random numbers between the bounds defined, in order to estimate the Actual utilisation.

10.10.3.3 Tariffs

The model allows for several different mechanism of revenue generation:

- NERSA – in which the allowable revenue is calculated in the NERSA worksheets and then pasted into the main model.
- Project Finance – user defined inputs (e.g. price) to generate revenue.

10.10.3.4 Funding

This section of the model deals with the project's funding requirements. The model allows for several facilities:

- Senior 1 facility – senior debt facility.

General Indications

- Order of Drawdown – user required to choose which source is used first – debt, equity or pro-rated.
- Repayment frequency – user required to indicate if repayment of loan is done quarterly or semi-annually (this will change the timeline of the model to suit the selection)

Debt Facilities

- Facility size – percentage of total funding requirement (as opposed to debt requirement).
- Tenor- repayment period from construction end.
- Grace – principal only grace period, starting at end of construction.
- Repayment methods:
  - Annuity –fixed total repayment.

- Linear – fixed principal repayment.
- DSCR –method such that total repayments meets a Debt Service Cover Ratio target.
- Manual – manual repayment sculpting.

- Upfront fee – arranging and/or underwriting fee. Upfront percentage of facility size.
- Commitment Fee – percentage of undrawn amounts, during construction.
- Agency fee – ZAR amounts, paid monthly escalating with inflation (switch and amounts required for construction and operations period).
- Interest rate – user required to specify the different components that make up the the all in rate.
- Hedged Total Rate – a section allowing to create a mismatch between the assumed base rate and the "actual" rate, assuming not hedged.
- Manual repayment – used when "Manual" repayment method is selected. User required to indicate percentage of loan repaid on a specific date.
- DSCR target – used when DSCR repayment method is used. Debt will be sculpted to ensure the ratio is equal to the target set in this section. User required to indicate target.

Cash Sweep

The model allows the user to indicate whether to "sweep" cash available, i.e. to the extent that there is a cash surplus over and above the debt service requirement, applying this function will apply the percentage indicated of that cash towards additional debt service. User required to indicate:

- Switch – active or not active.
- Percentage of excess cash that will be swept.

Debt Service Reserve Account

The model allows for the creation of a debt service reserve, to be applied should the project not generate enough cash to service the debt. If switched on, the model will add the requirement to the funding required (i.e. pre-funded). User is required to indicate:

- Switch
- Target debt service reserve amount – how many period of debt service should the model create in reserve.

Covenants

This section represents the minimal ratios that lenders are likely to require as evidence for the borrower's debt service ability. The user is required to indicate:

- Which set of ratios will be used:

  - Base Case
  - Other
- Number of years used for the Debt Service Cover Ratio ("DSCR") calculation:
  - Forward looking duration
  - Backward looking duration
- Ratio levels for 4 different ratios:
  - Interest Cover ratio
  - Minimal DCSR
  - Loan Life Cover Ratio
  - Project Life Cover Ratio
  - Average DSCR (Senior Only)

Equity

The model allows for five ordinary shareholders. For each of these, the user is required to detail:

- % Equity Funded – how much of the equity requirement is borne by the shareholder.
- % Equity Owned – percentage of the dividend flows due to the shareholder.
- % Ordinary – what percentage of the holding is pure equity.
- Local /foreign - shareholder nationality.
- % Free carry – percentage of equity owned that is not funded by the shareholder.
- Full legal name of shareholder.

The model further allows for preference shareholders (only for the shareholders listed under the 'Pref' heading). The funding of these shares is presumed to be a redeemable preference share, calculated on a real, after-tax IRR basis. A further mechanism of cash sweep is assumed to be in effect (as is usually the case with SA DFI lenders). In addition to the specifications required for a normal shareholder. The user is required to specify:

- Own contribution – pref facility gearing (how much equity will be contributed by the shareholder, out of the total pref requirement).
- Facility upfront fee – issuance fees.
- Real after tax target IRR
- Percentage sweep – similar to the sweep mechanism described above.
- Contingency reserve – how much of the cash available for distribution should be held back as a cushion.
- Vesting period requirement – when should the preference be redeemed. This is an integrity check element, as the vesting period is impacted by a variety of factors.

- BEE operating cost:
    - Community requirement amounts
    - Cost per annum – operational BEE expense

Shareholder Loans

This section deals with the loan specifics. User is required to indicate:

- All in rate for shareholder loans – must be greater than zero.
- Tenor
- Grace period

Dividends

This section regulates how dividends are paid in the model. User is required to indicate:

- Method – pay-out ratio (i.e. a percentage of available funds is paid) or manual.
- Restrict dividends to accounting profit – maximum dividends that can be paid equal the amount of retained earnings. This is compatible with SA companies act, but may not be the case in other jurisdictions.
- Pay-out ratio – what percentage of available funds will be paid out (applies only to pay-out ratio method).
- Pay-out cash in final period – if restricted dividends, this switch will pay-out all cash in the final period of operations.

