UNIVERSITY OF KWAZULU-NATAL

Evaluating the rate of return pricing methodology for ports in South Africa: A scenario analysis

Mondli Eugene Mbele
208527340

A dissertation submitted in partial fulfilment of the requirements for the degree of Master of Business Administration

Graduate School of Business & Leadership
College of Law and Management Studies

Supervisor: Professor Mihalis Chasomeris
2023

Declaration

I, Mondli Eugene Mbele, declare that

"(i) The research reported in this dissertation, except where otherwise indicated, is my original research.

(ii) This dissertation has not been submitted for any degree or examination at any other university.

(iii) This dissertation does not contain other persons' data, pictures, graphs or other information unless specifically acknowledged as being sourced from other persons.

(iv) This dissertation does not contain other persons' writing unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:

a) their words have been re-written, but the general information attributed to them has been referenced.
b) where their exact words have been used, their writing has been placed inside quotation marks, and referenced.

(v) Where I have reproduced a publication of which I am the author, co-author or editor, I have indicated in detail which part of the publication was actually written by myself alone and have fully referenced such publications.

(vi) This dissertation does not contain text, graphics, or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the dissertation and in the references section."

Signed: 

Date: 09 February 2023

Acknowledgments/Dedications

I would like to dedicate this dissertation to my parents Bongiwe and Dumisani Mbele. Words cannot explain my appreciation to you. You have been my pillar of strength, guidance, and most of all my source of inspiration. You have raised me to be unique just like everyone else and always encouraged me to persevere and to remain steadfast.

To Professor Mihalis Chasomeris, I humbly thank you for your guidance, support, and encouragement. This dissertation would have not been possible without your supervision. I thank the lord to have met you and it is a great privilege to have worked with you. Thank you!

Mondli Mbele

Acronyms

CAPM Capital Asset Pricing Model

CAPEX Capital Expenditure

CWIP Capital Works in Progress

COGS Cost of Goods Sold

CPI Consumer Price Index

DMS Dimson, Marsh, and Staunton

DPE Department of Public Enterprises

ESCAP Economic and Social Commission for Asia and the Pacific

ETIMC Excessive Tarif Increase Margin Credit

GCE Group Chief Executive

GDP Gross Domestic Product

GNP Gross National Product

GPCS Global Port Comparator Study

MOPS Marine Operators Performance Standards

KPIs' key performance indicators

MRP Market Risk Premium

NAAMSA National Association of Automobile Manufacturers of South Africa

NEDLAC National Economic Development and Labour Council

NERSA National Energy Regulator of South Africa

NFLS National Freight Logistics Strategy

NPA National Port Authority

NPA Act National Ports Act no 12 of 2005

OPEX Operating Expenses

PRSA Ports Regulator of South Africa

RAB Regulated Asset Base

RFR Risk-Free Rate

ROA Return on Assets

ROR Rate of Return

ROC Return on Capital

ROD Record of Decision

ROPS Rail Operator Performance Standards

RR Revenue Required

SAAFF South African Association of Freight Forwarders

SAASOA South African Association of Ship Operators and Agents

SAPO South African Port Operations

SARB South African Reserve Bank

SAR&H South African Railways and Harbours

SATS South African Transport Services

SS Sliding-Scale

STER Single Transport Economic Regulation

TFR Transnet Freight Rail

THCs Terminal Handling Charges

TNPA Transnet National Ports Authority

TOC Trended Original Cost

TOPS Terminal Operator Performance Standards

TFP Total Factor Productivity

TPT Transnet Port Terminals

UKZN University of KwaZulu-Nata

UNCTAD United Nations Conference on Trade and Development

WACC Weighted Average Cost of Capital

WEGO Weighted Efficiency Gains from Operations

Abstract

Port pricing plays a strategic role in the management of ports and port operations, and it is an important aspect that informs long-term port infrastructure investment plans and broader policy objectives. The South African government regards the maritime industry as a catalyst for economic growth and acknowledges the need to promote an efficient and effective transport system. However, port costs in South Africa are high by global standards and this has a negative impact on the country's economic growth and port competitiveness. While port costs in South Africa have improved over the years, they remain elevated. Specifically, container cargo dues and the total port costs to users in container ports are above the global sample average by 166% and 146% respectively. Consequently, the Ports Regulator of South Africa aims to implement a tariff strategy that will decrease container cargo dues to 36% below the benchmarked average. The study mainly adopted a quantitative scenario methodology but has some elements of qualitative scenario methodology. This study will recalculate the National Ports Authority's required revenue tariff application for 2023/24 using adjusted input components (i.e., the Regulatory Asset Base, Asset beta, Tax Rate, and Excessive Tariff Increase Margin Credit) informed by an evidence-based preliminary empirical and theoretical literature analysis. This will establish a sound theoretical foundation for each scenario and relies upon in-depth analysis. The recalculated required revenue tariff application for 2023/24 demonstrates that port tariffs could be reduced significantly. That is, scenarios 1 and 2 show that tariffs could increase at a slower rate which is below the upper inflation target band of 6%. Furthermore, scenario 3 shows that port tariffs could decrease by 10,4%, while scenario 4 shows that port tariffs could decrease to 2,4%. The study shows that there is scope to reduce South Africa's port tariffs by improving the accuracy of the components of the revenue required model, thereby fostering South Africa's trade competitiveness, and stimulating economic development in South Africa.

Key Words*:* Port Pricing; National Port Authority; Ports Regulator of South Africa; Required Revenue; Tariffs

Contents

List of Tables

List of Figures

CHAPTER 1: INTRODUCTION

1.1. Background Information

Maritime transport is indispensable to the global economy because more than 80% of world imports and exports are transported by sea (UNCTAD, 2020). Sea transport is the most environmentally friendly and cost-effective transport mode to carry imports and exports around the world. Well-organized and managed ports are necessary to handle imports and exports. Port efficiency, therefore, is a critical determinant of a nation's capacity and ability to participate in international trade. As such, ports in developing countries must ensure efficient operations to facilitate trade in the world economy (Acciaro, 2013; UNCTAD, 2020).

South Africa is an open developing economy that largely depends on seaborne commerce as more than a third of its gross domestic product (GDP) is made up of imports and exports (Zuccollo, 2013). The South African government regards the maritime industry as a catalyst for economic growth. However, the South African government is of the view that the South African maritime sector has the capacity to contribute more than its current contribution to the South African economy (Operation Phakisa, 2014; and Ports Regulator of South Africa, 2014).

1.2.The Evolution of Port Pricing in South Africa

The evolution of port pricing in South Africa has influenced how pricing is achieved to date. According to Chasomeris (2002), during the pre-Union period from 1833 to 1908 all seaports were controlled and administered independently. Each port autonomously concluded and managed its pricing and generated its profits. The self-governing of ports, as a result, led to high competition as each port strived to maximize the throughput handled.

The creation of the South African Railways and Harbours (SAR&H) in 1909 resulted in all ports being joined into a single organization and administration with a standardized tariff structure. The SAR&H adopted commercial principles that generated satisfactory profits and offered the manufacturing and agricultural sectors favorable discount rates. Consequently, this removed competition among the ports (Chasomeris, 2002).

Through the South African Transport Services Act of 1981, the pricing regime within the ports system somewhat changed after the SAR&H was altered into a state-owned enterprise named the South African Transport Services (SATS). SATS abolished the preferential treatment of

discounting tariff rates for agricultural and industrial sectors. However, it inherited the standardized tariff structure for all ports which resulted in port cross-subsidization.

According to Transnet (2020:1), "In 1989, Transnet was formed as a public company that is wholly government owned and before 2002, operated in various transport sectors including the ports divisions (Portnet), rail division (Spoornet), commuter rail division (metro rail), pipelines division (Petronet), airways division (South African Airways) and several other businesses. Portnet administered its ports on a national level setting a standardized tariff structure and ports continued to cross-subsidize each other."

Wharfage charges had a significant influence on the current configuration of the port system in South Africa. Wharfage charges are assessed for handling imports and exports using the ports' landside superstructure and infrastructure (UNCTAD, 1991). Wharfage fees are imposed by shipping lines to cover the port authority's cost for using berths to perform cargo operations. The wharfage was imposed on an ad valorem basis at a fixed rate based on the value of the cargo. Chasomeris (2002) maintains that this pricing system disregarded the cost and equity-based pricing principles and ensured the competitiveness of low-valued exports.

Portnet, as a division of Transnet, was restructured and vertically separated into Transnet National Ports Authority (TNPA) and South African Port Operations (SAPO), a port operations division. TNPA assumed the role of the landlord in charge of the port infrastructure and SAPO became the terminal operator. Subsequently, NPA and SAPO were renamed Transnet National Ports Authority (TNPA) and Transnet Port Terminals (TPT) respectively (NEDLAC, 2007).

A tariff reform exercise conducted in 2002 saw the replacement of ad valorem charges by cargo dues. Since 2009/10 port tariffs are determined through the revenue requirement methodology that was proposed by TNPA and adopted by the Ports Regulator of South Africa (PRSA). PRSA was established in 2007 as per the National Ports Act 12 of 2005. As outlined in the National Ports Act 12 of 2005 (c.5), the main "functions of the Ports Regulator include economic regulation of national ports to achieve government strategic objectives, promotion of equitable access to the national ports and monitoring the port authority in order to guarantee that the port authority performs its functions.

1.3.Motivation

Ports are important because they facilitate trade, create employment opportunities, stimulate economic development, and foster competitiveness (Acciaro 2013; Dwarakish, and Salim, 2015). Port pricing is a strategic aspect in the management of ports and port operations, and it is one of the key elements that informs broader port strategic plans and other developmental and infrastructure investment objectives (Gumede and Chasomeris, 2018). According to Jamison (2007), port pricing that is consistent, stable, and predictable allows port users to forecast their operating expenses. Aronietis et al (2010) show that the price competitiveness of ports mainly influences the port selection decision for shipping companies and shippers, and in the case of terminal operators, port selection decision is largely attributable to infrastructure and facilities. When determining tariffs, port regulators and authorities must appreciate the important developmental functions of ports.

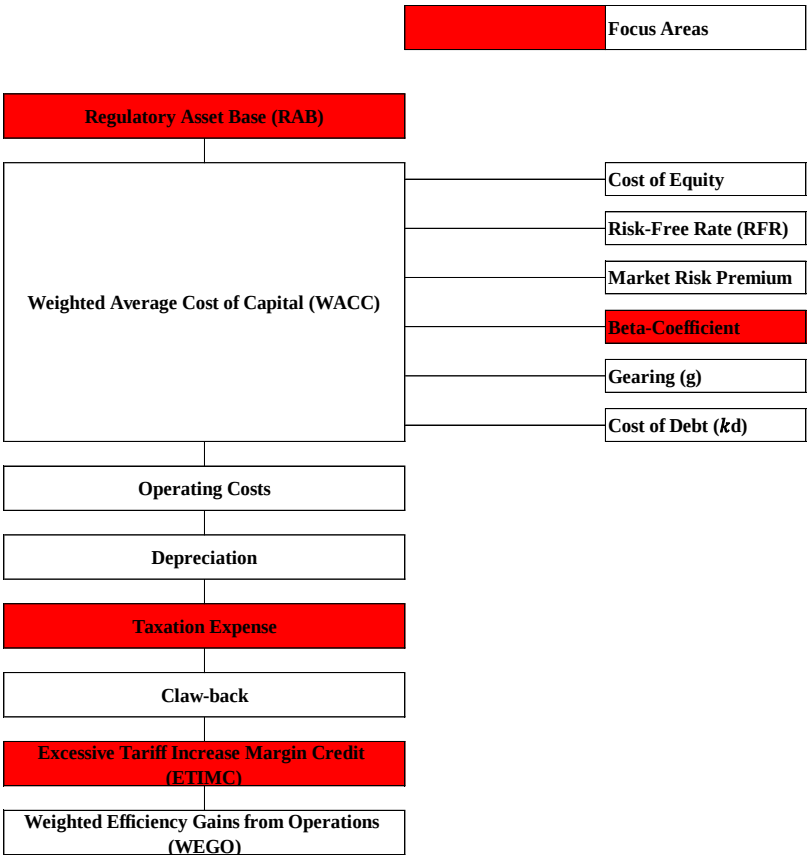
The pricing of port facilities in South Africa's ports is determined through the rate of return pricing model which is normally referred to as the Revenue Requirement (RR) methodology. In this methodology, the regulated entity is assured that tariffs will be set such that costs incurred are recovered, plus an adequate margin to fairly compensate investors. The Regulator will apply the modified Revenue Required approach for the 2021/22 – 2023/24 financial years, and the formula is as follows:

Revenue Requirement = [Regulatory Asset Base (RAB) x Weighted Average Cost of Capital (WACC)] + operating costs + depreciation + taxation expense ± claw-back ± Excessive Tariff Increase Margin Credit (ETIMC) ± Weighted Efficiency Gains from Operations (WEGO)

The formula above depicts the Revenue Requirement approach used by TNPA to set port tariffs which are regulated by the Ports Regulator of South Africa (PRSA). This approach is widely used by regulated entities in South Africa and internationally and has been used by the PRSA to assess tariffs in preceding tariff periods (Ports Regulator, 2020a).

There are four key components highlighted in Figure 1.1 below that influence the Required Revenue (RR) methodology, and this study will focus on them, namely the Regulatory Asset Base (RAB), the asset beta, the tax rate to be applied, and Excessive Tarif Increase Margin Credit (ETIMC).

Figure 1.1. Revenue Requirement Methodology Components



Source: Author compiled using data from Ports Regulator (2020a)

1.3.1. Regulatory Asset Base (RAB)

The RAB reflects the total value of assets that TNPA can earn a return on. This return is generally referred to as the Return on Capital (ROC). As the ROC is expressed in real terms, the value of total assets as represented by the RAB is indexed to inflation every year using the Trended Original Cost ("TOC") approach. This excludes assets acquired before 1990, on which a Historical Cost approach to depreciation and a nominal Weighted Average Cost of Capital (WACC) will apply. On an annual basis, the expected capital expenditure (CAPEX) and depreciation are added to the closing balance for the previous year to calculate a new closing balance for the current year. The projected working capital amount is added to calculate a total RAB estimate, which is averaged over the year to account for the progressive expenditure of capital works in progress (CWIP) over the period (Ports Regulator, 2020a).

According to the Ports Regulator (2020a:11), "the RAB value for the 2021/22 to 2023/23 period is determined using the following formulas:

RABy = ½ (RABc,y + RABo,y) + Wy

RABc,y = RABo,y (1 + CPIY) + CWIPY. (1 + CPIy)/2 -Dy

- RABy = value of the RAB used to determine the returns for period y
- RABo,y = opening value of RAB for the period y
- RABc,y = closing value of RAB for the period y
- Wy = forecast average net working capital over period y
- CWIPy = value of an expected capital investment over period y
- Dy = depreciation allowance for assets over review period y
- CPIy = annual rate of Headline CPI expected over period y"

The RAB is a decisive component in the computation of the Revenue Requirement because it represents the total value of the assets that TNPA is allowed to recover depreciation as a return of capital and to earn a return on capital through its' tariffs (Ports Regulator, 2018a; Meyiwa, and Chasomeris, 2020). Meyiwa and Chasomeris (2020) assert that the PRSA, having taken stakeholders submissions into consideration, permitted the revaluation of the RAB, using a financial capital maintenance approach, based on historic cost and trended original cost. According to Chasomeris (2020:4), "the NPA estimated that the PRSA Valuation of Assets would reduce the NPA's opening RAB value at 1 April 2019 by approximately R45 billion from R83.5 billion to R38.1 billion. In 2018/19, a change in the valuation of assets methodology resulted in a R15.8 billion reduction in the RAB. So, what happened to the R29.2bn difference? It appears that there is still scope for RAB value reductions".

1.3.2. Weighted Average Cost of Capital (WACC)

Generally, the WACC represents the minimum return on an investment to continue to attract capital, given the risks investors assume when they provide capital to the business (Corporate Finance Institute, 2017). In the Revenue Requirement formular, the WACC is the rate return that TNPA must earn on its RAB. According to the Ports Regulator (2020a:15), "a real WACC (the cost of equity and the cost of debt) is used and expressed in Vanilla terms (i.e., post-tax cost of equity and pre-tax cost of debt) to the post-1990 assets and a nominal WACC will be applied to pre-1990 assets. Accordingly, a separate allowance for the tax expense in the RR formula is required."

"$\boldsymbol{WACCvanilla} = \boldsymbol{kd}.\boldsymbol{g} + \boldsymbol{ke}(\mathbf{1} - \boldsymbol{g})$

- kd = pre-tax cost of debt
- ke = post tax cost of equity
- g = gearing, which is debt over total capital" Ports Regulator (2020a:16).

1.3.2.1.Cost of Equity

"The post-tax Cost of Equity ($\boldsymbol{ke}$) is calculated with reference to the Capital Asset Pricing Model (CAPM), which is expressed as:

$$\boldsymbol{ke} = \boldsymbol{rf} + \boldsymbol{\beta} \times \boldsymbol{MRP}$$

- Rf = Real risk-free rate
- β = Measure of TNPA's exposure to market (non-diversifiable) risk
- MRP = The market risk premium measuring the premium over and above the risk-free rate that investors might expect to earn".

1.3.2.2.Risk-Free Rate (RFR)

TNPA uses considerable debt to fund infrastructure projects. As such, in determining a risk profile for such an entity, the major risks confronting the organisation include interest rates volatility and other debt servicing costs. Additionally, infrastructure projects delays, inadequate engineering and project management capacity, cost uncertainty, and regulatory risk has a negative impact on the entity's risk profile.

However, the RR methodology, to a certain degree, counteracts the interest rate risk as regulators are in consensus that longer dated government bonds should apply for two objectives. Firstly, the Risk-Free Rate (RFR) should be determined on the basis that are in line other variables in Capital Asset Pricing Model (CAPM), particularly the Market Risk Premium (MRP), to ensure reliability and predictability in the calculations. Secondly, the RFR should be determined such that there is alignment with the average period of remaining life of an asset in the RAB. Additionally, the insertion of operational expenditure and the incorporation of a claw back, together with a well-defined tariff methodology sufficiently rewards TNPA for risk related to debt (Ports Regulator, 2020a).

"The Real RFR is deduced by using the Fisher Equation.

$\mathbf{1} + \boldsymbol{i} = (\mathbf{1} + \boldsymbol{r})(\mathbf{1} + \boldsymbol{E}(\boldsymbol{I}))$

Where:

- i = Nominal rate
- r = Real rate
- E(I) = Expected inflation" Ports Regulator (2020a:16).

1.3.2.3.Market Risk Premium

The market risk premium (MRP) part of the Capital Asset Pricing Model (CAPM) and represents the added return an investor receives or anticipate receiving for bearing a risky market portfolio as opposed to risk-free assets. The notion of risk (volatility of returns) and reward (rate of returns) is the focal point of the CAPM. This is because investors want to realise the highest rate of return at the lowest possible volatility of returns (Corporate Finance Institute, 2017).

The MRP is basically forward-looking and thus must be projected. As such, the consensus is that the historical premium is the most appropriate approximate of the forward looking MRP. Consequently, "the Regulator uses the latest available Dimson, Marsh and Staunton (DMS) estimate of the mean MRP as measured against bonds for SA to determine an MRP for TNPA's cost of equity calculation. The existence of negative serial correlation in the returns on South African equities results in an overestimation of the MRP when using the arithmetic mean. In addition, the relative (and recent) changes in terms of market diversification, improvements in the regulatory and legal frameworks safeguarding investors points to the appropriate risk premium forecast to be at the lower end of the long-term view. As such the Regulator will retain the use of the geometric mean of the DMS MRP. The calculation of the MRP average is done over the full period available in the DMS dataset as the cost associated with the larger standard error of a shorter period surpasses any advantages of using a more recent shorter period MRP." (Ports Regulator, 2020a:17).

1.3.2.4.Beta-Coefficient

Systematic risk, as measured by beta, represents the risk inherent to the entire market or market segment and cannot be eliminated or reduced by diversification (Rosenberg and Guy, 1976). There are two types of betas, subject to the capital structure of the company: levered beta and

unlevered beta. On the one hand, according to the Corporate Finance Institute (2017), unlevered beta also referred to as asset beta is the beta of a company without the impact of debt. Asset beta represents the volatility of returns for a company, without considering (the use of debt to fund to purchase assets) its financial leverage. In addition, it assesses the risk of an unlevered company against that of the market. On the other hand, levered beta which is also referred to as the equity beta is a measure that evaluates the volatility of returns of a company's stock against those of the market. Equity beta assists investors to measure the sensitivity of a security to macroeconomic risks (Corporate Finance Institute, 2017).

The beta coefficient which reflects the risks faced by TNPA under the RR methodology is usually a main component that determines the divergence between the tariff requested and the tariff increase granted (Ports Regulator, 2013b). The Ports Regulator uses the Hamada equation to re-lever the beta to result in an equity β (Ports Regulator, 2020a). The asset beta, therefore, has a direct bearing on the equity beta which in turn influences the cost of equity and by extension the Weighted Average Cost of Capital (WACC). Consequently, a higher (lower) asset beta translates into higher (lower) port costs.

TNPA is not a listed firm. For this reason, there is no published beta (β) which represents its' risk in relation to the companies listed on the market. As a result, a beta must be determined such that it represents the risks confronted by TNPA under the RR methodology that will ensure a return commensurate with the risk taken (Ports Regulator, 2020a).

The insertion of a claw-back and the Excessive Tariff Increase Margin Credit (ETIMC) component in the RR methodology, lowers TNPA's exposure to systematic risk and the prevailing regulatory system which guarantees future returns to a state-controlled monopoly with no competition, warrants the Regulator to use a beta that significantly lesser relative to that of large companies listed on the market as such the JSE top forty (Ports Regulator, 2020a; Ports Regulator, 2013a).

Other port entities cannot be readily used to provide insight into the appropriate beta for TNPA as it is very difficult to determine valid comparators of TNPA. This is because the distinctive characteristics of TNPA with a regulated monopoly position in South Africa and an implicit government guarantee make it virtually impossible to compare it to other port companies that are privately owned and managed (Ports Regulator, 2020a).

The Ports Regulator (2020a) argues that the beta should be lower given the stable returns allowed by the Regulator and the incorporation of the claw back component that efficiently eliminates systematic risk (mainly through decreasing volumes) together with the position that the β must be regarded as endogenous to the RR methodology. However, the Regulator will apply an asset beta of 0.35 over the 2021/22 to 2023/24 period owing to the difficulty of calculating the correct β.

Although the actually calculated beta of TNPA is almost 0.0 the Regulator will apply an asset beta of 0.35 over the 2021/22 to 2023/24 period because it is difficult to determine the accurate β. The ports Regulator argues that the asset beta of 0.35 is substantially lower than the Ports Regulator historically allowed asset beta of 0.5 because TNPA is a regulated monopoly with no competition, and it has an implicit government guarantee. It also maintains that the inclusion of the clawback and the ETMIC significantly lowers TNPA's exposure to systematic risk compared to the global average for ports (Ports Regulator, 2020a). Columbus Stainless (2017) argues that 0.0 is the appropriate beta for TNPA because it is fundamentally operating in a risk-free environment protected by government guarantees. NAAMSA (2017) contend that a lower asset beta should be applicable to TNPA as it operates as a monopoly in an environment without any systematic risk as the claw-back element has been incorporated in the RR methodology.

While the above-mentioned reasons put forward by the Ports Regulator for applying an asset beta of 0.35 are compelling, they are, however not thorough and complete. In support of this view, Chasomeris (2020) contends that if the actual calculation of beta is closer to 0, then why does the Ports Regulator continue to use a higher beta of 0.35? Perhaps there could be benefits in planned annual decreases in the value of the asset beta. Chasomeris (2015:167) states that "there is a need to further investigate and attempt to settle the debate on the appropriate asset beta to be used in the Revenue Required model for South Africa's ports." Therefore, the reasons put forward by the Ports Regulator need to be investigated thoroughly to confidently justify an asset beta that is below the global average.

The factors that affect systematic risk and methods of estimating equity and asset betas will be discussed extensively in sections 2.6.

1.3.2.5.Gearing (g)

The Ports Regulator determined that the applicable gearing for TNPA, which is infrastructure heavy, for the 2021/22 to 2023/23 period is at least 50%. The Ports Regulator made this determination having regard to appropriate tariff applications, trends in the divergence between the tariff requested and the tariff increase granted, several proposals, and its specific assessment of TNPA's gearing. Moreover, this mirrors a median position within a sample of ports and indicates a necessary re-investment of profits into the port system thereby reducing costs as well as debt service costs (Ports Regulator, 2020a).

Should TNPA be corporatized from a division of Transnet, into a subsidiary with its own Board of Directors, self-standing financial disclosure, ability to raise funds, and have authority over its own cash flow bank account, the Regulator may use the actual gearing determined through a due diligence process (Ports Regulator, 2020a).

1.3.2.6.Cost of Debt (*k*d)

The cost of debt is the effective rate that a company pays to its debtholders and creditors. These debtholders and creditors providers must be rewarded for the risk exposure associated with advancing loans to a company.

The Ports Regulator (2020a:18) states that "the NPA is required to submit the initial calculation of the variable as well as revised average embedded debt costs based on the average embedded NPA allocated Transnet Group cost of debt on a group level, on an annual basis as part of the annual tariff application. This forecast will be corrected on an annual basis based on audited financial information through the claw back mechanism."

If during the 2021/22 to 2023/23 period, TNPA is corporatized from a division of Transnet, into a subsidiary or stand-alone entity the Regulator will deliberate using the actual short-term vs long term debt structure. Due diligence must be exercised in determining the accurate cost of debt of TNPA (Ports Regulator, 2020a).

The RR methodology is largely influenced by the port authority's regulatory asset base (RAB) and the weighted average cost of capital (WACC). For this reason, it is crucial to ensure that the valuation and determination of the RAB and WACC are as accurate as possible when setting annual tariff adjustments (Meyiwa, and Chasomeris, 2020). It is, therefore, important to assess and dissect the RAB and WACC components of the RR formula to determine

appropriate port prices that are in the best interest of the country's economic and developmental objectives.

1.3.3. Operating costs

The Regulator thoroughly examines the operating cost estimates for the period on a line-by-line-item basis. In addition, the NPA is required to submit a comprehensive explanation for all of the expenses applied for, particularly on major items such as labour and energy costs. (Ports Regulator, 2020a).

1.3.4. Depreciation

Depreciation is generally considered as an annual accounting charge for wear, tear, of the company's fixed assets (Corporate Finance Institute, 2017). In regulation, depreciation is viewed as capital recovery, that is, the spreading of the plant investment over time to be recovered in revenue requirement. The Regulator mainly determines the appropriate application of depreciation ensure financial capital maintenance (Ports Regulator, 2020a). The following formula, which considers capital expenditure and inflation, is used to calculate the depreciation of fixed assets:

"**Dy = (RAB(o,y) + (RAB(o,y) x CPI(y)) + (Capex(y)/2.CPI(y)))/RUL**

Where:

- RABy = value of the RAB used to determine the returns for period y
- RABo,y = opening value of RAB for the period y
- RABc,y = closing value of RAB for the period y
- Dy = depreciation allowance for assets over review period y
- CPIy = annual rate of Headline CPI expected over period y
- RUL = Remaining useful life in years" Ports Regulator (2020a:12).

1.3.5. Taxation expense

Taxation expense is a direct tax levied on the net income or profit of a corporate entity from their business (Corporate Finance Institute, 2017). The current corporate structure of Transnet allows the Group to offset profits of one operating division against losses of others, a taxation allowance based on the corporate tax rate granted to TNPA may result in excess revenue, given that significant losses incurred by other divisions result in lower taxes payable by the Group.

However, subject to amendments by the National Treasury, the PRSA will allow the current corporate tax rate of 28% (t) if TNPA is corporatized from a division of Transnet into a subsidiary. Otherwise, an equitable tax rate, based on the supposition that TNPA is still an operating division, instead of a subsidiary of the Transnet Group, will be calculated and corrected through the claw back process and applied. The Equitable Tax Rate formula is as outlined below (Fakir and Chasomeris, 2022; Ports Regulator, 2020a):

"$\boldsymbol{te} = \boldsymbol{t}\ (\boldsymbol{Pg}/\Sigma\boldsymbol{Pi})$

Where:

te = equitable tax rate,

t = 28% or the corporate tax rate,

Pg = Transnet Group pre-tax net profit for the year,

ΣPi = Sum of pre-tax profits of profitable divisions/segments/ units for the year" Ports Regulator (2020a:19).

To calculate the equitable tax rate for each financial year, the sum of all profitable and loss-making segments in the Transnet Group for the financial years under consideration is aggregated. As anticipated, the equitable tax rate in each year is considerably lesser than the 28% corporate tax rate that was always used. Over the 7-year period the average equitable tax rate was calculated at 15.73% as illustrated in table 2.1 below. While the PRSA allowed the use of the pass-through of corporate tax rate (28%) from 2011 to 2017, in 2018 it applied an equitable tax rate of 15.73% which will result in the proportional sharing of the Transnet Group taxation liability by each of its profitable divisions (Fakir and Chasomeris, 2022).

Table 2.1: Calculation of equitable tax rate (%) from divisional profit and loss (R'million) data

Financial year	NPA	TPT	TFR	TPL	TRE	All other segment	Inter-segment elimination	Total group profit	Σ profit units	Σ loss units	Equitable tax rate: t_e (%)
2017	2934	1233	1525	2804	-1607	-2866	242	4265	8738	-4473	13.67
2016	4089	996	-337	1233	-423	-4320	230	1468	6548	-5080	6.28
2015	3270	736	5943	1704	101	-3897	-267	7590	11754	-4164	18.08
2014	4251	234	5169	1649	250	-3814	-604	7135	11553	-4418	17.29
2013	2705	218	5070	1273	1022	-3304	-943	6041	10288	-4247	16.44
2012	3333	765	3553	1282	688	-2560	-820	6241	9621	-3380	18.16
2011	3990	728	1925	475	784	-1576	-634	5692	7902	-2210	20.17
										Ave. t_e:	15.73

Source**:** Fakir and Chasomeris (2022:6).

Fakir and Chasomeris (2022) argue that the equitable tax rate approach result in each year is considerable lesser than the tax allowed in the preceding years. Therefore, this shows that the use of the equitable tax rate could lead to considerable savings to port users and lower the cost of doing business in South Africa. Specifically, port users could have saved between of 27.97% in 2011 to 77.58% in 2016 in port tariffs. If this approach had been employed from the beginning, the average percentage decrease in tax revenues for the 7-year period would have been 43.83%. In monetary terms, this would have added up to an accumulated saving for port users of more than R2.6 billion (US$187m) over the 7-year period.

The formation of TNPA, as an independent subsidiary of Transnet SOC LTD is in progress and the impact of TNPA's corporatisation on the Company's balance sheet is still being assessed. According to Transnet (2022b:81) "once the relevant provisions of the NPA Act are amended, as recommended, the incorporation of the TNPA SOC LTD will be in accordance with the company's Memorandum of Incorporation (MOI) and will establish a State-Owned Company as defined in the Companies Act, No 71 of 2008, incorporated in accordance with and/or governed by the NPA; the PFMA and other applicable legislation. For ports, the process of establishing the National Ports Authority as a subsidiary of Transnet is well advanced. The corporate subsidiarisation will ensure a more competitive environment in the port terminal operations space and will enhance oversight of port terminal operations to improve their effectiveness."

The PRSA will allow a corporate tax rate of 28% if TNPA is corporatized from a division of Transnet into a subsidiary as the Minister of Finance, Enoch Godongwana stated during the Budget Speech on 23 February 2022 that the corporate income tax rate would be decreased from 28% to 27% for companies with the financial year ending on or after 31 March 2023 (Godongwana, 2022).

1.3.6. Claw-back

The main objective of applying clawbacks is to ensure that TNPA and port users are treated in a fair and equitable manner and are not subjected to unfair gains or losses due to inaccurate forecasting, imperfect information, and economic shocks. Specifically, the volatility of trade volumes coupled with the complexity in forecasting imports and exports accurately poses major problems, especially concerning the estimation of volumes in outer years of a multi-year

tariff period (Ports Regulator, 2020a). The incorporation of a claw back element causes the Required Revenue method to closely resemble the Revenue Cap approach (Ports Regulator, 2022).

1.3.7. Excessive Tariff Increase Margin Credit (ETIMC)

The Ports Regulator (2020a) regulates South Africa's ports to ensure the long-term sustainability of the maritime sector and the South African economy. Therefore, the Ports Regulator has to develop long-term plans that transcend the immediate tariff decision and take into account several ways to adequately deal with any future shocks to the system. For instance, it is usually accepted that the required infrastructure expenditure may increase sharply in the future, albeit such projects have not yet been evaluated in detail. Furthermore, exogenous market factors such as unexpected or expected fluctuations in imports and exports, inflation, and the Risk-Free Rate may also lead to abrupt tariff hikes. As such, the main objective for retaining and building up TNPA's Excessive Tariff Increase Margin Credit (ETIMC) is to circumvent excessive future tariff increases, thus facilitating the smoothing of exorbitant tariff hikes in the future, and to take countercyclical tariff decisions when economic activity is subdued.

The ETIMC proceeds are collected by the PRSA from port users, and they earn a return to pay port users for the opportunity cost of their capital. The return earned on ETMIC proceeds corresponds to the WACC allowed by the PRSA because the WACC represents the minimum return that is due to investors given the risks they bear when they commit funds to TNPA. The return on the ETIMC is then added to the balance and the total amount in the ETIMC account published annually in the Record of Decision (ROD) by the PRSA (Ports Regulator, 2022).

In regard to the use of the ETMIC provision the Regulator may allow the release of a fraction, or the entire of the amount of the ETIMC facility to impact tariff levels whenever it sees fit. The ETMIC provision may be used to avoid spikes in tariffs due to a sharp increase in capital expenditure, volume volatility, or any market related factor. In addition, the Regulator may take into account broader national objectives when making decision to increase, or to use the ETIMC facility to impact tariffs (Ports Regulator, 2022).

The amount and timing of the ETMIC application is difficult to estimate because of the dynamic nature of capital expenditure programmes, and volatile port volumes. Therefore, the PRSA is in a better positioned to determine the appropriate utilisation of the ETIMC to avoid excessive future tariff increases (NAAMSA, 2017). The PRSA did not apply the ETIMC in the 2023/24 tariff application (Transnet, 2022a). According to the Ports Regulator (2019), owing to the muted economic outlook over the 2022/23 and 2023/24 tariff period, if necessary, the Ports Regulator will utilise the ETIMC to achieve a tariff increase which is below the upper 6% inflation target band. This statement is an implicit intention to employ a price cap approach to determine port tariffs. SAASOA (2021) supports the use of the price cap approach and argues that the RR method is not appropriate as using the ETMIC to downward adjust the estimated tariff increase as determined by the RR method may deplete the ETIMI reserves. Consequently, future tariff spikes would not be able to be cushioned by the ETIMC but rather paid by port users as higher tariffs. So, instead of running down the ETIMC reserves the PRSA should consider if it is worthwhile for TNPA to renegotiate for more favourable cost of capital, and what are the required cost-cutting measures to attain a specific targeted CPI-X tariff adjustment (SAASOA, 2021).

Table 2.2: ETIMC Calculation (R million)

Transaction type	R million
2012/13 ETIMC retained	900
2012/13 WACC return on ETIMC (average ETIMC across year)	20
2013/14 ETIMC opening total	920
2013/14 Estimated ETIMC retained in 2013/14	1 378
2013/14 ETIMC closing total	2298
2013/14 Average ETIMC	1609
2013/14 WACC return on ETIMC	60
2013/14 ETIMC closing balance	2 358
2014/15 Average ETIMC	2 358
2014/15 WACC return on ETIMC	*108*
2014/15 ETIMC closing balance	2 466
2015/16 ETIMC Utilised	-150
2015/16 WACC Return on ETIMC	108,5
2016/17 WACC return on ETIMC	112
2016/17 ETIMC Total	2 537
2017/18 WACC Return on ETIMC	110
2017/18 ETIMC Utilised	-681
2017/18 ETIMC Total	1 966
2018/19 WACC Return on ETIMC	147
2018/19 ETIMC retained	345
2018/19 ETIMC Total	2 458
2019/20 WACC Return on ETIMC	161
2019/20 ETIMC Retained	539
2019/20 ETIMC Total	3 158
2020/21 WACC Return on ETIMC	211
2020/21 ETIMC Utilised	-567
2020/21 ETIMC Total	2 802
2021/22 WACC Return on ETIMC	149
2021/22 ETIMC Utilised	-1 201
2021/22 ETIMC Total	1 750
2022/23 WACC Return on ETIMC	83
2022/23 ETIMC Retained / Utilised	-1 188
2021/22 ETIMC Total	**645**

Source: Ports Regulator (2021:23)

Table 2.2 above shows the calculation of the ETIMC and the closing balance at the end of the tariff year.

The RR methodology was augmented with the ETIMC to avoid excessive future tariff increases, thereby enable the smoothing of exorbitant tariff hikes over multiple periods in the future. The COVID-19 pandemic severely disrupted international trade and as result port volumes and port tariffs were impacted negatively. Therefore, in the 2022/23 tariff year the PRSA reached a decision to use R1.188 billion from ETIMC facility to provide some respite to port users. As a result, only R645 million is left in the ETIMC facility (Ports Regulator, 2021). The ETIMC reserves will soon be depleted unless significant revenues are retained in the facility.

1.3.8. Weighted Efficiency Gains from Operations (WEGO)

While the RR methodology known for ensuring a fair and reasonable rate of return related to the cost of capital, it has a few well-known disadvantages that weakens its' effectiveness (Chasomeris, 2015; Gumede and Chasomeris, 2017). Moreover, the modifications incorporated into the RR methodology such as the claw back further discourage efficiency and competitiveness because they detract gains from profits derived from improved efficiency and competitiveness as well as higher market volumes. As a result, to circumvent this drawback the Ports Regulator of South Africa augmented the RR methodology with an efficiency incentive component in the form of Weighted Efficiency Gains from Operation (WEGO). The WEGO component "allows up to 5% additional profit to the National Ports Authority (the NPA) for a 10% increase in year-on-year improvements on a basket of key performance indicators (KPIs), and similarly up to 5% decrease in profit for a 10% decline in performance." (Ports Regulator, 2018b:1).

Whilst "the inclusion of an efficiency incentive component in the RR methodology will have positive results, these will only materialize over the long term. Therefore, this necessitates an approach that will immediately reflect and distinguish between volume gains (or volume losses) attributable to efficiency effects and underlying market forces. The introduction and continued improvement of the Terminal Operator Performance Standards (TOPS), Rail Operator Performance Standards (ROPS), Road Operator Performance Standards (HOPS), as

well as the Marine Operators Performance Standards (MOPS), is very important to the Regulator" (Ports Regulator, 2020a:22).

1.4.Research problem

In South Africa, the government regards the maritime industry as a catalyst for economic growth and acknowledges the need to promote a competent and adequate transport system (Gumede, 2012). However, port costs in South Africa are high by global standards and this has an adverse effect on the nation's economic growth and port competitiveness. While earlier studies proved that port costs in South Africa were amongst the highest in the world (Ports Regulator, 2014), the latest Global Port Comparator Study (GPCS) by the South African Ports Regulator found that relative port costs in South Africa have improved but they remain elevated. For instance, during 2020/21 the total TNPA costs to users in container ports were 38% above the global sample average down from 360% in 2012/13. While the total port costs for automotive were 20% below the global sample average down from 246% above the average in 2012/13, cargo due in this sector remained high at 73% above the global sample average in 2020/21, down from 743% in 2012/13. In contrast, the report shows that total port costs for bulk commodities are considerably lower than the global sample averages. The total port costs for iron ore and coal were 54% and 50% respectively below the global sample average during 2020/21 having been 31% and 43% respectively lower than the global sample averages in 2012/13 (Ports Regulator, 2020b).

Historically, after carefully considering the TNPA Tariff Application, the Ports Regulator almost never grants TNPA the requested tariff increase. The Ports Regulator either approves a lower average tariff increase or often grants TNPA a 0% tariff hike. This, in turn, creates price uncertainty and negatively affects port users' ability to estimate their expenses.