Returns

This sections determines some of the parameters used in the returns calculations in the model. The model allows the user to choose between the NERSA defined WACC parameters and a user defined one. The user is required to specify:

- Returns currency - on what currency should the overall equity IRR be calculated on. Note this will not apply to all types of returns calculated by the model, specifically the IFS/AFS will remain in ZAR.
- Risk free rate.
- Market risk premium.
- Beta.

The model will use the calculated cost of equity for equity NPV calculations and the implied WACC (cost of debt will be taken from the model calculated numbers, based on senior debt facility inputs).

Working Capital

This section regulates the timing difference between the receipt of revenue and the payment of expenditure. User is required to specify:

- Debtor days – days between sale and receipt of revenue.
- Creditor days – days between incurred expenses and actual payment of expenditure.

10.10.4 Worksheet: Scenarios

The model allows the user to evaluate different possibilities for several key values. Two major variability factors are allowed:

- Path – Base, high and low cases. User can insert different values in the applicable section, and these can be varied with the applicable scenario (e.g. degradation levels). See section 2.2 - cell formatting.
- Flex – increase/decrease a certain value by a percentage. These cells appear in different places throughout the model, and are controlled from the scenarios sheet. See figure 4.

Figure 27 - Typical Flex cell

Flex
0%

The following should be noted:

- Column F represents the values applied in the model, i.e. the "live" scenario.
    - This column draws its values from the scenario chosen on cell H8 (number between 1 and 20).
    - If a certain parameter is null (i.e. blank - NOT zero) the model will take the value from scenario 1.
    - Parameters with a zero value assigned to them are regarded as values. In order to disregard a cell, use clear contents form excel menu.
- Column H is an over-ride column. Regardless of the live scenario values, any value in this column will take precedence.

<u>Switching Between Scenarios</u>

- In named range "Scenario" ("Scenarios" sheet, Cell H8) choose the desired number.
- Examine integrity indicators on "Scenarios" sheet cells (E5:E6).
- If these indicators display the Integrity Failed format displayed in section 10.4.3 then, depending on the scenario characteristics, the following may be required:
    - "Solve Funding" macro on "Funding+ Revenue" G91.

10.10.5 Worksheet: Simulation

In this worksheet the user is required to specify:

- An assumption for the first year utilisation.
- Lower and upper bounds for the random number generation (i.e. 75 to 100 will mean that a random number will be generated such that it is between 75-100% of the previous year's actual utilised capacity.
- Number of repetitions - i.e. how many 20 year cases are to be run.

The sheet then shows the results of the various cases as well as the live scenario values:

- Equity IRR achieved in a case.
- Price per cbm per month for every year in every case.
- The random number applied in every year.

10.11 Macros

The following section will describe key macros applied in the model. Macros are used to either simplify procedures or eliminate circular references, which are more computing resources intensive and less accurate.
Macros are designated in the model through a button (see figure 5).

Figure 28 - Typical macro Button

10.11.1 Funding

A copy paste macro to make sure funding requirement is correctly captured. This is because of the Interest during Construction element of the debt, which is inherently circular (borrow an amount such the amount borrowed is enough to cover the needs plus the interest paid on that the same amount).

10.11.2 Solve AR

A macro that ensures that the applied allowable revenue is identical to the calculated one from the NERSA work sheet.

10.11.3 Run Simulation

Simulation macro.

10.11.4 Solve AFUDC

Solve Interest during Construction using for NERSA calculation of tariff.

10.11.5 Lock, Edit

Allow/restrict access to model calculations. This requires a password.

10.11.6 Clean up

Restore default presentation settings.

10.11.7 Scenarios

A macro that runs through all the scenarios in the model. For each scenario integrity checks and tariff will be calculated together with returns. These will recorded in the scenarios table on the Scenarios sheet.

10.12 Integrity

The model maintains several integrity checks. These checks can be divided into two major categories:

- Validity - model calculation incomplete. Parameters like sources equal uses, assets equal liabilities etc.
- Breach – model fails a parameter defined by the user. i.e. DSCR target required is 1.4 and only 1.3 is achieved.

The model shows a summary of the models integrity on all the sheets. Figure 6 shows the indicators.