Against this background, it is evident that there is a desire and a need to reduce port authority charges, in particular cargo dues that are still 166% above the benchmarked mean and a need to implement a tariff strategy that continues to work towards the PRSA goal of cargo dues that are 36% below the benchmarked average. Additionally, in South Africa, the South African Reserve Bank uses inflation targeting and aims to keep inflation as measured by the consumer price index (CPI) between 3 and 6%. As such, the PRSA aims to keep TNPA price increases below the upper band of 6%. In most years PRSA has been able to use the RR model to ensure weighted average tariff adjustments that are below 6% (Grater and Chasomeris, 2022).

This study aims to evaluate the key components of the RR tariff methodology to determine appropriate port prices. The study intends to dissect Asset beta, RAB, tax, and ETIMC components and recalculate TNPA's required revenue tariff application for 2023/24 using adjusted input components informed by an evidence-based preliminary empirical and theoretical literature analysis. As such, the study will explore a range of possible future alternatives and analyse the consequences of possible decisions and actions which might be taken. This will establish a sound theoretical foundation for each scenario and relies upon in-depth analysis. The rationale is to fill gaps in research by producing comprehensive information around the subject matter.

1.5.Research Questions of this study

1. What are the main concerns regarding the Revenue Requirement pricing methodology for ports in South Africa?
2. What are the main factors that drive port prices in South Africa?
3. What is the justification for using alternative values of the Regulatory Asset base, Asset beta, tax, and ETIMC to recalculate TNPA's revenue required and tariff adjustment for 2023/24?
4. What would be the effects of using adjusted values of the Regulatory Asset base, Asset beta, tax, and ETIMC on the Transnet National Ports Authority's revenue required and port tariffs?
5. How can the accuracy of the components of the revenue required methodology and port pricing in South Africa be improved?

The study intends to evaluate the Asset beta, RAB, tax, and ETIMC components and recalculate TNPA's required revenue tariff application for 2023/24 using adjusted input components informed by an evidence-based preliminary empirical and theoretical literature analysis.

1.6.Research Objectives of this study

1. To evaluate the Rate of Return Pricing Methodology used to calculate the 2023/24 National Ports Authority's tariffs.
2. To identify the main factors that influence TNPA prices in South Africa.

3. To justify using alternative values of the Regulatory Asset base, Asset beta, tax, and Excessive Tariff Increase Marin on port prices.
4. To use scenario analysis to recalculate Transnet National Ports Authority's revenue required and tariff adjustment for 2023/24 using alternative values of Regulatory Asset base, Asset beta, tax, and Excessive Tariff Increase Margin Credit.
5. To provide recommendations to improve port pricing in South Africa and the accuracy of the components of the revenue required pricing methodology.

1.7.Importance of the study

The significance of this study is to understand and advance knowledge of the RR tariff methodology applied by the South African Ports Regulator on TNPA and how it can be enhanced to lower the cost of doing business, facilitate trade, and foster economic growth. The study will make a valuable contribution in the discourse of an efficient and effective transport system. The study is, therefore, of interest to the South African Ports Regulator, Transnet National Port Authority, the Department of Transport, and other stakeholders.

1.8.Research Methodology

This dissertation mainly adopted a quantitative scenario methodology. This study will re-calculate the National Ports Authority's required revenue tariff application for 2023/24 using adjusted input components (i.e., the Regulatory Asset Base, Asset beta, Tax Rate, and Excessive Tariff Increase Margin Credit) informed by an evidence-based preliminary empirical and theoretical literature analysis. Amer et al., (2013) state that quantitative scenario-building methods extensively use statistical and computational tools. A quantitative scenario analysis approach is appropriate for this study because it uses computational tools and numerical data of reduced or concentrated factors to explore alternatives that could improve and enhance sustainability.

1.8.1. Research Design

Creswell and Creswell (2009) describe research design as a strategy and a process for research that informs broad assumptions as well as detailed data collection and analysis methods. Leedy and Ormrod (2015) define research design as an approach to solving a research problem. This study will identify and explain common steps involved in the different scenario generation methods and classify them into broad themes to develop a comprehensive scenario generation framework to structure the approach and process of the study. In turn, this framework will be

used to recalculate the TNPA required revenue tariff application for 2023/24 using alternative values of the Regulatory Asset base, Asset beta, tax, and Excessive Tariff Increase Margin Credit on port prices to demonstrate that there is scope to significantly reduce port tariffs.

1.8.2. Data Collection Methods

This dissertation relied purely on secondary data that was collected, analyzed, and synthesized. Secondary data include data that has been previously collected by other researchers for another primary purpose and will be analysed to be reused to solve a specific research problem (Vartanian, 2010; Martins et al, 2018). Secondary data include published research, academic journals, internet articles, media reports, and data which been manipulated and analysed for other purposes than those of the current study (Assessment Capacities Project, 2012). Accordingly, this research used secondary data that is in the public domain and accessible through various websites and databases. Specifically, this study used relevant academic journals, published research, reports, books, and articles to assess the key factors that influence port prices in South Africa. Organizations as such The Ports Regulator of South Africa, Transnet, University of KwaZulu Natal (UKZN) will be used as information sources.

1.8.3. Data Analysis Methods

The study will make use of Microsoft Excel (MS Excel) to perform scenario analysis as well as sensitivity analysis. This study will recalculate TNPA's required revenue tariff application for 2023/24 using adjusted input components informed by an evidence-based preliminary empirical and theoretical literature analysis. This will establish a sound theoretical foundation for each scenario and relies upon in-depth analysis.

1.9.Dissertation Structure

Dissertation Structure

- Chapter 1 (Introduction) – This chapter provides an introduction and overview of South Africa's port pricing history. It also covers the research problem statement, research aims, and objectives, the importance of the study, as well as the research methodology.
- Chapter 2 (literature review) – This chapter covers the literature review which focuses on port pricing, port pricing objectives, port pricing approaches, the Rate of Return methodology, systematic risk, and the key factors that influence port prices in South Africa.

- Chapter 3 (Research Design and Methodology) – This chapter will provide comprehensive information on the research methodology, data collection, and analysis method.
- Chapter 4 – (Scenario generation and analysis). The chapter reports on the scenario analysis and assesses the outcomes of a range of possible future alternatives.
- Chapter 5 (Conclusion) – This chapter will include the conclusion of the study and present recommendations. In addition, this chapter will propose areas for future research.

CHAPTER 2: LITERATURE REVIEW

2. Introduction

This chapter will provide a summary of the review of literature that presents the most authoritative scholarship on the research problem. Specifically, this chapter covers port pricing literature in relation to port pricing objectives and different port pricing approaches with a particular focus on the value-based approach also referred to as the financial or the rate of return approach. In addition, this chapter will review the rate of return pricing methodology for ports in South Africa.

2.1. Port Pricing

Port pricing has gained more attention from academics in the field of port economics. Acciaro (2013) asserts that efficient port pricing plays a key role in facilitating trade and economic growth. That is, port efficiency has a positive impact on port throughput, and therefore, is an important contributor to economic growth (Dwarakish, and Salim, 2015; Rodrigue and Notteboom, 2020).

While most ports have considerable market power, they are now more inclined to become more competitive in response to external shocks and constantly changing global market conditions. Port competitiveness is a function of a myriad of factors as such; “port and terminal handling charges, water draft, geographical location, feeder and multimodal connectivity, service, predictability reliability and stability, client relationship management, and communication” (Bandara, Nguyen, and Chen, 2013:11).

According to Bandara (2015), port pricing is one of the basic yet fundamental decisions confronting port stakeholders, as it directly and significantly affects two vital aspects of seaports, namely profitability and competition. By contrast De Martino and Morvillo (2008) and Scaramelli (2010) maintain that the views of most port stakeholders have changed from giving more importance to aspects that are related to infrastructure and pricing thereof to quality of service, reliability, and flexibility. They argue that it is on this basis that, although most cost elements are relevant, it is generally acknowledged that cost elements are no longer significant in the choice of a port or terminal.

On the other hand, Aronietis, Van de Voorde, and Vanelslander (2010:18) “identified different criteria as important for port selection for different actors. The authors argue that shippers

frequently mention (in order of citation times) costs, operations quality, and reputation, and port location as important in port selection. For shipping companies, the port selection decision is influenced by (in order of citation times) cost, location, port infrastructure and facilities, and port operations quality and reputation. For terminal operators, key port selection determinants are (in order of citation times) port infrastructure and facilities, port operations quality and reputation, cost, location, intermodal/hinterland links, port information systems, congestion in port and, efficiency."

In South Africa, while earlier studies showed that port costs were amongst the highest in the world (Ports Regulator, 2014), the latest Global Port Comparator Study (GPCS) by the Ports Regulator of South Africa (to be referred to as "the Ports Regulator") found that relative port costs in South Africa have improved but they remain elevated. For instance, during 2020/21 the total TNPA costs to users in container ports were 38% above the global sample average down from 360% in 2012/13. While the total port costs for automotives were 20% below the global sample average down from 246% above the average in 2012/13, cargo due in this sector remained high at 73% above the global sample average in 2020/21 down from 743% in 2012/13. In contrast, the report shows that total port costs for bulk commodities are considerably lower than the global sample averages. The total port costs for iron ore and coal were 54% and 50% respectively below the global sample average during 2020/21 having been 31% and 43% respectively lower than the global sample averages in 2012/13 (Ports Regulator, 2020b).

Meyiwa and Chasomeris (2020) state that port costs in the history of TNPA have mainly been recovered from cargo owners, whereas shipping companies pay lower tariffs compared to the global benchmarked average. TNPA is of the view that allocating a large share of costs to shipping lines will make South African ports unattractive and they will invariably pass the higher costs to cargo owners. The authors also show that the costs allocated to cargo owners have been declining over the years, but they still contribute the largest share of TNPA revenue (Meyiwa and Chasomeris, 2020).

The different criteria used by different port users for port selection identified by Aronietis et al (2010) show that shipping companies and shippers are more price elastic than terminal operators. These different criteria for port selection can be used to inform cost allocation among port users. Therefore, based on the different criteria for port selection, port authorities should aim to recover the bulk of the revenue from terminal operators as they are more price inelastic.

However, terminal operators will invariably pass on the higher costs through higher Terminal Handling Charges (THCs). This issue can be addressed through the regulation of Terminal Handling Charges.

2.2. Port Pricing Objectives

When structuring pricing policies and setting tariffs, ports usually attempt to take into consideration the "following pricing objectives: (i) to promote the most efficient use of the facilities, (ii) to retain the benefits resulting from investment within the country, and (iii) to recover sufficient revenue to meet financial objectives. Other objectives of port pricing objectives include reducing total logistics costs from a national point of view; increase market share in selected markets; offering an incentive to port users to enhance their facilities and services; and ensuring that the tariff is both pragmatic and simple" (ESCAP, 2002:5; and UNCTAD, 1995:20).

2.3. Port Pricing Approaches

Port pricing structure generally reflects the history and traditions of each port. UNCTAD (1995) regards port pricing as a strategic instrument with three approaches to port pricing, namely cost-based, value-based, and strategic pricing.

2.3.1. Cost-based Approach

The economic approach advocates for marginal cost pricing, and considers the effects on all parties, including benefits and costs to others. The cost-based approach, particularly marginal cost, has received significant attention compared to the other port pricing approaches (UNCTAD 1995; Bandara, Nguyen, and Chen 2016). Proponents of marginal cost pricing argue that it is appropriate for efficient port pricing as ports are characterized by substantial fixed costs and marginal costs are low (Suwanpargpraek 1988; Haralambides 2001).

Marginal cost pricing, however, has some problems. First, according to Haralambides (2002, cited in Gumede and Chasomeris 2018), it is difficult to estimate and distribute the marginal costs. Second, marginal cost pricing is suitable in a perfectly competitive market. But the port industry is characterized by a monopoly (Goss & Stevens 2001; Meersman et al., 2003).

Mchizwa (2014) states that marginal cost pricing is complex but full cost recovery based on the user pays principle is more pragmatic. Gumede and Chasomeris (2018) explain that it is

generally accepted that there cost recovery for port infrastructure in paramount. With respect to South Africa's ports, over and above full cost recovery, a risk-related rate return on investment is permitted by the Ports Regulator.

2.3.2. The Strategic Approach

Strategic port pricing is based on the principle that port charges are associated with the port's strategic objectives. Consequently, the strategic pricing approach can be a very useful instrument in achieving the ports strategic objectives and plans. In some instances, the port's strategic objectives inform the approach to differentiated port charges (UNCTAD, 1995). Wilmsmeier (2012) holds that the decision by a port to use the strategic approach may also be influenced by a long-term strategy aimed at expanding the market or the objective to maximise profits from a particular user group.

2.3.3. Value-based Approach

The value-based approach also referred to as the financial or the rate of return approach bases prices on accounting costs to generate a profit. This pricing approach seeks to generate adequate revenues to cover all costs incurred in providing services and facilities, including expenditure on infrastructure (UNCTAD, 1995).

The effectiveness of value-based tariffs is assessed by how efficiently the tariff structure differentiates between different port users. Different tariffs for dry bulk, liquid bulk, containers, and breakbulk cargoes may be applied to differentiate between cargoes in accordance with their value and price elasticity (ESCAP, 2002).

The literature review in relation to value-based approach focuses on the regulation on the rate of return in much more detail in section 2.4.1 below.

2.4. Pricing Models

There are three main pricing models that are used by most regulated utility firms, namely Rate of Return (ROR), Price Cap, and Sliding-Scale. While the ROR regulation is widely used by most utility firms it is often criticised for being inefficient and having high administrative costs. The main alternative to the ROR regulation is price cap regulation, where the regulator sets the price level that a company cannot exceed, and then permits the regulated entity to retain any

profit it generates in the price regulation period through improving its cost efficiency (Alexander and Irwin, 1997; Liston, 1993). However, price-cap regulation also has its limitations as discussed in more detail below.

2.4.1. Rate of Return Regulation

The "rate of return regulation (ROR), a form of cost-plus regulation, is often used by regulators to determine fair and equitable prices for utility companies. This is because they provide the company the opportunity to recover the costs it has incurred in providing services. Moreover, customers are protected from paying prices that would generate monopoly profits for the organisation" (Jamison, 2007:1). Ports, such as TNPA, also employ ROR regulation to achieve efficient pricing and become more competitive. Ports, particularly those that are self-financing, need to operate efficiently and effectively, and generate a sufficient and commercially acceptable ROR (OECD, 2011).

While the rate of return regulation is renowned for ensuring a fair and reasonable rate of return related to the cost of capital, it has a few well-known shortcomings that weaken its' effectiveness. For instance, the rate of return regulation is criticized for disincentivising companies to operate efficiently. Also, the rate of return regulation places significant importance on cost recovery, thus, the company could be tempted to increase its returns by making unnecessary infrastructure investments. This phenomenon is called the Averch-Johnson effect (Jamison, 2007; Kirkpatrick, and Parker, 2004).

Truen (2022:30) argues that regulators using the rate of return method regularly monitor performance to improve efficiency and prevent overinvestment, and sometimes incorporate "efficiency incentives in the regulatory structure. This has been the case in the South African ports system, where the Ports Regulator has introduced an efficiency incentive called the Weighted Efficiency Gains from Operations (WEGO)."

Clearly, the rate of return regulation has several advantages and disadvantages. It is, therefore, important to assess whether a rate of return regulation is appropriate and suitable for achieving pricing objectives of ports**.** Jamison (2007) submits that "there are five traditional criteria for determining whether a rate of return is appropriate. The first is whether the rate of return is sufficient to attract capital to invest in capital expenditure. A second criterion is the realization of efficient management practices. The third criterion measures efficient utilization of services.

A fourth criterion is rate consistency, stability, and predictability, which in turn allows customers to forecast their expenses. The last criterion is fairness to investors." It would be an insightful exercise to assess the South African Ports' rate of return regulation method against these criteria to determine whether it is appropriate.

2.4.2. Price Cap Regulation

The use of price cap regulation by many countries has been increasing in over the last decade as it is perceived to incentivise firms to be more efficient (Jamison, 2009). In general, price caps are designed to encourage firms to be more efficient thereby revealing their actual efficient production costs over time (Kirkpatrick et al., 2005). Liston (1993:25) states that "price-cap regulation, by which ceilings ("caps"), based on indices of price and technological change are imposed, below which the regulated firm has full pricing freedom." Under the price cap approach, the regulator to sets the price level that a company cannot exceed, and then permits the regulated entity to retain any profit it generates in the price regulation period through improving its cost efficiency. This regulated price is adjusted annually by the inflation rate plus or minus a specific amount and notwithstanding the firm's profitability (Alexander and Irwin, 1997). For instance, prices of the regulated entity are set to increase by the rate of inflation, which is usually the Consumer Price Index (CPI), less the efficiency gain factor, X Therefore, the price setting rule is CPI-X. The regulated entity is then allowed to earn excess revenues given that it can reduce costs by more than the X factor (Kirkpatrick et al., 2005).

Kirkpatrick et al., (2005:6) states that "the more stable and secure the environment for investors, the lower the cost of capital and the greater should be the level of investment funds from both domestic and foreign investors attracted into the industry." Unlike the rate of return regulation, under the price cap regulation profits may be volatile and are not guaranteed, leading to an uncertain environment for investors. Consequently, as beta represents the firms' systematic risk, price cap regulation tends to exhibit higher betas than rate-of-return regulation (Alexander and Irwin, 1997). Therefore, in contrast to the rate of return regulation, the price cap regulation is expected to have a higher cost of capital. Thus, price cap regulation is not perceived as an ideal pricing method for capital intensive utility firms that require substantial investment funds, and it is regarded as a major limitation in the context of economic development (Kirkpatrick et al., 2005). Cowan (2002) also argues that price-cap regulation may be more suitable for industries with excess capacity and without significant investment

needs to expand. Moreover, price cap regulation is said not to be suitable for most developing countries as they appear have inadequate regulatory capacity, incompetent personnel, and appropriate laws to support regulatory reliability. This is attributable to the fact regulatory organisations in developing countries are usually short-staffed, and they lack the required resources and funding to provide sound regulatory oversight (Kirkpatrick et al., 2005).

The main advantages of the price cap regulation compared to the rate of return approach they include: (i) lower administrative costs, (ii) reduction of the Averch -Johnson effect, and (iii) fewer public consultations which lead to an incentive to minimize costs. In contrast, price-cap regulation also has the following limitations: (i) due to incentives to lower costs the regulated entity may be tempted to compromise the quality of service in order to generate larger, (ii) when the price cap is set too high results in the reduction of consumer surplus, (iii) price cap regulators have autonomy when determining price caps because they are not required to make public the rate of return. This may result in the regulated entity capturing the regulatory process, (iv) the absence of public consultations denies stakeholders a platform and an opportunity communicate their views and undermines pricing (Brian, 2010; Kirkpatrick et al., 2005).

2.4.3. Sliding-Scale Regulation

Most countries implement a combination of the rate of return regulation and price cap regulation which is called Sliding-Scale (SS) Regulation. Under this hybrid method a price cap is set, and the regulated entity may retain all revenues if the rate of return on investment is below a specific level but if the rate of return is above that specific level the regulated entity must share profits with consumers through reducing prices (Braeutigam and Panzar,1993; Kirkpatrick et al., 2005). Braeutigam and Panzar (1993:197) state that “under SS regulation it is necessary to calculate firm rates of return and to suffer many of the associated accounting and monitoring problems.” Therefore, SS regulation is ideal if the regulator wants to implement price cap regulation but keep getting access to information that the rate of return regulation requires.

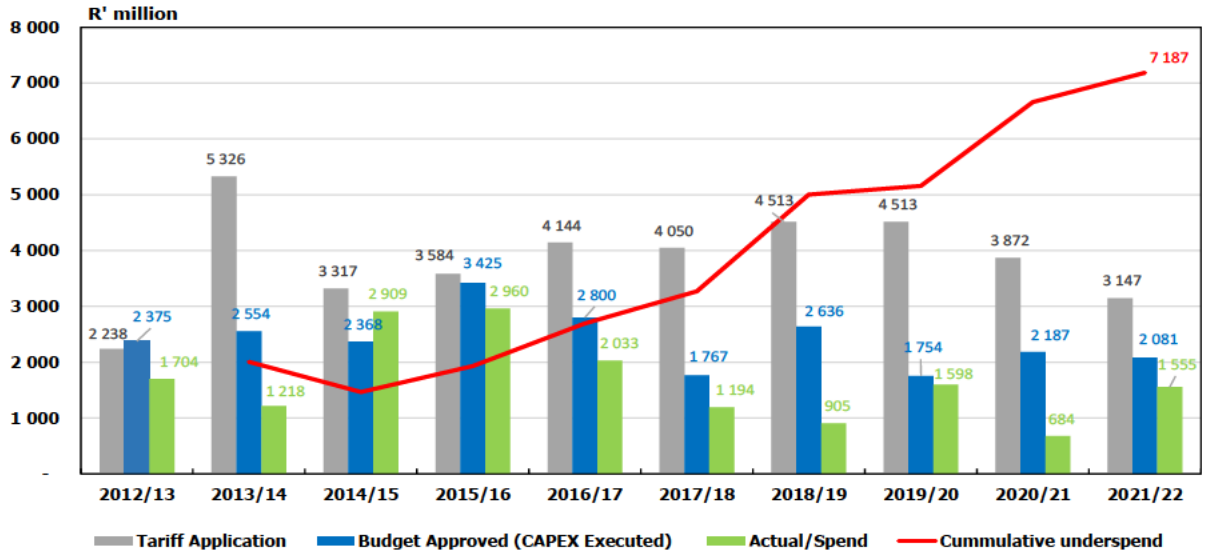
There are different pricing models available to utility firms with large capital requirements. It is incumbent on utility firms to use the appropriate pricing model to guarantee efficient port pricing to sustainably provide key infrastructure and facilitate trade and lower the cost of doing business. The next sections will discuss the underlying reason for poor investment in port infrastructure.

2.5. Underinvestment in South Africa's Ports

The rate of return pricing methodology which is used by TNPA to set port tariffs is often criticised for encouraging entities to overinvest in infrastructure because it assures the recovery of all costs incurred plus a return on capital to compensate investors. Despite this, although TNPA makes significant profit margins, there is significant underinvestment in South Africa's Ports. In turn, this undermines South Africa's trade competitiveness and economic growth and development prospects. The underinvestment in South Africa' ports is mainly attributable to the fact that TNPA revenues and profits are not being sufficiently ploughed back into the ports system mainly due to governance issues coupled with inadequate pricing. Transnet's centralised organisational structure, where the Group Chief Executive (GCE) and the board of directors take decisions for all operating divisions, allows the organisation to redistribute profits between operating divisions (Meyiwa and Chasomeris, 2020). Also, Meyiwa and Chasomeris (2020) explain that while port users are in support of cross-subsidisation within the port sector, they however argue that the bulk of TNPA's profits are used to cross-subsidise other less profitable Transnet divisions rather than being reinvested into the ports sector to maintain and upgrade critical infrastructure. As a result, capital requirements in the port sector remain significant.

The Ports Regulator demonstrated that over a six-year period from 2010 to 2015, TNPA had a cumulative underspend on their Capital expenditure programme of more than R8.6 billion (Chasomeris, 2020). Chasomeris and Gumede (2020) show that "from 2016/17 to 2018/19 TNPA annual profit before tax increased 155% from just over R2.9 billion in 2017 to more than R7.4 billion in 2019. Over the same period, TNPA was granted an increase in CAPEX from R4.1 billion to R5.4 billion. Actual capital expenditure, however, declined 55% from just over R2 billion to R905 million. The decline in investment into the ports system is not consistent with TNPA's planned increases in capital expenditure and is a major concern to port users, the Ports Regulator and TNPA". Grater and Chasomeris (2022), explain that during 2019/20 actual capital expenditure on port infrastructure somewhat increased to R1.598 billion. However, the effect of COVID-19 pandemic and the lockdown's impact on economic activity contributed to the significant decrease in investment spending to R684 million in 2020/21. As of 2021/22 the cumulative underspending in Capex is a staggering R7.187 billion.

Figure 2.1. TNPA Capital Expenditure Trends



Source: Author compiled using data from Chasomeris and Gumede (2022) and TNPA (2021).
Note: the 2021/22 "Actual/Spend" is only a forecast.

Meyiwa and Chasomeris (2020) rationalise that the corporatisation of TNPA, as required by the National Ports Act of 2005, would eradicate cross-subsidisation between Transnet Divisions, thereby allowing the port authority to ring-fence its' profits for infrastructure investment in the ports system. Accordingly, On 22 June 2021, the President of South Africa, Cyril Ramaphosa, declared the establishment of TNPA as a stand-alone, wholly owned subsidiary of Transnet with its own Group Chief Executive (GCE) and Board of Directors.

Thus far, Transnet is preparing for the incorporation of the TNPA SOC LTD. According to Transnet (2021:127) "Transnet and the Department of Public Enterprises (DPE) are working on the process by which the business of TNPA, including all assets, liabilities, rights, and obligations of Transnet relating thereto, shall be transferred to the new subsidiary. This process will determine the impact of TNPA's corporatisation on the assets, liabilities, performance, and cash flows in the Company's separate financial statements. Therefore, the impact on the Company financial statements is still to be determined". Also, in the intervening time, an Interim TNPA Board was appointed effective 1 July 2021 (Transnet, 2021).

2.5.1. Underlying reasons for underinvestment in South African ports

It is important to reflect on the underlying reasons behind the protracted underinvestment in South Africa's ports which undermines South Africa's trade competitiveness and economic

growth development efforts. Most of these underlying reasons were captured in the National Freight Logistics Strategy (NFLS) of 2005, and they remain relevant (Pieterse et al., 2016).

2.5.1.1. Protracted Underinvestment in the Rail Network

During the 20th century, freight transport in South Africa placed more emphasis on achieving political and economic objectives. As a result, the freight rail sector was protected. Specifically, road competition was restricted by means of road freight overregulation through tonnage and licensing requirements (Havenga et al., 2014). In 1988, the road transportation sector was deregulated due to mounting pressure from industry and the global deregulation trend. Since then, investment in the rail sector declined significantly and critical infrastructure and rolling stock dilapidated. As a result, the rail sector became operationally inefficient, unprofitable, and lost a significant market share to road, particularly general freight (Baloyi, 2014; Havenga et al., 2014). Therefore, proceeds from Transnet's profitable divisions, namely, TNPA and pipelines, are being used to cross-subsidise the less profitable freight rail division to redress for historical underinvestment in the sector. This, as a result, causes a significant investment backlog in the port system which, in turn, weakens trade competitiveness (Pieterse et al., 2016).

In 2012, Transnet announced the market demand strategy (MDS) to reverse the historical underinvestment in transport infrastructure. This R300 billion investment strategy was aimed at growing and upgrading South Africa's port and rail infrastructure over a seven-year period. However, the strategy did not yield the envisaged results due to State Capture largely facilitated by widespread corruption in the governance of Transnet.

2.5.1.2. Ineffective Regulation

The undercapitalization in critical freight transport infrastructure is partly attributable to a regulatory system that is ineffective in managing pricing, promoting competition, and eradicating cross-subsidisation. This is because economic regulation of the transport sector in South Africa is disintegrated. While the ports, energy, and aviation sector are regulated, rail and roads are not subjected to economic regulation (Pieterse et al., 2016). Transnet National Ports Authority "tariffs are regulated by the Ports Regulator of South Africa, while tariffs for Transnet Pipelines are regulated by the National Energy Regulator of South Africa (NERSA). Transnet Freight Rail (TFR) and Transnet Port Terminal (TPT) tariffs are unregulated as they are determined by the Transnet management (as per the shareholder compact with the Department of Public Enterprises)" (Transnet, 2021:2).

The existing freight rail regulatory regime in South Africa does not support volume density and growth, efficient operational performance, and productivity. Pieterse et al., (2016:17) states that "the freight rail regulatory regime lacks a settlement process; rules on pricing, investment and access; and an independent regulator with legislated investigative, enforcement and decision-making powers". As a result, The Department of Transport (DOT) is in the process of promulgating a Single Transport Economic Regulator (STER) Bill to promote the development of a competitive, efficient, and viable South African transport industry contributing to economic growth and development. The Bill aims to regulate the entire the transport industry, namely, road, rail, aviation, and maritime transport from a pricing and competitive perspective.

2.5.1.3. Highly competitive road freight sector that benefits from an unlevel playing field

The majority of businesses in South Africa are reliant on the services provided by the road freight transport industry. As such, the road freight sector contributes significantly to economic growth and development. However, there are some problems associated with road freight transport as it is apparent that some road freight operators are more concerned with maximizing profits above anything. It is, therefore, generally accepted by most transport industry practitioners that the playing field between road and rail is not level. This means that the road freight transport industry is favoured in certain ways over rail (Pieterse et al., 2016:19; Van der Mescht, 2006:488). The following include some of the key advantages that accrue to road freight leading to rail inability to effectively compete against the road freight transport.

First, trucks, as a group, do not contribute proportionally to motor cars for their use of the roads and are subsidized by motor cars. This imbalanced disparity signals the need for a more equitable road user charge for trucks. The road freight operators would lose their competitive advantage over rail if the user pay principle had to be applied to recover the required funds directly from them (Stander and Pienaar, 2005). Second, according to Van der Mescht (2006:488), "an unacceptable high number of road freight vehicles are overloaded beyond the legal limit, increasing the magnitude of imposed loads on road pavements, bridges and culverts. In the process, life cycles of road infrastructure are reduced, which impacts negatively on road maintenance budgets. Added to this is the cost of policing overloading, which includes not only the capital expenditure required for installing permanent weighbridges, but also the operational costs of manning them". Third, Van der Mescht (2006), explain that some truck drivers choose to use lower order roads instead of national roads to evade toll fees, weighbridges, and traffic

police. Finally, negative externalities such as pollution, damage to roads, road accidents and other factors are not considered into the road freight transporters' cost base (Pieterse et al., 2016).

These advantages enjoyed by the road freight transport industry have caused the rail freight sector to be uncompetitive, particularly in rail friendly market segments. This not only has implications for the protracted underinvestment in the rail freight sector but has wider undesired effects for South Africa's export competitiveness (Pieterse et al., 2016).

According to Pieterse et al., (2016:19), "considering the hidden costs to the taxpayer due to overloading by unscrupulous road transport operators, government intervention is necessary to counter the continuing abuse of publicly owned road infrastructure which is also contributed to by the employment of undocumented foreign nationals who are often unqualified and untrained but offering a cheap source of labour."

This section establishes that there has been a protracted underinvest in critical infrastructure in South Africa's ports as TNPA have to cross-subsidise the less profitable division of Transnet. This can be addressed by improving the economic regulation of the entire transport industry in South Africa. The next section considers various methods of determining the correct beta for unlisted firms such as TNPA, thereby ensuring that TNPA generates adequate revenue to invest in and maintain port infrastructure.

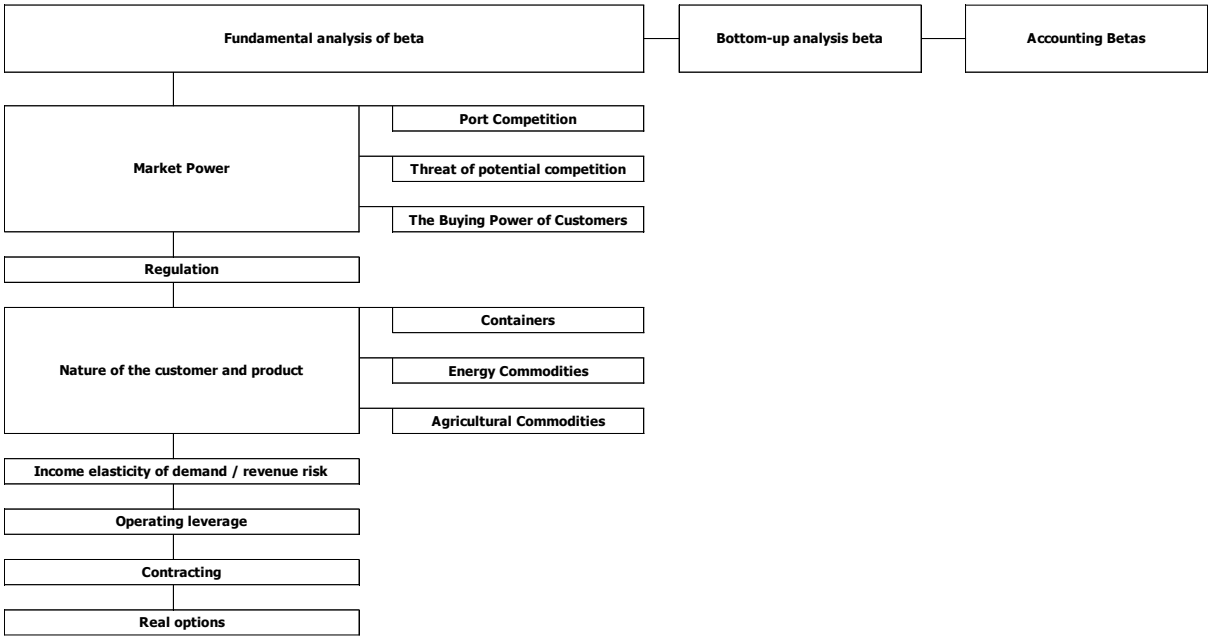
2.6. Methods of Estimating Equity and Asset Betas

Section 1.3.2.4 above explains that TNPA is not a listed firm, therefore, there is no published beta (β) which represents its' risk in relation to the companies listed on the market. As a result, a beta that represents TNPA's risk under the RR methodology must be determined. Accordingly, this section seeks to review the different methods of estimating the beta coefficient for unlisted firms.

There are three main methods for calculating the asset beta of firms. The most used and well-established method is to use historical data on market prices for the securities of firms and estimate betas using regression analysis. However, this method is only available to listed firms (Fallon et al., 2021). Other approaches include:

- Fundamental analysis of beta
- Accounting Betas
- Bottom-up analysis beta

Figure 2.2. Methods for Estimating Beta for Unlisted Firms



Source Author compiled using data from Fallon et al., (2021); Incant Economic Consulting, (2020); Synergies Economic Consulting, (2017); Damodaran, (1999); and Rosenberg and Marathe, (1976).

2.6.1. Fundamental analysis of beta

The fundamental approach to analysing beta presumes that the risk premium of a firm is influenced by measurable characteristics of the firms' business. Comparing the characteristics of the firms' business against other firms may provide more insight regarding the particular risk class that a firm belongs to. Furthermore, this may allow analysts to make an indicative estimate of the firm's beta (Fallon et al., 2021).

There are key factors to consider that influence systematic risks in ports and other network industries. These factors include market power, regulation, nature of the customer / product, the type of business environment that in the firm operates in, income elasticity of demand / revenue risk, degree of operating leverage, degree of financial leverage, contracting, real options, Covid-19 pandemic (Fallon et al., 2021; Incenta Economic Consulting, 2020; Synergies Economic Consulting, 2017; Damodaran, 1999).

Several researchers have studied the association between betas and fundamental factors. For instance, Rosenberg and Marathe (1976) argue that fundamental information relating to an

entity can be used in addition to historical beta estimates to provide enhanced estimates of future betas. Fundamental analysis of beta can be very useful in estimating betas. Once a regression beta has been estimated, fundaments can be used to adjust and correct the regression betas reflect the current fundamentals of the firm (Damodaran 1999).

Lally (2000) maintains that, despite adjusting for financial leverage, correction for other fundamental factors that have an impact on beta is not reassuring due to the absence of theoretical formulas and continuing debate about the appropriate formula. Nonetheless, it is general practice to adjust and correct comparator betas subjectively to take into consideration the influence of some of the fundamental factors. Lally also proposes that econometric methods could enable for statistical corrections of the direct recognition of other explanatory variables. The next section discusses the fundamental factors that are likely to affect systematic risk of ports and the direction of the influence in detail.

2.6.1.1. Market Power

In general, a port has market power if it has a sustained high market dominance. In the European Union (EU) competition law a port is deemed to have market power if it has the liberty, to a significant extent, to behave independently of its customers and competitors. Several factors are important when examining whether ports have market power. These including the level of existing competition, the threat of potential competition, and the extent of buyer power (Incenta Economic Consulting, 2020; OECD, 2011).

The empirical findings in this subject matter are mixed. Sullivan (1982) maintains that significant market share is associated with lower asset betas. This assertion stand to reason as the volatility of returns for a dominant company with significant market power is likely to be low due less competition. On the other hand, Curley et al (1982) finds no link between market concentration and asset betas.

2.6.1.1.1. Port Competition

Port competition is classified into intra-port and inter-port competition. The former refers to competition between ports and the latter refers to competition between port terminals or ancillary service providers within the same port (Mchwiza, 2014). Most ports are not significantly affected by intra-port competition because they enjoy a considerable degree of

market dominance within a confined hinterland. Conversely, “a recent trend has been the increasing number of the major world shipping alliances encouraged by muted profitability and excess capacity, which has consolidated negotiating parties and decreased the bargaining power of ports. This, as a result, has created an incentive for alliances between ports. Despite this, the effect of market power on systematic risk is insignificant and has a relatively neutral bearing on the relative systematic risks on ports” (Incenta Economic Consulting, 2020:32). Similarly, Frontier Economics (2019) investigated the claims pertaining to actual and potential competition confronted by ports and found that ports have little competition and their actual or potential future exposure to competition cannot justify a higher-than-average beta.

In the case of South Africa, ports are assessed to be less risky in contrast to the global average for ports due of the complimentary system of ports and associated tariff structure that differentiates between different port users and enables cooperation between ports instead of competition and diversification and distribution of costs, revenues, and risks throughout the ports system (Gumede and Chasomeris, 2017).

2.6.1.1.2. Threat of potential competition

Despite the prevailing level of competition between ports, the degree of potential competition is also important for determining market power. The threat of entry by new ports, to a certain degree, restrict the abuse of market power of existing ports. Ports usually abuse their market power through excessive pricing of port services. This phenomenon occurs when ports charge a price which is unreasonably exorbitant because it not commensurate to the economic value of its’ port services. Consequently, excessive port pricing which is unfavourable to port users because they must pay unduly higher prices for port services leads to high costs of doing business and reduces social welfare owing to the allocative inefficiency triggered by the higher prices. However, barriers to entry are generally significant, particularly for ports that are highly integrated into logistics networks and supply chains. In turn, this reinforces the market dominance of ports (OECD, 2011).

2.6.1.1.3. The Buying Power of Customers

The buying power of customers is generally measured by price elasticity of demand (Lally, 2003). Intuitively, industries with customers should exhibit higher (lower) price elasticity of demand have greater (less) systematic risk and therefore have higher (lower) asset betas. According to Notteboom et al (2022), various market segments and port users have different

price elasticities because they respond differently to price changes. Some port users have no choice but use a particular port either due to the absence of alternative ports or because a decision to use a different port would result in high switching costs. In contrast, other port users are relatively flexible with respect to the port selection decision and highly responsive to changes in port prices and tariffs. Oum et al., (1990) argue that transportation tends to be inelastic because it is a derived demand except for some freight shipments depending on the level of intermodal competition. Transport demand, that is, tends to be more inelastic in countries with less intense intermodal competition. Suykens and Van de Voorde (1998) state that total port costs contribute a small share to the total costs of the entire logistics chain. As a result, overall demand for port services is inelastic. However, the demand elasticity for a specific port is high because of a high likelihood of switching one port for another. A study conducted by Haralambides (2002) calculated by how much container volumes would change if dredging costs were borne by Hamburg port users through user charges showed that in Europe port users are very sensitive to price changes for port services. The study also revealed that a 10 Euros (about 5%) increase in terminal handling charges per TEU would result in a 15.3% (about half a million TEU) decrease in container volumes.