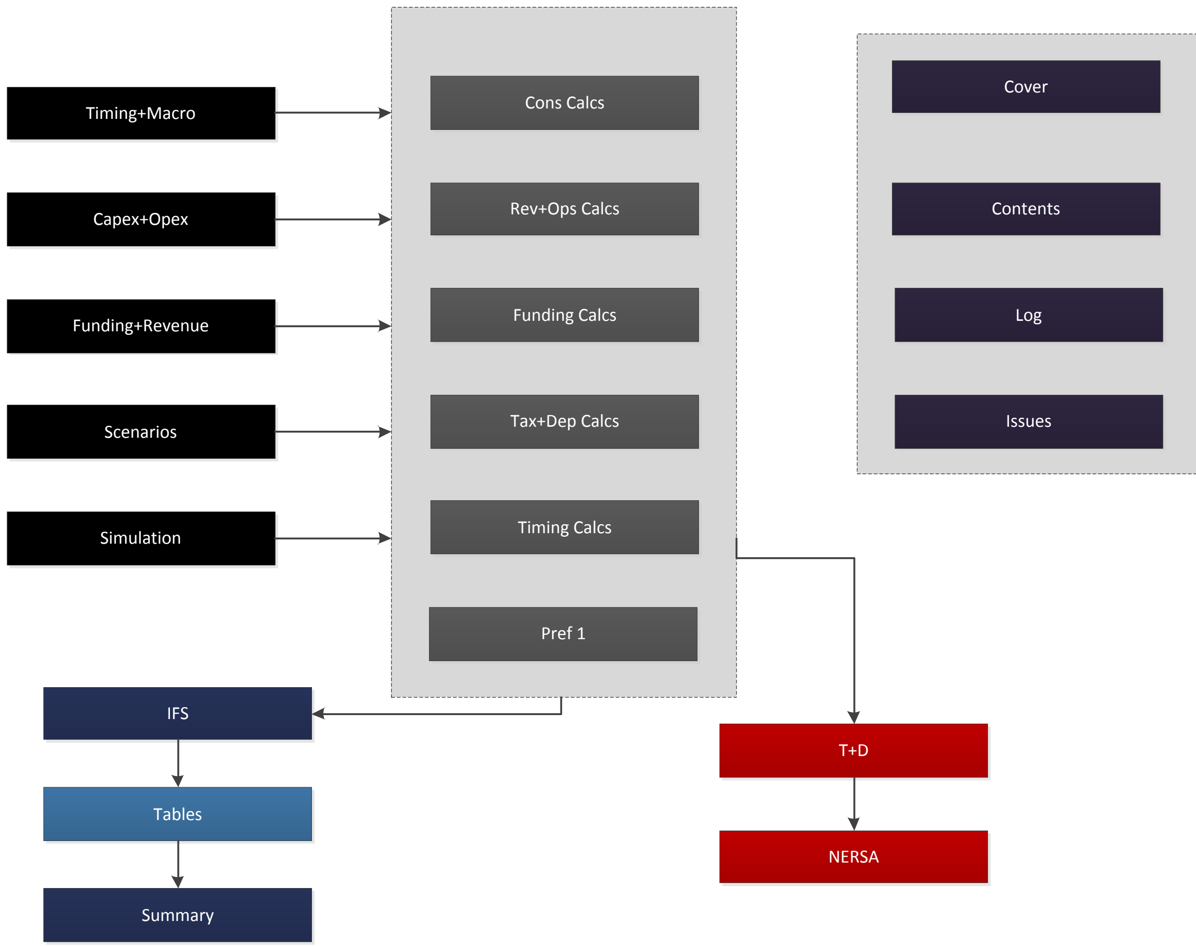
Figure 29 - Sheet Integrity Summary

Scenario	Base Case
Valid?	YES
Breach?	NO

In the event a integrity check has failed, these indicators will assume the Integrity Failed format displayed in the formatting section.

These indicators summarise the checks done in the model and are displayed in appendix 3.

10.13 Model Structure



10.14 Integrity Checks

Set out below, is an example Integrity Panel of the model.

Test	Type	Result	Tolerance	Ok / Fail
Balance Sheet (IFS) 2	Breach	-	0.001	Ok
Cash Balance <0	Valid	-	0.001	Ok
Sources & Uses	Breach	-	0.001	Ok
ICR Covenants	Valid	-	0.001	Ok
DSCR Covenants	Valid	10	0.001	Fail
LLCR Covenants	Valid	-	0.001	Ok
PLCR Covenants	Valid	1	0.001	Fail
TCR Covenants	Valid	10	0.001	Fail
TPLCR Covenants	Valid	10	0.001	Fail
TLLCR Covenants	Valid	-	0.001	Ok
SHL Outstanding	Valid	-	0.001	Ok
Tariff Delta	Breach	0	0.001	Ok
DSRA Delta	Breach	-	0.001	Ok
Equity Plug Used?	Valid	-	0.001	Ok
Funding Deltas	Breach	-	0.001	Ok
Assets equal RAB?	Breach	-	0.001	Ok
Regulatory Balance Sheet	Breach	-	0.001	Ok

	This Case	All Cases
Valid	Ok	Ok
Breach	Ok	Ok