In the South African context, a research thesis by Mchizwa (2014) assessed the sensitivity of the port users to port price changes and demonstrated the potential impact of future price changes on the South African transport system and economic growth. Firstly, the study showed that the relationship between dry bulk import and exports handled in South Africa's ports system and port charges is weak. Secondly, it demonstrated that there is no statistically significant association between break-bulk imports and exports and port prices. Finally, it revealed that container exports and imports have a strong negative correlation with port prices. Specifically, a 1% increase in container imports cargo dues proved to result in a 1% decrease in container imports. Therefore, the demand for container imports is relatively unit elastic because the estimated elasticity is slightly above 1 in absolute value. In respect of container exports, a 1% increase in cargo dues will led to a 0.37% decrease in container export volumes, other things remaining constant. Consequently, container exports are price inelastic because the elasticity for container exports is less than 1. While the price elasticity of demand in South Africa's ports for container imports is relatively unit elastic, the price elasticity of demand for the other commodities is very low. This suggests that South Africa's ports should have a lower beta.

2.6.1.2. Regulation

Lally (2003) argues that industries whose prices are subject to the rate of return regulation should be less responsive to real GNP fluctuations, because the regulatory process is intended to bring about a fixed rate of return. Rosenberg and Guy (1976) states that these types of firms have amongst the lowest betas after considering several firm specific variables. Similarly, according to Incenta Economic Consulting (2020), in cases where revenue cap regulation has been imposed on industries with a high degree of market dominance as such energy and water distribution and transmission, this has had a buffering effect on cash flows, and therefore a lower asset beta is observed. The buffering of cash flow for regulated entities occurs where a regulator sets prices that are substantially lower than what the entity would charge if unregulated and configures the regulatory system to protect the regulated entity from market risk. That is, prices are reviewed periodically and readjusted based on updated estimates of cost and other forecasts

In contrast, Alexander et al. (1996) demonstrates that utilities subject to the United Kingdom type of regulation which sets prices for five years have substantially higher average asset betas than for utilities subject to United States style of regulation which sets prices for only a year. According to Lally (2002), most of the difference in asset betas is due to the disparities in regulatory regimes and some to market leverage differences.

This suggests that industries that are regulated through a revenue cap regime, such as South Africa's ports, have reduced exposure to market risk and by consequence should have a lower-than-average asset beta. Moreover, the inclusion of the Claw-Back and Excessive Tariff Increase Margin Credit (ETIMC) by the Ports Regulator in the RR methodology as well as the intrinsic public nature of TNPA lowers South Africa's ports' exposure to market risk and thereby compels Regulator to use a Beta significantly lower than proposals such as the Johannesburg Stock Exchange (JSE) top 40 (Ports Regulator, 2013a). Specifically, the Claw-Back ensures that TNPA and port users are not subjected to unfair gains or losses due to inaccurate forecasting, imperfect information, and economic shocks. The ETIMC is to avoid excessive future tariff increases, thereby enable the smoothing of exorbitant tariff hikes over multiple periods in the future, and to take countercyclical tariff decisions during periods of subdued economic activity (Ports Regulator, 2020a).

2.6.1.3. Nature of the customer and product

There are two important aspects that must be considered when assessing "the impact of the nature of the customer and product on systematic risk. First is the difference between private and public sector demand. Industries producing a product that is exclusively demanded by the public sector should be less responsive to real GNP fluctuations than for industries producing a similar product but exclusively demanded by the private sector, because public sector demand is less responsive to real GNP fluctuations. A second aspect relates to the customer composition. Household or personal customers are less responsive to GNP shocks while business customers are more sensitive to GNP fluctuations" (Lally 2003:20-21).

Likewise, according to Incenta Economic Consulting (2020), industrial and commercial customers are generally more sensitive to economic cycles than residential customers because Industrial and commercial business is directly linked to economic activity. Ports rely exclusively on industrial and commercial customers which makes them susceptible to economic cycles. Additionally, when studying the systematic risk of ports, it is important to appreciate the composition of cargo because this will have a significant influence on the relative level of systematic risk.

2.6.1.3.1. Containers

For instance, containers which contain mainly high-value manufactured goods generally exhibit a high degree of pro-cyclicality, and therefore have a higher level of systematic risk. The pattern of trade of motor vehicles mirrors that of imports and exports of high-value luxury goods through containers, but with a greater level of pro-cyclicality (Incenta Economic Consulting, 2020; Haugh et al., 2010)

2.6.1.3.2. Energy Commodities

In general, the degree of energy consumption in advanced economies is relatively higher than those of developing economies. This confirms that the use of energy directly influences productivity, economic activity, and development. Energy consumption, therefore, plays a crucial role in increasing economic growth directly, and via export promotion indirectly. (Thapa-Parajuli et al., 2021; Samawi et al., 2017). Consequently, exports and imports of energy commodities as such crude oil, coal, and Liquid Natural Gas (LNG) have a relatively higher systematic risk because they are positively associated with economic cycles. In contrast,

Incenta Economic Consulting (2020) maintains that energy cargo can have a relatively low systematic risk as the price element that generates systematic risks for producers does not impact ports except when the loading rate is linked to the energy commodities' price.

2.6.1.3.3. Agricultural Commodities

Trade of agricultural commodities such as grains which are classified as bulk cargo, and break bulk are indispensable necessities, and their value and consumption is determined by erratic weather patterns. As a result, they appear to have a trivial if any relationship to the economic cycles (Incenta Economic Consulting, 2020).

2.6.1.4. Income elasticity of demand / revenue risk

According to Incenta Economic Consulting (2020:44) "income elasticity of demand and the revenue risk is a decisive determinant of systematic risk. Income elasticity of demand tends to be higher for industrial and commercial customers and supports the observations made above regarding the nature of the customer and product. While it would be difficult to determine the various income elasticities of demand for many industries, it is possible to deduce some appreciation of relative sensitivities by studying the performance in Return on Assets (ROA) recorded during the global economic crisis."

Lally (2003) argues that firms that produce essential products with low-income elasticity of demand should be less sensitive to real Gross National Product (GNP) shocks than firms that produce discretionary products with high income elasticity of demand, because the demand for their product will be less responsive to real GNP fluctuations. This suggests that ports have a higher asset beta because their customers are mainly industrial and commercial and, given high market dominance, their services are essential.

2.6.1.5. Operating leverage

According to Lally (2003), industries with characterised by higher fixed operating costs to total operating costs are said to have a higher operating leverage. These industries should be more sensitivity to real GNP fluctuations because their cash flows will be more sensitive to own demand, and thus to real GNP fluctuations. Several studies as cited by Lally (2003), including Rubinstein (1973), Lev (1974) and Mandelker and Rhee (1986) show that operating leverage is positively associated with equity beta for a number of firms in many industries. By contrast Booth (1991), assesses a perfectly competitive firm facing price uncertainty, and concludes is

a negative relationship between operating leverage and beta. Despite this, Lally (2003) argues that local monopolists appear correspond more with the conclusions reached by Rubinstein et. al. than Booth. Consequently, this suggests that their greater operating leverage should amplify their asset betas. Similarly, Incenta Economic Consulting (2020), maintain that the fluctuation of profit for firms with revenue streams that are highly pro-cyclical and also have a high degree of operating leverage will be intensified, leading to a higher asset beta.

Empirical calculation of operating leverage is difficult. One approach, which is a crude approach, is to analyse the ratio of operating costs (Opex) to total gross non-current assets of a firm. A low Opex/Gross Noncurrent Assets ratio of a firm relative to other firms in the same industry is an indicator that operating leverage may be low. Another approach to measure the ratio of operating costs plus the Cost of Goods Sold (COGS) (Opex + COGS) to "total gross non-current assets of a firm as many businesses also have other activities for which the Cost of Goods Sold (COGS) is recorded" (Incenta Economic Consulting, 2020: 20).

According to Zhang, (2012:44), "the Degree of operating leverage is generally used in finance literature and theories as a quantitative measure of operating risk. The most used formula to represent operating leverage is:"

$$\text{Degree of Operating Leverage (DOL)} = \%\Delta\text{EBITDA} \div \%\Delta Q$$

Zhang, (2012:44) states that this "definition of DOL contains an elasticity concept: the ratio of percentage change in operating income (EBIT) to percentage change in units sold (Q). Empirical measurement of the relationship depicted in the expression above can be attained by estimating the $\gamma 1$ coefficient in a regression of the following form:"

$$\text{Ln EBITDA} = \gamma 0 + \gamma 1 \text{ Ln Sales} + \mu$$

2.6.1.6. Contracting

The effect of the "duration of contract prices with suppliers and customers on beta will be subject to the type of economic shock and the firm's response to it in the absence of a provisionally fixed price. For instance, on the one hand, in the absence of temporally fixed prices a profit maximising monopolist will increase its output price in the event of a positive economy-wide demand shock. On the other hand, an output price that is contractually fixed for

a predetermined period prevents the firm from increasing its' output price, and thereby lowers the firm's beta. By contrast, in the event of an adverse economy-wide reduction in output due to a cost shock, a similar constraint on output price also prevents a firm from increasing its' output price to absorb the adverse cost shock, and this increases its' beta" (Lally, 2003:21). According to Incenta Economic Consulting (2020), contracting is irrelevant ports, airports, and toll-roads. Although railways have short term contracts (usually 1-3 years and up to 5 years for coal) these provide little protection against variation in revenue because of economic fluctuations, and thus are unlikely to significantly influence asset betas.

2.6.1.7. Real options

Real options theory entails decision making and value creation in a volatile and uncertain environment (Ruffino, 2010). According to Martin (2016) the term "real options" is generally used to explain investment scenarios involving non-financial real assets with some degree of optionality. For instance, a factory owner with surplus capacity has an option which can be exercised at any time to increase production.

Real options can affect beta as economic cycles "are likely to have uneven influence on the feasibility of new expansion projects. In industries that are heavily regulated such as energy and water transmission and distribution, real options are less likely to have a material bearing on beta because the expansion projects are also heavily regulated and the opportunity to earn abnormal profits is mostly associated to the sharing of efficiency gains" (Incenta Economic Consulting, 2020:20).

Myers and Turnbull (1977) state that if firms have growth options, their betas will differ from those of their individual projects. The presence of such growth options should raise the firm's responsiveness to real GNP fluctuations and hence contribute to a relatively higher asset beta. Chung and Chareonwong (1991) assessed the association between beta and growth options and found empirical support for a positive correlation. Black and Scholes (1973) illustrated that the sensitivity of an option value to an underlying variable is dependent on the term to maturity of the option and its' closeness to "the money".

2.6.2. Bottom-up analysis beta

Firms are generally comprised of several diverse business functions, and the asset beta of the firm is a weighted average of the asset betas related to those diverse business functions. The bottom-up approach involves (Fallon et al., 2021:31):

- "Classify the different business functions that the firm is involved in.
- For each of different business functions, identify a listed firm/s mainly engaged only in that business function.
- Estimate the equity betas of the firms identified as comparators for each of the different business functions using econometric analysis.
- Make the necessary adjustments for levering and for cash holdings.
- Calculate the weighted average of the unlevered betas obtained for each business function, with the weights being the estimated values of those business functions in the firm being analysed."

The outcome of following this approach is called the 'bottom-up' beta. According to Fallon et al., (2021:31) "an estimate of the standard error of the bottom-up betas can be obtained using a weighted average of the standard errors of the econometrically estimated betas, divided by the square-root of the number of firms over which the average is calculated."

2.6.3. Accounting Betas

Accounting information can be very useful "to estimate the beta for an entity. The accounting beta approach seeks to estimate the equity or asset beta of an entity by means of accounting earnings, instead of traded prices. This requires regressing accounting earnings or net income on the returns on a diversified portfolio of assets such as an index-based market return. Otherwise, the earnings of a firm may be regressed against macroeconomic indicators that attempt to gauge returns on a much broader range of assets" (Fallon et al., 2021:32).

According to Ball et al. (2022) "argue that traditional beta estimates, in which the market return on a firms' equities is regressed against a securities market returns index, rely on a restrictive subset of aggregate assets, resulting in mismeasurement of systematic risk. Their study uses macroeconomic indicators to represent aggregate asset risk: namely, movements in total factor productivity (TFP) to represent supply-side risks and movements in aggregate wealth to represent demand-side risks. They argue that accounting-based betas should be based on

macroeconomic indicators, because they are better aligned in time with accounting earnings than are the returns of a market index, which are forward looking."

Ball et al. (2022) maintain that accounting-based beta estimates must be used in conjunction with the betas estimated from market securities. In contrast, other researchers such as Damodaran (1999) and Damodaran (2011) are not in favour of the accounting beta approach and citing that it may be difficult to calculate systematic risk using accounting betas as accounting metrics of earnings are: (i) only estimated quarterly or annually, causing deficient observations and less reliability; (ii) normally smoothed out, reducing the underlying effects of volatility in business conditions; (ii) affected by a number adjustments in non-operating factors such as depreciation, and by distributions of corporate costs at the divisional level.

Likewise, Lally (2000) argues that betas determine systematic risk in returns which embody cash flow and discount rates systematic risk whereas accounting betas only reveal systematic risk in cash flows. This indicates that accounting earnings are less unpredictable in contrast with returns that reveal the underlying value of a company, thus rendering accounting beta estimates to some extent ambiguous.

2.7. Conclusion

Efficient port pricing plays a key role in facilitating trade and economic growth. Port pricing is one of the basic yet fundamental decisions confronting port stakeholders, as it directly and significantly affects two vital aspects of seaports, namely profitability and competition. On the one hand, port pricing literature maintains that the views of most port stakeholders have changed from giving more importance to aspects that are related to infrastructure and pricing thereof to quality of service, reliability, and flexibility. On the other hand, other views argue that shippers frequently mention costs, operations quality and reputation, and port location as important in port selection. The port pricing structure generally reflects the history and traditions of each port. Port pricing is regarded as a strategic instrument with three approaches to port pricing, namely cost-based, value-based, and strategic pricing. The cost-based approach, particularly marginal cost, has received significant attention compared to the other port pricing approaches. However, it has some problems. First, it is difficult to estimate and distribute the marginal costs. Second, marginal cost pricing is suitable in perfectly competitive market. The Strategic port pricing approach is based on the principle that port charges are associated with the port strategic objectives. Consequently, the strategic pricing approach can be instrumental

in achieving the port strategic objectives and plans. The value-based approach also referred to as the financial or the rate of return approach argues for prices to be set based on accounting costs to achieve a profit. This pricing approach targets to achieve sufficient revenues to cover all costs incurred in providing services and facilities, including capital expenditure. In South Africa's ports, the rate of return pricing methodology is generally referred to as a Revenue Requirement (RR) methodology. In this methodology, the regulated entity is assured that tariffs will be set such that costs incurred are recovered, plus an adequate margin to fairly compensate investors. This chapter dissected the components of the Revenue Requirement (RR) methodology with a particular focus of the most influential components (i.e., Regulatory Asset Beta, Taxation Expense, Asset Beta, and Excessive Tariff Increase Margin Credit).

In regard to the asset beta, the different methods for estimating equity and asset betas were reviewed with the aim to determine the appropriate asset beta for South Africa's ports. Specifically, the Fundamental analysis of beta, Accounting Betas, and the Bottom-up analysis beta were considered. However, it became apparent that none of these approaches is appropriate for calculating TNPA asset beta. While the fundamental analysis of beta, which is a qualitative approach, suggests that TNPA asset beta is lower than the global average, this method proved to be difficult to translate the qualitative fundamental analysis of beta to quantitative data.

With respect to accounting-based beta estimates must be used in conjunction with the betas estimated from market securities. However, other researchers are not in favour of the accounting beta approach and citing that it may be difficult to calculate systematic risk using accounting betas due to a number of issues of accounting metrics of earnings. In addition, accounting earnings are less unpredictable in comparison to returns that reveal the underlying value of a company, thus rendering accounting beta estimates to some extent ambiguous.

The Bottom-up analysis beta approach require firms to, for each of different business functions, identify a listed firm/s mainly engaged only in that business function. In addition, firms have to estimate the equity betas of the firms identified as comparators for each of the different business functions using econometric analysis. This approach is not appropriate for calculating TNPA asset beta as TNPA is not a listed firm. For this reason, there is no published beta (β) which represents its' risk in relation to the companies listed on the market.

The following chapter will discuss the different research methodology approaches that are available to researchers in the inquiry process and explain in detail the research design and research methodology that was used to conduct the research.

CHAPTER 3: REASEARCH DESIGN AND METHODOLOGY

3. Introduction

This chapter will discuss the research design and research methodology that was used to conduct the research. Mafuwane (2012) asserts that, firstly, there is a need to explain and distinguish research design from research methodology to clear the confusion concerning the usage of the terms, especially by emerging researchers. Both the terms design and methodology are preceded by the noun research. Therefore, it is logical to first answer the question: ―What is research? This question will be addressed in section 3.1. The definition of research design and the research design that this study will apply will be covered in section 3.2. Section 3.3 discusses the main research methodology approaches that are used in research. That is, qualitative and quantitate research methods. Next, section 3.4 explains the type of research methodology employed in this dissertation. Data collection methods are considered in section 3.5. Section 3.6 discusses data analysis. Reliability and Validity issues are reflected upon in section 3.7. Finally, section 3.8 concludes the chapter.

3.1. Research

Muhammad (2016) defines research is a scientific approach of addressing a specific research question, resolving a problem, and advancing the frontiers of knowledge through a systematic collection, manipulation, and analysis of data. Walliman (2010) explain that research is a term that is generally used for any kind of study or an inquiry to learn facts that are of interest to scholars. According to Saunders et al (2019:130) “A well-thought-out and consistent set of assumptions will constitute a credible research philosophy, which will underpin your methodological choice, research strategy and data collection techniques and analysis procedures. This will allow you to design a coherent research project, in which all elements of research fit together.”

Based on the above definitions of research, it follows that research is an organized process, designed to discover new knowledge and insight on a particular phenomenon. The research process entails identifying a specific problem, transforming that problem into a research problem, data collection, and organizing, data analysis, and disseminating the research findings.

3.1. Research Design

Creswell and Creswell (2009) describe research design as a strategy and a process for research which informs broad assumptions as well as detailed data collection and analysis methods. Leedy and Ormrod (2015) defines research design as an approach for solving a research problem. The research design specifies the overall structure and framework of the study and process the researcher follows when conducting a study. This process involves data collection, data organisation, and data analysis. According to O'Sullivan et al. (2016), research design generally refers to the entire plan and structure of the research project. Specifically, the design explains the purpose of the research and expounds the plan that will address the research question(s). Simply put, research design is planning.

According to MiBler-Behr (1993, cited in Kosow and GaBner 2008), there are various practical approaches that can be used in the scenario development process. Scenario methodology is a broad term that embodies a methodological construct that includes a multitude of research techniques and approaches with different steps with varying levels of complexity. Several proposals for classifying these steps have been put forward by various scholars. Table 2 below provides a summary of generic scenario generation steps proposed by leading researchers in the field of scenario planning.

Table 3.1: Generic Scenario Generation Steps

Generic Scenario Generation Steps	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8
Gausemeier / Fink / Schlake (1996)	Scenario preparation	Analysis	Prognostics	Formation	Transfer			
Mahmoud et al (2009)	Scenario definition	Scenario construction	Scenario analysis	Scenario assessment	Risk management			
Kosow and Gaßner (2008)	Scenario Field Identification	Key Factor Identification	Key Factor Analysis	Scenario Generation	Scenario Transfer			
Burmeister / Neef / Beyers (2004)	Monitoring	Analysis	Projection	Transformation				
Phelps / Chan / Kapsalis (2001)	Defining the scope	Database construction	Building scenarios	Hoosing strategic options				
Steinmüller (2002)	Problem analysis	Scenario field identification	Consistency checks	Projection	Scenario building	Analysis of distruptive events	Impact analysis	Scenario transfer

Source: Author compiled using data from Kosow and GaBner, 2008:24; Mahmoud et al (2009:802-804)

While scenario methods are a confluence of various research techniques and approaches with different steps, it is possible to identify common steps involved in the scenario generation process. The most theoretical of these is a classification into the three phases of analysis,

prognosis, and synthesis (Kosow and GaBner 2008). Nonetheless, for the purposes of this dissertation, this study will identify common steps involved in the different scenario generation methods and classify them into broad themes to develop a comprehensive scenario generation framework to structure the approach and process of the study. In turn, this framework will be used to recalculate the TNPA required revenue tariff application for 2023/24 using alternative values of the Regulatory Asset base, Asset beta, tax, and Excessive Tariff Increase Margin Credit on port prices to demonstrate that there is scope to significantly reduce port tariffs.

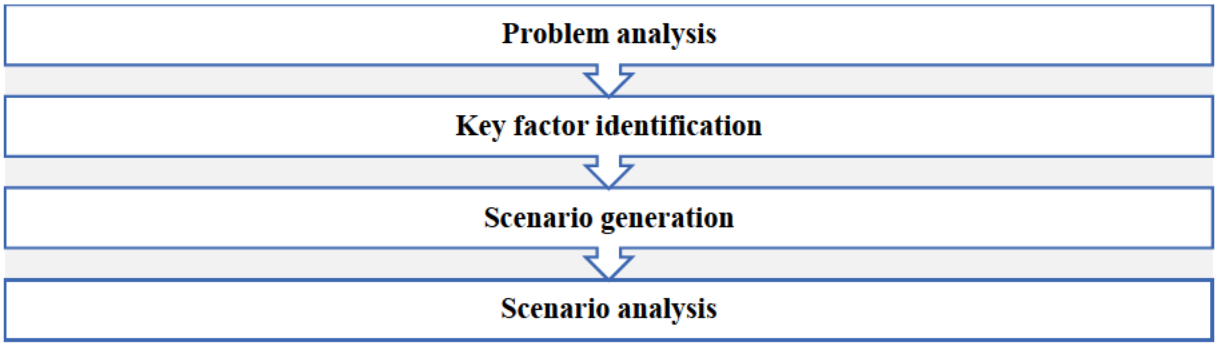
As a deduction based on the generic scenario steps listed in Table 3.1 above, the most common and logical scenario generation steps identified across different scenario generation methods are classified into the following four broad themes. In addition, under each theme/ or step an account of how each step will be accomplished in the study is explained.

1. **Problem analysis:** In respect of problem analysis, the first step in every scenario process entail understanding the research problem and objectives, articulating the aim and importance of the study, and explaining the purpose of developing scenarios. This will be is addressed in the introductory chapter.
2. **Key factor identification:** Key factors identification refers to variables and issues that receive the most or particular attention throughout the scenario process. Identifying these key factors entails understanding the research problem and objectives. In some instances, the essential information regarding key factors is integrated into the scenario process through the empirical and theoretical analysis literature review. However, in other instances it is also produced through interview, surveys, and workshops. Through the literature review in chapter 2, this study will identify the key factors that drive port prices in South Africa and provide the justification for using alternative values of these key factors (i.e., Regulatory Asset base, Asset beta, tax, and the ETIMC) to recalculate TNPA's revenue required and tariff adjustment for 2023/24.
3. **Scenario generation:** This step involves the actual construction of scenarios with detailed quantitative and/or qualitative information that influences the results. This study will generate scenarios in chapter 4 using quantitative data based on the key factors identified in the literature review in the previous step.
4. **Scenario analysis**: In regard of scenario analysis, the model outputs as influenced by the individual key factors identified are examined. Once the scenarios are generated,

this dissertation will analyse and interpreted the model results of using alternative of Regulatory Asset base, Asset beta, tax, and Excessive Tariff Increase Margin Credit.

The aforementioned four broad themes were used to develop a theoretical framework, as illustrated in Figure 3.1 below, which will inform the structure and approach and guide the research process.

Figure 3.1: Four-Step Scenario Generation Framework



Source: Author compiled using data from Kosow and GaBner, 2008:24; Mahmoud et al (2009:802-804)

The Four-Step Scenario Generation framework is unequivocally coherent and logical. Thus, this study will apply this framework in the scenario generation process to recalculate the National Ports Authority's revenue required and tariff adjustment for 2023/24 using alternative values of Regulatory Asset base, Asset beta, tax, and Excessive Tariff Increase Margin Credit.

3.2. Research Methodology

Kothari (2004) defines research methodology as a technique to systematically solve the research problem and it may be construed as a science of learning how research is conducted scientifically. Schwardt (2007) defines research methodology as a model that describe the inquiry process. It entails analysing principles, assumptions, and procedures in a specific approach to inquiry. McMillan and Schumacher (2010) explain that a research methodology is systematic and strategic, and it aims to produce new knowledge on a particular research problem.

The process of conducting research starts with the identification of a specific research problem. This research problem will inform the type of data that needs be collected, the collection

method, and the required data analysis techniques. In turn, this informs whether a qualitative or quantitative methodology should be employed in the study.

The following section discusses the different research methodology approaches that are available to researchers in the inquiry process.

3.2.1. Qualitative Research

An unambiguous definition of qualitative research is that it uses words as data which is collected, organised, and analysed Clarke et al., (2013). Qualitative inquiry includes using various data gathering approaches, particularly structured interviews with participants, and uses an inductive reasoning method to data analysis (Weinreich, 2009). Qualitative methods, according to Mafuwane (2012:74) "include direct observation, document analysis and overview, participant observation, and open-ended unstructured interviewing. These methods are designed to help researchers to understand the meanings people assign to social phenomena and to elucidate the mental processes underlying behaviours". Weinreich (2009:21), explains that the advantage of qualitative research lies in that "it generates rich, detailed data that leave the participants' perspective intact and provide a context for the phenomena being studied." However, the weakness of qualitative research is that data collection is often labour intensive and time consuming (Choy, 2014).

3.2.2. Quantitative Research

Quantitative research, as stated by Van der Merwe (1996), is a research method designed to examine theories, establish facts, validate correlations between variables, and forecast results. Quantitative data can determine relationships between given variables and results. Other researchers should be able to use such data and replicate the study to confirm original findings (Dudwick et al, 2006). The procedure for conducting a quantitative inquiry begins with an investigator selecting a topical subject matter. The researcher must then narrow the subject matter to focus on a specific research question that the study will answer. Generally, this entails a thorough review of existing literature and formulating hypotheses that are often informed by social theory (Neuman, 2006). Weinreich (2009) explains that quantitative research employs techniques derived from natural sciences that are intended to guarantee objectivity, consistency generalisability, and reliability. Quantitative research uses numbers as data, which is collected, organised, analysed using statistical software Clarke et al., (2013).

3.3.Research Method Employed

This dissertation mainly adopted a quantitative research methodology. Specifically, this study applied a quantitative scenario analysis on the required revenue (RR) model which is a mathematical/finance model used to calculate port tariffs in South Africa. This study will re-calculate the National Ports Authority's required revenue tariff application for 2023/24 using adjusted input components (i.e., the Regulatory Asset Base, Asset beta, Tax Rate, and Excessive Tariff Increase Margin Credit) informed by an evidence-based preliminary empirical and theoretical literature analysis. This will establish a sound theoretical foundation for each scenario and relies upon in-depth analysis.

According to Porter (1985:28), a scenario is "an internally consistent view of what the future might turn out to be- not a forecast, but one possible future outcome". Meyer (2007, cited in Gambelli et al., 2010) stress that over the last few years, scenario analysis has become a widely used technique in the decision-making process to provide support and advice to policy maker. Moriarty (2012) states that scenario analysis is an established praxis-based methodology that aims to propose a feasible course of action based on achievable options of the future and explore prospects of improving sustainability. Amer et al., (2013) state that quantitative scenario building methods extensively use statistical and computational tools, while qualitative scenario approaches essentially rely on narrative and literary techniques. In this regard, scenarios are characterised based qualitative data and quantitative data. In addition, quantitative scenarios approaches are explorative in nature because they demonstrate the effects of alternative courses of action. On the other hand, qualitative scenario approaches are innately normative as they are used to determine how a certain desired goal can be attained. Therefore, normative scenarios are useful for goal setting and developing strategies (Kosow and Gaßner, 2008). Döll, P., (2004:48), explain that "purely quantitative scenarios are generated, for example, by running mathematical models of the system of interest such that future states of the system are computed". Quantitative scenarios, according to Kosow and Gaßner (2008), compels researchers to provide a solid definition of a reduced number of factors.

A quantitative scenario analysis approach is appropriate for this study because it uses computational tools and numerical data of reduced or concentrated factors to explore alternatives that could improve and enhance sustainability. Specifically, a quantitative scenario analysis approach is suitable because this inquiry seeks to: (i) identify the main factors that influence TNPA prices in South Africa; (ii) examine the justification for using alternative

values of the Regulatory Asset base, Asset beta, tax, and Excessive Tariff Increase Margin Credit on port prices; (iii) recalculate the required revenue tariff application for 2023/24 to demonstrate that port tariffs could be reduced significantly; (iv) provide recommendations to improve port pricing in South Africa and the accuracy of the components of the revenue required pricing methodology.

3.4.Data collection methods

This dissertation relied purely on secondary data that was collected, analysed, and synthesised. Secondary data include data that has been previously collected by other researchers for another primary purpose and will be analysed to be reused to solve a specific research problem (Vartanian, 2010; Martins et al, 2018). Secondary data include published research, academic journals, internet articles, media reports, and data which been manipulated and analysed for other purposes than those of the current study (Assessment Capacities Project, 2012). Accordingly, this research used secondary data that is in the public domain and accessible through various websites and databases. Specifically, this study used relevant academic journals, published research, reports, books, and articles to assess the key factors that influence port prices in South Africa.

Organisations as such the Ports Regulator of South Africa, Transnet, University of KwaZulu Natal (UKZN) will be used as information sources. More specifically, the study will use the Ports Regulator of South Africa Tariff Methodology Manuals and Record of Decisions, various TNPA tariff applications, and stakeholders' comments on the TNPA tariff application for the period 2010/11 to 2021/22. These documents will be sourced from the Ports Regulator's website. The study will also use Transnet's annual financial statements and integrated reports for the periods 2019/20 to 2021/22 accessible from the Transnet website. In addition, the study will also extensively rely on research on port pricing in South Africa contained in the UKZN research database.

3.5.Data analysis

The study will make use of Microsoft Excel (MS Excel) to perform scenario analysis as well as sensitivity analysis. This study will recalculate TNPA's required revenue tariff application for 2023/24 using adjusted input components informed by an evidence-based preliminary empirical and theoretical literature analysis. This will establish a sound theoretical foundation for each scenario and relies upon in-depth analysis.

3.6.Reliability and Validity

The concept of reliability and validity are used to assess the quality of research. They confirm the accuracy with which a technique measures a specific phenomenon. In a quantitative study, validity concerns whether the findings of the study are accurate and represent what they are ought to assess. Reliability relates to whether the findings of a study are consistent and can be replicated to confirm original results (Cohen et al, 2002). Correspondingly, this study used secondary data that is in the public domain. Therefore, the results of this study can be validated for accuracy, and they are reliable and consistent because they can be reproduced.

The standards used to evaluate the reliability and validity of scenarios and scenario methods are usually similar to those of what is considered as good research. However, there are other scenario-specific criteria suitable for evaluating the reliability and validity of scenarios. Existing literature recommends certain criteria as critical in evaluating the reliability and validity of scenarios and scenario procedures, irrespective of the objective and nature of the scenario process. While scenarios are theoretical in nature, they are not arbitrary. A good scenario, therefore, should exhibit the following attributes (Kosow and GaBner, 2008:38): "plausibility, consistency, comprehensibility and traceability, distinctness, and transparency."

3.6.1. Plausibility

In the context of scenarios, plausibility proposes that the considered scenarios must at least be practically possible, feasible, and achievable. However, this does not mean that the scenarios must be probable or desirable (Kosow and GaBner, 2008:38; Amer et al., 2013). In scenario planning literature, most researchers argue that when developing scenarios for alternative future outcomes, the selection of scenarios should not be constrained to the most probable ones. However, just because a scenario is possible does not deem it meaningful and relevant. Therefore, methodological reviews regard plausibility as a central quality criterion in scenario generation (Schmidt-Scheele, 2020). The scenarios generated in this study are plausible and reasonable as they are contentious issues that are of concern to port users, the Ports Regulator, academics, and other key stakeholders.

3.6.2. Consistency

In regard to consistency, Kosow and GaBner, (2008) and Amer et al., (2013) argue that the pairing of factors in a scenario has to be mutually inclusive to ensure that there is no

contradiction and inconsistency. Lyons et al, (2021:36) explain that "for a scenario to be credible, the combination of variable projections of which it is to be comprised must be able to reasonably coexist. For instance, it is reasonable that high demand for public transport could sit alongside low fares, but high demand for public transport may not be consistent with high growth in driverless cars." The scenarios considered in the study are mutually exclusive as they be analysed objectively and independently.

3.6.3. Comprehensibility and traceability

In terms of comprehensibility and traceability, scenarios must be thorough and comprehensive to be understandable. However, they should not comprise an excessive number of factors and elements that they become complex and incomprehensible. Also, a reasonable number of factors will avoid unnecessary analysis (Kosow and GaBner, 2008; Dean, 2019). The scenarios generated in this study are clear and understandable as Section 4.1 of the study thoroughly explains each scenario.

3.6.4. Distinctness

In respect of distinctness, Kosow and GaBner (2008) and Dean (2019) maintain that the elected scenarios must be unique from one another to the extent that they can be analysed and juxtaposed as independent and distinct road maps of the future. This study focused on four distinct components of the RR methodology (i.e., asset beta, RAB, tax, and ETIMC) which are analysed independently.

3.6.5. Transparency

Throughout the scenario development process, scenarios are subjected to a host of assumptions, methodologies, and choices. For instance, in answer to the central question of which key factors are to be studied and how possible salient characteristics in future are to be defined and determined. The assumptions made during the scenario development processes which in turn informs the decision-making process should be made clear to improve the level of verifiability and authenticity (Kosow and GaBner, 2008; Dean, 2019). From the outset the study is clear that it focuses on four key components of the RR methodology (i.e., asset beta, RAB, tax, and ETIMC) that mainly influence port tariffs.

3.7. Ethical considerations

All ethical issues were considered in this study. The study proposal was submitted and presented to the Graduate School of Business and Leadership, University of KwaZulu-Natal as well as the Human and Social Sciences Research Ethics Committee at the University of KwaZulu-Natal that approved the study and granted an ethical clearance certificate (Please see appendix 1).

3.8. Conclusion

Research is an organized process, designed to discover new knowledge and insight on a particular phenomenon. The research process entails identifying a specific problem, transforming that problem into a research problem, data collection, and organizing, data analysis, and disseminating the research findings. The research design specifies the overall structure and framework of the study and process the researcher follows when conducting a study. The process of conducting research starts with the identification of a specific research problem. This research problem will inform the type of that needs be collected, the collection method, and the required data analysis techniques. In turn, this informs whether a qualitative or quantitative methodology should be employed in the study.

A quantitative scenario analysis approach is appropriate for this study because it uses computational tools and numerical data of reduced or concentrated factors to explore alternatives that could improve and enhance sustainability. Accordingly, this study uses quantitative scenario analyses of the RR model using adjusted input components (i.e., the Regulatory Asset Base, Asset beta, Tax Rate, and Excessive Tariff Increase Margin Credit). This dissertation relied purely on secondary data that was collected relevant academic journals, published research, reports, books, and articles to assess the key factors that influence port prices in South Africa. More specifically, the study will use the Ports Regulator of South Africa Tariff Methodology Manuals and Record of Decisions, various TNPA tariff applications, and stakeholders' comments on the TNPA tariff application for the period 2010/11 to 2021/22. The concept of reliability and validity are used to assess the quality of research was discussed in detail and the ethical clearance was obtained.

The next chapter discusses scenario analysis and assesses the outcomes of a range of possible future alternatives and appreciates the consequences of possible decisions and actions which might be taken.

CHAPTER 4: SCENARIO GENERATION AND ANALYSIS

4. Introduction

There are a number of contentious components of the Revenue Required model proposed by TNPA. This chapter recalculates TNPA's required revenue tariff application for 2023/24 using adjusted input components (i.e., the Asset beta, Tax Rate, Regulatory Asset Base, and Excessive Tariff Increase Margin Credit (ETIMC)) informed by an evidence-based preliminary empirical and theoretical literature analysis. As such, this chapter explores a range of possible future alternatives and analyses the consequences of possible decisions and actions which might be taken.

4.1.Scenario Generation

4.1.1. Asset Beta

Rosenberg and Guy (1976:1) state that "systematic risk, as measured by beta, represents the risk inherent to the entire market or market segment and cannot be eliminated or reduced by diversification." Although the actually calculated beta of TNPA is almost 0, the Regulator will apply an asset beta of 0.35 over the 2021/22 to 2023/24 period because it is difficult to determine the accurate β. The ports Regulator argues that the asset beta of 0.35 is substantially lower than the Ports Regulator historically allowed asset beta of 0.5 because TNPA is a regulated monopoly with no competition, and it has an implicit government guarantee. It also maintains that the incorporation of the clawback and the ETMIC in the regulatory structure significantly lowers TNPA's exposure to systematic risk compared to the global average for ports (Ports Regulator, 2020a).

While there are various methods for calculating the asset beta of firms, the widely used and well-established method is to use historical data on market prices for the securities of those firms and approximate betas using regression analysis. This approach, however, is only available to listed firms. Other approaches include Fundamental analysis of beta, Accounting Betas, and Bottom-up analysis beta (Fallon et al., 2021).

The fundaments analysis of beta which is a qualitative approach received more attention. However, while the fundamental analysis of beta suggests that the TNPA asset beta is lower than the global average, it became apparent that it is difficult to translate the qualitative

fundamental analysis of beta into quantitative data. Therefore, the asset beta scenario asks the question – what should be the asset beta if port tariffs are to increase by no more than the forecasted CPI of 5,3%? This is in line with PRSA's aim to keep TNPA price increases below the CPI upper band of 6% as targeted by the South African Reserve Bank.

The accounting beta approach which seeks to estimate the equity or asset beta of an entity by means of accounting earnings has some drawbacks. For instance, Damodaran (1999) and Damodaran (2011) are not in favour of the accounting beta approach and citing that it may be difficult to calculate systematic risk using accounting betas as accounting metrics of earnings are: (i) only estimated quarterly or annually, causing deficient observations and less reliability; (ii) normally smoothed out, reducing the underlying effects of volatility in business conditions; (ii) affected by a number adjustments in non-operating factors such as depreciation, and by distributions of corporate costs at the divisional level.

The Bottom-up analysis beta approach, according to Regulator et al., (2020), require firms to, for each of the different business functions, identify listed firm/s mainly engaged only in that business function. In addition, firms have to estimate the equity betas of the firms identified as comparators for each of the different business functions using econometric analysis. This approach is not appropriate for calculating TNPA asset beta as TNPA is not a listed firm. For this reason, there is no published beta (β) which represents its' risk in relation to the companies listed on the market.

4.1.2. Equitable Tax Rate

The current corporate structure of Transnet allows the Group to offset profits of one operating division against losses of others, a taxation allowance based on the corporate tax rate granted to TNPA may result in excess revenue, given that significant losses incurred by other divisions result in lower taxes payable by the Group (Ports Regulator, 2020a). Fakir and Chasomeris (2022) show that the equitable tax rate in each year is considerably lesser than the 28% corporate tax rate that was always used. Over the 7-year period the average equitable tax rate was calculated at 15.73%. While the PRSA allowed the use of the pass-through of corporate tax rate (28%) from 2011 to 2017, in 2018 it applied an equitable tax rate which will result in the proportional sharing of the Transnet Group taxation liability by each of its profitable divisions (Fakir and Chasomeris, 2022).

However, subject to amendments by the National Treasury, the PRSA will allow the current corporate tax rate of 28% (t) if TNPA is corporatized from a division of Transnet into a subsidiary. Otherwise, an equitable tax rate, based on the supposition that TNPA is still an operating division, instead of a subsidiary of the Transnet Group, will be calculated and corrected through the claw back process and applied (Fakir and Chasomeris, 2022; Ports Regulator, 2020a).

4.1.3. Regulatory Asset Base

The RAB is a decisive component in the computation of the Revenue Requirement because it reflects the total value of assets that TNPA can earn a return on (Ports Regulator, 2018a; Meyiwa, and Chasomeris, 2020). Meyiwa and Chasomeris (2020) assert that the PRSA, having taken stakeholders submissions into consideration, permitted the revaluation of the RAB, using a financial capital maintenance approach, based on historic cost and trended original cost. According to Chasomeris (2020:4), "the NPA estimated that the PRSA Valuation of Assets would reduce the NPA's opening RAB value on 1 April 2019 by approximately R45 billion from R83.5 billion to R38.1 billion. In 2018/19, a change in the valuation of assets methodology resulted in a R15.8 billion reduction in the RAB. So, what happened to the R29.2bn difference? It appears that there is still scope for RAB value reductions".

Against this backdrop, reducing the opening RAB by R29,2bn would significantly reduce port tariffs, thereby lowering the cost of doing business, fostering trade competitiveness, and stimulating economic development in South Africa. In Scenario 3, the opening book value of assets will be adjusted downwards by R29,2bn to assess the actual impact on TNPA's revenue required and tariff adjustment for 2023/24.

4.1.4. Excessive Tariff Increase Margin Credit

The Ports Regulator (2020a) regulates South Africa's ports to ensure the long-term sustainability of the maritime sector and the South African economy. Therefore, the Ports Regulator has to develop long-term plans that transcend the immediate tariff decision and take into account several ways to adequately deal with any future shocks to the system. For instance, it is usually accepted that the required infrastructure expenditure may increase sharply in the future, albeit such projects have not yet been evaluated in detail. Furthermore, exogenous

market factors such as unexpected or expected fluctuations in imports and exports, inflation, and the Risk-Free Rate may also lead to abrupt tariff hikes. As such, the main objective for retaining and building up TNPA's Excessive Tariff Increase Margin Credit (ETIMC) is to circumvent excessive future tariff increases, thus facilitating the smoothing of exorbitant tariff hikes in the future, and to take countercyclical tariff decisions when economic activity is subdued.

However, it is a challenge to estimate the amount and timing of the ETMIC application because of the dynamic nature of capital expenditure programmes, and volatile port volumes. Specifically, because the Authority's investment spending is a function of its detailed capital planning and strategic planning initiatives which are designed to provide appropriate port infrastructure ahead of demand, improve vessel and cargo turnaround; and maximise asset utilisation to sustain the existing business (Transnet, 2022a). SAASOA (2021) argues that the Required Revenue method is not appropriate as using the ETMIC to downward adjust the estimated tariff increase as determined by the RR method may deplete the ETIMI reserves. Consequently, future tariff spikes would not be able to be cushioned by the ETIMC but rather paid by port users as higher tariffs. This scenario assesses the impact of utilising the R645 million remaining in the ETIMC facility on TNPA's revenue required and tariff adjustment for 2023/24.

Table 4.1: Preliminary empirical and theoretical literature analysis informing scenarios

	Scenario 1 Tariff Adjustment = CPI and Goal Seek the Asset Beta	**Scenario 2 Applied an Equitable Tax Rate of 15,73%**	**Scenario 3 Reduced RAB Opening Balance by R29 bn**	**Scenario 4 Applied ETIMC of R645 million**
Relevant Literature	1. Price Cap Regulation: Section 2.4.2	1. Taxation expense: Section 1.3.5	1. Regulatory Asset Base (RAB): Section 1.3.1	1. Excessive Tariff Increase Margin Credit (ETIMC): Section 1.3.7.
	2. Methods of Estimating Equity and Asset Betas: Section 2.7		2. Underinvestment in South Africa's Ports: Section 2.5	
	3. Beta-Coefficient: Section 1.3.2.4			

Table 4.1 above provides a summary the different scenarios with the literature section references to the literature supporting the choice of values for the different variables.

Table 4.1: Recalculating the TNPA Tariff Application for 2023/24

	Base Case Scenario	Scenario 1 Tariff Adjustment = CPI and Goal Seek the Asset Beta	Scenario 2 Applied an Equitable Tax Rate of 15,73%	Scenario 3 Reduced RAB Openin Balance by R29 bn	Scenario 4 Applied ETIMC of R645 million
Regulatory Asset Base (R'm)	**FY 2023/24**	**FY 2023/24**	**FY 2023/24**	**FY 2023/24**	**FY 2023/24**
Opening book value	85 468	85 468	85 468	**56 268**	85 468
Add: Capex	2 475	2 475	2 475	2 475	2 475
Add: Inflation Index	4 530	4 530	4 530	2 982	4 530
Indexed Asset Base	92 473	92 473	92 473	61 725	92 473
Depreciation	- 2 685	- 2 685	- 2 685	- 2 685	- 2 685
Closing Book Value	89 788	89 788	89 788	59 040	89 788
Average Asset Base	87 628	87 628	87 628	57 654	87 628
Less: Working Capital	- 2 769	- 2 769	- 2 769	- 2 769	- 2 769
Regulatory Asset Base	**84 859**	**84 859**	**84 859**	**54 885**	**84 859**
Real Rate of Return (%)	**FY 2023/24**	**FY 2023/24**	**FY 2023/24**	**FY 2023/24**	**FY 2023/24**
Inflation Forecast	5,30%	5,30%	5,30%	5,30%	5,30%
Norminal Risk-free rate	9,56%	9,56%	9,56%	9,56%	9,56%
Real risk free rate	4,05%	4,05%	4,05%	4,05%	4,05%
Market Risk Premium (MRP)	5,10%	5,10%	5,10%	5,10%	5,10%
Asset beta	0,35	**0,25**	0,35	0,35	0,35
Equity beta	0,61	0,43	0,64	0,61	0,61
Gearing	50,0%	50,0%	50,0%	50,0%	50,0%
Debt/equity ratio	100,0%	100,0%	100,0%	100,0%	100,0%
Norminal Weighted Average Cost of Debt (WACD)	10,9%	10,9%	10,9%	10,9%	10,9%
Tax rate	27,0%	27,0%	**15,73%**	27,0%	27,0%
Real Cost of equity (post-tax)	7,14%	6,25%	7,34%	7,14%	7,14%
Real WACD (pre-tax)	5,3%	5,3%	5,3%	5,3%	5,3%
Revenue Requirement (R'm)	**FY 2023/24**	**FY 2023/24**	**FY 2023/24**	**FY 2023/24**	**FY 2023/24**
RAB	84 859	84 886	84 859	54 885	84 859
Vanilla WACC	6,21%	5,77%	6,31%	6,21%	6,21%
Return on Capital	5 269	4 895	5 354	3 408	5 269
Plus: Depreciation	2 685	2 685	2 685	2 685	2 685
Plus: Operating Costs	6 577	6 577	6 577	6 577	6 577
Plus Taxation Expense	1 120	1 120	653	1 120	1 120
Plus/Less: Clawback	- 885	- 885	- 885	- 885	- 885
Plus/Less: ETIMC		-	-	-	**- 645**
Plus/Less: WEGO	- 204	- 204	- 204	- 204	- 204
Revenue Allowed	**14 562**	**14 188**	**14 180**	**12 701**	**13 917**
Less: Real Estate	4 210	4 210	4 210	4 210	4 210
Marine Revenue	***10 352***	***9 978***	***9 970***	***8 491***	***9 707***
Prior Year Revenue	9 117	9 117	9 117	9 117	9 117
Estimated Volume Growth	3,94%	3,94%	3,94%	3,94%	3,94%
Revenue after volume growth	9 476	9 476	9 476	9 476	9 476
Required Revenue	10 352	9 978	9 970	8 491	9 707
Tariff Increase	***9,2%***	***5,3%***	***5,2%***	***-10,4%***	***2,4%***

Source: Author compiled and calculated using data from Transnet (2022a)

4.2.Scenario Analysis

4.2.1. Scenario 1: Determining the Appropriate Asset Bata

This scenario follows a normative scenario technique to calculate TNPA asset beta. According to Kosow and GaBner (2008:39), "normative scenarios adapt values and interests. They pose questions about the desirability of conditions in the future "What do we want the future to be like? Where do we want to go with it?" and/or questions which take possible futures as their point of departure: "How can we get there? What must happen in order for it to become reality?" Accordingly, through the goal setting function in excel, this scenario poses the question "what should be the port asset beta if port tariffs are to increase by no more than the forecasted CPI of 5,3%? This question is informed by the PRSA's aim to keep TNPA price

increases below the CPI upper band of 6% as targeted by the South African Reserve Bank. In most years PRSA has been able to use the RR model to ensure weighted average tariff adjustments that are below 6% (Gumede and Chasomeris, 2017; Grater and Chasomeris, 2022). The results show that if port tariffs are to increase by no more than the forecasted CPI of 5,3%, the port asset beta should be 0,25 for 2023/24. This asset beta is 0,1 less than beta of 0.35 used in 2022/23.

Against this background, this scenario effectively proposes a Sliding-scale regulation (i.e., a hybrid of price cap regulation and rate of return regulation) where the maximum increase in tariff should be CPI of 5,3% and then adjusting the variables as such the asset beta to ensure that the 5.3% outcome is achieved. This approach closely reflects price cap regulation except that the PRSA requires specific and detailed information for efficient regulation under the RR method. Therefore, implementing a sliding-scale regulation (i.e., a hybrid of the rate of return regulation and price cap regulation) will allow the PRSA to keep TNPA tariff increases below the CPI upper band of 6% as targeted by the SARB and to continue to have access to all of the information required for regulation under the RR model thereby ensuring a fair and reasonable rate of return related to the cost of capital.

Given the challenge of calculation the asset beta for ports in South Africa, despite various methods that are available for calculating the asset beta of firms, sliding-scale regulation may be useful in determining the appropriate asset beta for TNPA. Moreover, the effects of transitioning from the RR model to the SS approach are inconsequential as the PRSA will continue to have access to all of the information required for regulation under the RR and port users will still have the opportunity through public consultations to communicate their concerns regarding port prices. Under SS regulation port users stand to benefit because if the rate of return is above a predetermined level the regulated entity will share profits with consumers through reduced prices (Braeutigam and Panzar, 1993).

4.2.2. Scenario 2: Equitable Tax Rate

Given that that TNPA is not yet corporatized because the formation of TNPA, as an independent subsidiary of Transnet SOC LTD is in progress and the impact of TNPA's corporatisation on the Company's balance sheet is still being assessed, this scenario assesses the effect of applying an average equitable tax rate that was calculated at 15.73% over the 7-

year period on port prices. The results of this scenario show that the required increase in ports tariffs would decrease to 5,2% if the average equitable tax rate of 15,73% is applied in the calculation of the National Ports Authority's revenue required and tariff adjustment for 2023/24.

Against this background, if the average equitable tax rate of 15,73% rather than the corporate tax of 27% is applied in the determination of TNPA's revenue required and tariff adjustment for 2023/24, port users would make significant savings (Fakir and Chasomeris, 2022). Therefore, the corporatisation of TNPA is important and it needs to be expedited to ensure that port users are not subjected excessive port tariffs. Moreover, the corporatisation of TNPA will lower the cost of doing business and create a more competitive and effective port environment.

4.2.3. Scenario 3: Adjusting the Regulatory Asset Base

This scenario recalculates the National Ports Authority's revenue required and tariff adjustment for 2023/24 by reducing the opening book value of assets downwards by R29,2bn. The results of this scenario show that if the opening book value of assets is reduced by R29.2bn to recalculate the TNPA's revenue required and tariff adjustment for 2023/24, the closing RAB would decrease from R84,8bn to R54,8bn and port tariffs would decrease by 10,4%. Lower port prices, in turn, would lead to higher port throughput, more efficient use of port facilities and economic growth in South Africa (Acciaro, 2013).

These results are expected as the RR methodology is largely influenced TNPA's asset RAB and WACC. Accordingly, it is crucial to ensure that the valuation and determination of the RAB and WACC are as accurate as possible when setting annual tariff adjustments (Meyiwa, and Chasomeris, 2020). In addition, this ensures the determination of appropriate port prices that are in the best interest of the country's economic and developmental objectives.

4.2.4. Scenario 4: Excessive Tariff Increase Margin Credit

This scenario assesses the impact of utilising the R645 million remaining in the ETIMC facility on TNPA's revenue required and tariff adjustment for 2023/24. The results of this scenario show that that if the R645 million remaining in the ETIMC facility is used in the calculation of TNPA's revenue required and tariff adjustment for 2023/24 ports tariffs would significantly

decrease to 2,4%. However, there would be no funds left in the facility to avoid excessive future tariff increases and port users may have to pay exorbitant port tariffs in the future. This, as a result, will increase the cost doing business, stifle trade and economic growth, and may have a negative impact on volumes moving through the ports system.

SAASOA (2021) contends that the RR method is not appropriate as using the ETMIC to downward adjust the estimated tariff increase as determined by the RR method may deplete the ETIMI reserves. Consequently, future tariff spikes would not be able to be absorbed by the ETIMC but rather paid by port users as higher tariffs. So, instead of running down the ETIMC reserves the PRSA should consider whether it is worthwhile for TNPA to renegotiate a more favourable cost of capital, and what are the required cost-cutting measures to attain a specific targeted CPI-X tariff adjustment (SAASOA, 2021: 4).

The ETIMC reserves will soon be depleted unless significant revenues are retained in the facility. However, to build up the ETIMC reserves in order to prevent port users from paying higher port tariffs in the future due to, for instance, significant required capital expenditure requires port users to pay higher tariffs in the present. It appears that applying the sliding-scale approach is worth considering as it would ensure port tariffs below the 6% upper inflation target band while retaining sufficient funds in the ETIMC facility to avoid excessive future tariff increases.

4.3.Conclusion

The recalculated required revenue tariff application for 2023/24 using adjusted input components (i.e., the Regulatory Asset Base, Asset beta, Tax Rate, and Excessive Tariff Increase Margin Credit) informed by an evidence-based preliminary empirical and theoretical literature analysis demonstrate that port tariffs could be reduced significantly. That is, scenarios 1 and 2 show that tariffs could increase by a slower rate which is below the upper inflation target band of 6%. Furthermore, scenario 3 shows that port tariffs could decrease by 10,4%, while scenario 4 shows that port tariffs could decrease to 2,4%. Scenarios 1 and 2 could be implemented immediately as the regulator seeks to align tariff increases to the CPI upper band of 6% and TNPA is still a division on Transnet Group. On the other hand, it may not be practical to immediately implement scenarios 3 and 4 as they can potentially affect TNPA's ability to sustainably roll out critical capital expenditure.

The next chapter provides a conclusion and recommendations on how to recommendations to enhance port pricing in South Africa and the accuracy of the components of the revenue required pricing methodology.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5. Introduction

The main objective of this dissertation was to evaluate the key components of the RR tariff methodology to determine appropriate port prices. The study aimed to dissect Asset beta, RAB, tax, and ETIMC components and recalculate TNPA's required revenue tariff application for 2023/24 using adjusted input components informed by an evidence-based preliminary empirical and theoretical literature analysis. This chapter intends to provide a conclusion to the dissertation and recommendations to improve port pricing in South Africa and the accuracy of the components of the revenue required pricing methodology.

5.1. Conclusions on the Research Questions

This inquiry sought to address five specific research questions. A summary of the answers to these research questions is provided below.

5.1.1. What are the main concerns regarding the Revenue Requirement pricing methodology?

There are four key components that influence the Required Revenue (RR) methodology used by TNPA to determine port prices, namely, the Regulatory Asset Base (RAB), the asset beta, the tax rate to be applied, and Excessive Tarif Increase Margin Credit (ETIMC).

The beta coefficient which reflects the risks faced by TNPA under the RR methodology is usually a main component that determines the divergence between the tariff requested and the tariff increase granted (Ports Regulator, 2013b). The Ports Regulator uses the Hamada equation to re-lever the beta to result in an equity β (Ports Regulator, 2020a). The asset beta, therefore, has a direct bearing on the equity beta which in turn influences the cost of equity and by extension the Weighted Average Cost of Capital (WACC). Consequently, a higher (lower) asset beta translates into higher (lower) port costs.

While the PRSA allowed the use of the pass-through of corporate tax rate (28%) from 2011 to 2017, in 2018 it applied an equitable tax rate of 15.73% which will result in the proportional sharing of the Transnet Group taxation liability by each of its profitable divisions (Fakir and Chasomeris, 2022:6).Furthermore, Fakir and Chasomeris (2022:8) state that "the equitable tax

rate result in each year is significantly lower than the tax previously allowed, thus indicating that the use of this method could result in substantial savings to port users.

The RAB is a central constituent in the computation of the Revenue Requirement as it represents the total value of the assets that TNPA is allowed to recover depreciation as a return of capital and to earn a return on capital through its' tariffs (Ports Regulator, 2018a; Meyiwa, and Chasomeris, 2020). Therefore, it is important to ensure that the valuation and determination of the RAB and WACC are as accurate as possible when setting annual tariff adjustments (Meyiwa and Chasomeris, 2020). It is for this reason that this study evaluated the RAB and WACC components of the RR formula to determine correct port prices that are in the best interest of the country's economic and developmental objectives.

The incorporation of the ETIMC element in RR methodology is instrumental in avoiding excessive future tariff increases, thereby enable the smoothing of exorbitant tariff hikes over multiple periods in the future. The COVID-19 pandemic severely disrupted international trade and as result port volumes and port tariffs were impacted negatively. Therefore, in the 2022/23 tariff year the PRSA reached a decision to use R1.188 billion from ETIMC facility to provide some respite to port users. As a result, only R645 million is left in the ETIMC facility (Ports Regulator, 2021).

5.1.2. What are the main factors that drive port prices in South Africa?

In the 2023/24 tariff application, Transnet (2022a:8) states that "in terms of the Directives, when considering the proposed tariffs for the Authority, the Regulator must ensure that such tariffs allow the Authority to: a) recover its investment in owning, managing, controlling and administering ports and its investment in port services and facilities; b) recover its costs in maintaining, operating, managing, controlling and administering ports and its costs in providing port services and facilities; and c) earn a return commensurate with the risk of owning, managing, controlling and administering ports and of providing port services and facilities." In addition, port costs in the history of TNPA have largely been collected from cargo owners, whereas shipping companies pay lesser tariffs compared to the global benchmarked average. TNPA contends that allocating a considerable share of costs to shipping lines will make South African ports unattractive and they will invariably pass the higher costs to cargo

owners. However, the costs allocated to cargo owners have been declining over the years, but they still contribute the largest share of TNPA revenue (Meyiwa and Chasomeris, 2020).

5.1.3. What is the justification for using alternative values of the Regulatory Asset base, Asset beta, tax, and ETIMC to recalculate TNPA's revenue required and tariff adjustment for 2023/24?

In regard to the asset beta, the different methods for estimating equity and asset betas were reviewed with the aim to determine the appropriate asset beta for South Africa's ports. Specifically, the Fundamental analysis of beta, Accounting Betas, and the Bottom-up analysis beta were considered. However, it became apparent that neither of these approaches is appropriate for calculating TNPA asset beta as TNPA. According to the Ports Regulator (2020a), although the actually calculated beta of TNPA is almost 0, the Regulator will apply an asset beta of 0.35 over the 2021/22 to 2023/24 period because it is difficult to determine the accurate β. The ports Regulator argues that the asset beta of 0.35 is substantially lower than the Ports Regulator historically allowed asset beta of 0.5 because TNPA is a regulated monopoly with no competition, and it has an implicit government guarantee. It also maintains that the incorporation of the clawback and the ETMIC in the regulatory structure significantly lowers TNPA's exposure to systematic risk compared to the global average for ports. Columbus Stainless (2017) argues that 0.0 is the appropriate beta for TNPA because it is fundamentally operating in a risk-free environment protected by government guarantees. NAAMSA (2017) contend that a lower asset beta should be applicable to TNPA as it operates as a monopoly in an environment without any systematic risk as the claw-back element has been incorporated in the RR methodology. In support of this view, Chasomeris (2020) contends that if the actual calculation of beta is closer to 0, then why does the Ports Regulator continue to use a higher beta of 0.35? Perhaps there could be benefits in planned annual decreases in the value of the asset beta. Chasomeris (2015:167) states that "there is a need to further investigate and attempt to settle the debate on the appropriate asset beta to be used in the Revenue Required model for South Africa's ports." Therefore, the reasons put forward by the Ports Regulator need to be investigated thoroughly to confidently justify an asset beta that is below the global average.

Concerning the taxation expense, the current corporate structure of Transnet allows the Group to offset profits of one operating division against losses of others, a taxation allowance based on the corporate tax rate granted to TNPA may result in excess revenue, given that significant

losses incurred by other divisions result in lower taxes payable by the Group. Fakir and Chasomeris (2022) show that the equitable tax rate in each year is considerably lesser than the 28% corporate tax rate that was always used. Over the 7-year period the average equitable tax rate was calculated at 15.73%. While the PRSA allowed the use of the pass-through of corporate tax rate (28%) from 2011 to 2017, in 2018 it applied an equitable tax rate of 15.73% which will result in the proportional sharing of the Transnet Group taxation liability by each of its profitable divisions. However, subject to amendments by the National Treasury, the PRSA will allow the current corporate tax rate of 28% (t) if TNPA is corporatized from a division of Transnet into a subsidiary. Otherwise, an equitable tax rate, based on the supposition that TNPA is still an operating division, instead of a subsidiary of the Transnet Group, will be calculated and corrected through the claw back process and applied.

The Regulatory Asset Base is a decisive component in the computation of the Revenue Requirement because it represents the total value of the assets that TNPA is allowed to recover depreciation as a return of capital and to earn a return on capital through its' tariffs. The PRSA, having taken stakeholders submissions into consideration, permitted the revaluation of the RAB, using a financial capital maintenance approach, based on historic cost and trended original cost. TNPA suggested that the PRSA Valuation of Assets would decrease TNPA's opening RAB value on 1 April 2019 by about R45 billion from R83.5 billion to R38.1 billion. A modification of the assets valuation methodology in 2018/19 resulted in a R15.8 billion decrease in the RAB. Therefore, this begs the question, what happened to the R29.2bn difference? (Chasomeris, 2020). It is apparent that there is still scope for RAB value reductions which would play a significant role in lowering port prices.

TNPA's Excessive Tariff Increase Margin Credit is to avoid excessive future tariff increases, thereby enable the smoothing of exorbitant tariff hikes over multiple periods in the future, and to take countercyclical tariff decisions during periods of subdued economic activity. However, SAASOA (2021) contends that the RR method is not appropriate as using the ETMIC to downward adjust the estimated tariff increase as determined by the RR method may deplete the ETIMI reserves. Consequently, future tariff spikes would not be able to be absorbed by the ETIMC but rather paid by port users as higher tariffs. So, instead of running down the ETIMC reserves the PRSA should consider whether it is worthwhile for TNPA to renegotiate a more favourable cost of capital, and what are the required cost-cutting measures to attain a specific targeted CPI-X tariff adjustment (SAASOA, 2021).

5.1.4. What would be the effects of using adjusted values of the Regulatory Asset base, Asset beta, tax, and ETIMC on the Transnet National Ports Authority's revenue required and port tariffs?

The recalculated required revenue tariff application for 2023/24 using adjusted input components (i.e., the Regulatory Asset Base, Asset beta, Tax Rate, and Excessive Tariff Increase Margin Credit) informed by an evidence-based preliminary empirical and theoretical literature analysis demonstrate that port tariffs could be reduced significantly. That is, as illustrated in table 4.1 above, scenarios 1 and 2 show that tariffs could increase by a slower rate which is below the upper inflation target band of 6%. Furthermore, scenario 3 shows that port tariffs could decrease by 10,4%, while scenario 4 shows that port tariffs could decrease to 2,4%.

5.1.5. How can the accuracy of the components of the revenue required methodology and port pricing in South Africa be improved?

The valuation method of the various elements of the RR methodology needs to be constantly scrutinised, interrogated, and reviewed to ensure the determination of correct port prices that are a true reflection of the underlying costs and efficiencies associated with providing port facilities to port users.

5.2. Recommendations

After carefully considering the RR methodology used by ports in South Africa to determine port prices it is patent that there is scope to improve the accuracy of the components of the revenue required methodology and port pricing in South Africa thereby fostering South Africa's trade competitiveness and stimulating economic development in South Africa.

- The asset beta should be set such that port tariffs increase by no more than the forecasted CPI. This is in line with the PRSA's aim to keep TNPA price increases below the CPI upper band of 6% as targeted by the South African Reserve Bank. This means that the PRSA needs to transition from the RR model to the SS approach. However, from the public-policy perspective the option to transition from the RR model to the SS approach has to be assessed.
- An equitable tax rate, based on the supposition that TNPA is still an operating division, instead of a subsidiary of the Transnet Group, should be calculated and corrected

through the claw back process and applied. Otherwise, subject to amendments by the National Treasury, the PRSA should allow the current corporate tax rate of 27% (t) once TNPA is corporatized from a division of Transnet into a subsidiary.

- There is a need to appreciate the impact of revaluating the RAB using a financial capital maintenance approach, based on historic cost and trended original cost on the financial sustainability of TNPA and port user costs.
- Given that there are insufficient funds left in the facility to avoid excessive future tariff increases, port could be paying exorbitant port tariffs in the future unless significant revenues are retained in the facility. Therefore, it appears that applying the sliding-scale approach is worth considering as it would ensure port tariffs that are below the 6% inflation upper target band while retaining sufficient funds in the ETIMC facility to avoid excessive future tariff increases.
- The corporatisation of TNPA needs to be expedited to ensure that revenues and profits are sufficiently ploughed back into the ports system to maintain and upgrade critical infrastructure and adequate pricing that is in the best interest of port users is achieved. This will also ensure that TNPA's profits are not used to cross-subsidise other less profitable.

5.3. Limitations and Opportunities for Future Research

One of the focal points of this study was to thoroughly investigate the reasons put forward by the Ports Regulator that justify an asset beta that is below the global average and settle the debate concerning what is the appropriate asset beta for ports in South Africa. The different methods for estimating equity and asset betas, which include the Fundamental analysis of beta, Accounting Betas, and the Bottom-up analysis beta, were reviewed. However, it became apparent that neither of these approaches is appropriate for calculating TNPA asset beta as TNPA. While the fundamental analysis of beta, which is a qualitative approach, provided useful insights and suggests that TNPA asset beta is lower than the global average, this method proved to be difficult to translate the qualitative fundamental analysis of beta to quantitative data. Thus, a study that focuses on methods of quantifying qualitative fundamental analysis of beta would be very insightful and would assist in settling the debate around the determination of an appropriate asset beta for ports in South Africa.

This study could have assessed how efficient is the RR model for TNPA compared to other ports that use the same model. However, it was beyond the scope of this study which focused

on evaluating the key components of the RR tariff methodology to determine appropriate port prices in South Africa's ports. There are five conventional criteria for determining whether a rate of return is appropriate. The first is whether the rate of return is adequate to attract capital to invest in infrastructure expenditure. A second criterion is the achievement of efficient management practices. The third criterion assesses efficient utilisation of services. A fourth criterion is rate consistency, stability, and predictability, which in turn allows customers to forecast their expenses. The last criterion is fairness to investors. It would be an insightful exercise to assess the rate of return used to determine port tariffs in South Africa against these criteria to determine whether it is appropriate.

6.References

Acciaro, M., (2013). A critical review of port pricing literature: What role for academic research? *The Asian Journal of Shipping and Logistics*, *29*(2), pp.207-228.

Alexander, I. and Irwin, T., (1997). Price caps, rate-of-return regulation, and the cost of capital. Available at: https://openknowledge.worldbank.org/server/api/core/bitstreams/e1b84db4-69ec-5d26-9b80-ffbe938ef81c/content. (Accessed 30 June 2023).

Alexander, I., Mayer, C. and Weeds, H. (1996), 'Regulatory Structure and Risk: An International Comparison', prepared for The World Bank. Available at: https://documents1.worldbank.org/curated/en/845941468739569300/pdf/multi-page.pdf. (Accessed 30 June 2023).

Amer, M., Daim, T.U. and Jetter, A., (2013). A review of scenario planning. Futures, 46, pp.23-40. Available at: https://www.academia.edu/22556022/A_review_of_scenario_planning. (Accessed 30 June 2023).

Aronietis, R., Van de Voorde, E. and Vanelslander, T., (2010). Port competitiveness determinants of selected European ports in the containerized cargo market. *Association for European Transport and contributors*. Available at: https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=b2f449b9495d70c7736fe965f1be00b6c0d6aba1. (Accessed 30 June 2023).

Assessment Capacities Project (2012). Qualitative and quantitative research techniques for humanitarian needs assessment: An introductory brief. Available at: http://reliefweb.int/report/world/qualitative-and-quantitative-research (Accessed: 13 November 2022).

Ball, R., Sadka, G. and Tseng, A., (2022). Using accounting earnings and aggregate economic indicators to estimate firm-level systematic risk. *Review of Accounting Studies*, *27*(2), pp.607-646.

Baloyi, B., (2014). The Role of South Africa's Freight Rail Regulatory Framework in Genera l Freight's Sluggish Growth Performance'. Centre for Competition, Regulation and Economic Development, University of Johannesburg.

Bandara, Y.M., Nguyen, H.O. and Chen, S.L., (2013). Determinants of port infrastructure pricing. *The Asian Journal of Shipping and Logistics*, *29*(2), pp.187-206.

Bandara, YMS (2015). Influential factors in seaport infrastructure pricing. University Of Tasmania. Thesis. Available at: https://doi.org/10.25959/23238794.v1. (Accessed 30 June 2023)

Black, F. and Scholes, M. (1973), 'The Pricing of Options and Corporate Liabilities', Journal of Political Economy, vol.81, pp.637-654.

Braeutigam, R.R. and Panzar, J.C., (1993). Effects of the change from rate-of-return to price-cap regulation. The American Economic Review, 83(2), pp.191-198.

Brian, W., (2010). Price Cap Regulation. Energy Regulatory Partnership Program. Abuja, Nigeria. Michigan Public Service Commission. Available at: https://pubs.naruc.org/pub.cfm?id=5387C07B-2354-D714-5199-D4242EE421BA. (Accesses 1 January 2023).

Booth, L. (1991), 'The Influence of Production Technology on Risk and the Cost of Capital', Journal of Financial and Quantitative Analysis, vol. 26, pp. 109-127.

Caldecott, B., Howarth, N. and McSharry, P., (2013). Stranded assets in agriculture: Protecting value from environment-related risks. Smith School of Enterprise and the Environment. Available at: https://www.smithschool.ox.ac.uk/sites/default/files/2022-03/stranded-assets-agriculture-report-final.pdf. (Accessed 30 June 2023).

Chasomeris, M. (2002). South Africa's Port Performance: Policy, Pricing and Growth. Durban: Unpublished paper, Department of Economics and Finance, University of KwaZulu Natal.

Chasomeris, M.G., (2015). Port infrastructure pricing: A critique of the revenue required methodology. *Port Infrastructure Pricing: A Critique of the Revenue Required Methodology*, pp.153-170.

Chasomeris., M., (2020). Comments on the National Ports Authority Revenue Required Tariff Methodology 2021/22 and Beyond. Available at: https://www.readkong.com/page/prof-mihalis-micky-chasomeris-comments-on-the-national-6628903. (Accessed 30 June 2023).

Chasomeris, M. and Gumede, S., (2022). Regulation, governance and infrastructure pricing in South Africa's ports sector. In Regulation and Finance in the Port Industry: Lessons from Worldwide Experiences (pp. 53-67). Cham: Springer International Publishing.

Choy, L.T., (2014). The strengths and weaknesses of research methodology: Comparison and complimentary between qualitative and quantitative approaches. IOSR journal of humanities and social science, 19(4), pp.99-104.

Chung, K.H. and Charoenwong, C., (1991). Investment options, assets in place, and the risk of stocks. *Financial Management*, pp.21-33.

Clarke, V. and Braun, V., (2013). Successful qualitative research: A practical guide for beginners. Successful Qualitative Research, pp.1-400. Available at: https://www.researchgate.net/publication/256089360_Successful_Qualitative_Research_A_Practical_Guide_for_Beginners. (Accessed 6 November 2023).

Cohen, L., Manion, L. and Morrison, K., (2002). *Research methods in education*. Sixth Edition. Routledge. 2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN. Available at: https://gtu.ge/Agro-Lib/RESEARCH%20METHOD%20COHEN%20ok.pdf. (Accessed 30 June 2023).

Columbus Stainless, (2017). Comment on the proposed draft Tariff Methodology for Tariff Years 2018/2019-2020/21. Ports Regulator of South Africa. 30 December. Available at http://www.portsregulator. org/ports_reg_011.htm (Accessed: 30 November 2022)

Corporate Finance Institute., (2017). Guide to unlevered beta (asset beta), how to calculate it, and what it's used for [online]. Available at: https://corporatefinanceinstitute.com/resources/knowledge/valuation/unlevered-beta-asset-beta/.(Accessed: 7 May 2022)

Cowan, S., (2002). Price-cap regulation. Swedish economic policy review, 9(2), pp.167-188. Available at: https://www.researchgate.net/publication/265423229_Price-cap_regulation. (Accessed 15 November 2023).

Creswell, J.W. and Creswell, J.D., (2009). Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications.

Curley, A.J., Hexter, J.L. and Choi, D., (1982). The cost of capital and the market power of firms: a comment. *The Review of Economics and Statistics*, pp.519-523.

Damodaran, A., (1999). Estimating risk parameters. WP, Stern School of Business, New York.

Damodaran, A., (2011). Chap. 3 The Basics of Risk. *Applied Corporate Finance, third ed. John Wiley & Sons*.

Dean, M., (2019). Scenario planning: A literature review. A report of project, A Paper prepared as part of the MORE (Multi-modal Optimisation of Roadspace in Europe) Project - Work Package 3 (Future Scenarios: New Technologies, Demographics and Patterns of Demand) Project Number: 769276-2. Available at: https://cordis.europa.eu/project/id/769276. (Accessed 30 June 2023).

Döll, P., (2004). Qualitative-quantitative scenarios as a means to support sustainability-oriented regional planning. In Environmental Challenges in the Mediterranean 2000–2050 (pp. 47-60). Springer, Dordrecht.

Dudwick, N., Kuehnast, K., Jones, V. N., and Woolcock, M. (2006). Analysing Social Capital in Context: A Guide to Using Qualitative Methods and Data, World Bank Institute, Washington.

Dwarakish, G.S. and Salim, A.M., (2015). Review on the Role of Ports in the Development of a Nation. *Aquatic Procedia*, *4*, pp.295-301.

ESCAP, U., (2002). Comparative analysis of port tariffs in the ESCAP region, United Nations, New York. Available at: https://repository.unescap.org/bitstream/handle/20.500.12870/2916/ESCAP-2002-RP-Comparative-analysis-port-tariffs-ESCAP-region.pdf?sequence=1&isAllowed=y: (Accessed 30 June 2023).

Fakir, M. & Chasomeris, M.G., (2022). 'Ports regulation in South Africa: An equitable tax rate approach', Journal of Economic and Financial Sciences 15(1), a736. Available at: https://doi.org/10.4102/jef. v15i1.736 (Accessed: 1 September 2022).

Frontier Economics (2019). Issues in cost of capital estimation for the port of Melbourne. Prepared for the essential services commission. Available at: https://www.esc.vic.gov.au/sites/default/files/documents/issues-in-cost-of-capital-estimation-for-the-port-of-melbourne-frontier-economics-20191212.pdf. (Accessed 30 June 2023).

Gambelli, D., Vairo, D. and Zanoli, R., (2010). Exploiting qualitative information for decision support in scenario analysis. Journal of decision systems, 19(4), pp.407-422.

Garbers, J.G. (Ed.). (1996). Effective Research in the Human Sciences. Pretoria: Van Schaik. Available at: https://www.pins.org.za/pins/pins25/pins25_bookreview08_Collings.pdf. (Accessed 30 June 2023).

Godongwana, E., (2022). Budget Speech. 23 February, National Treasury. Available at: https://www.parliament.gov.za/storage/app/media/Pages/2022/2-february/23-02-2022_budget_speech/speech.pdf. (Accessed on 15 August 2022).

Grater, S. & Chasomeris, M.G., (2022), 'Analysing the impact of COVID-19 trade disruptions on port authority pricing and container shipping in South Africa', Journal of Transport and Supply Chain Management 16(0), a772. Available at: https://doi. org/10.4102/jtscm. v16i0.772 (Accessed: 10 October 2022).

Gumede, S. and Chasomeris, M.G., (2017). A critique of South Africa's National Ports Authority's revenue required pricing methodology. *International Journal of Transport Economics*, *44*(4).

Gumede, S. and Chasomeris, M., (2018). Pricing strategy and tariff structure for a port authority: a case study of South Africa. *Maritime Policy & Management*, *45*(6), pp.756-769.

Gumede, S.A., (2012). *Assessing stakeholders' perspectives on maritime port pricing in South Africa* (Masters dissertation). Available at: https://ukzn-dspace.ukzn.ac.za/bitstream/handle/10413/12759/Gumede_Sanele_Aubrey_2012.pdf?sequence=1&isAllowed=y. (Accessed on 30 June 2023).

Haugh, D., A. Mourougane and O. Chatal (2010), "The Automobile Industry in and Beyond the Crisis", OECD Economics Department Working Papers, No. 745, OECD Publishing, Paris, Available at: https://doi.org/10.1787/5kmmp8wg6cmq-en. (Accessed: 20 April 2022).

Havenga, J.H., Simpson, Z.P. and De Bod, A., (2014). South Africa's freight rail reform: a demand-driven perspective. Journal of Transport and Supply Chain Management, 8(1), pp.1-7.

Haralambides, H.E., (2002). Competition, excess capacity, and the pricing of port infrastructure. *International journal of maritime economics*, *4*, pp.323-347.

Incenta Economic Consulting (2020). Estimating the Port of Melbourne's equity beta: Port of Melbourne. Available at: https://www.esc.vic.gov.au/sites/default/files/documents/Appendix%20Q%20-%20Incenta%20Estimating%20the%20Port%20of%20Melbourne%20equity%20beta.PDF (Accessed: 3 April 2022).

Jamison, M.A., (2007). Rate of return: regulation. *Encyclopaedia of Energy Engineering and Technology*, *3*, pp.1252-1257.

Jamison, M.A., 2007. Regulation: price cap and revenue cap. Encyclopedia of energy engineering and technology, 3, pp.1245-51. Available at: https://bear.warrington.ufl.edu/centers/purc/docs/papers/0527_jamison_regulation_price_cap.pdf. (Accessed 30 June 2023).

Kosow, H. and Gaßner, R., (2008). Methods of future and scenario analysis: overview, assessment, and selection criteria (Vol. 39, p. 133). DEU. Available at: https://www.idos-research.de/uploads/media/Studies_39.2008.pdf. (Accessed 12 November 2023).

Kothari, C.R. (2004) Research Methodology: Methods and Techniques. 2nd Edition, New Age International Publishers, New Delhi. Available at: https://ccsuniversity.ac.in/bridge-library/pdf/Research-Methodology-CR-Kothari.pdf. (Accessed 30 June 2023).

Kirkpatrick, C. and Parker, D., (2004). *Infrastructure regulation: models for developing Asia* (No. 60). ADBI Research Paper Series. Available at: https://www.econstor.eu/bitstream/10419/111153/1/adbi-rp60.pdf. (Accessed 30 June 2023).

Kirkpatrick, C., Parker, D. and Zhang, Y.F., (2005). Price and profit regulation in developing and transition economies: A survey of the regulators. Public Money and Management, 25(2), pp.99-105.

Kosow, H. and GaBner, R., (2008). Methods of future and scenario analysis: overview, assessment, and selection criteria (Vol. 39, p. 133). DEU.

Lally, M., Faff, R.W. and Brailsford, T., (2000). The cost of equity capital and its estimation. McGraw-Hill.

Lally, M., (2002). Betas and market leverage. *Accounting Research Journal*, *15*(1), pp.91-97.

Lally, M., (2003). The Weighted Average Cost of Capital for Electricity Lines Businesses. Victoria University, School of Economics and Finance, Report no. Weelington. Available at: https://comcom.govt.nz/__data/assets/pdf_file/0030/88365/ELB4aug20030.pdf. (Accessed 2 October 2023).

Leedy, P. D., & Ormrod, J. E. (2015). Practical research. Planning and design (11th ed.). Boston, MA: Pearson.

Lev, B., (1974). On the association between operating leverage and risk. *Journal of financial and quantitative analysis*, *9*(4), pp.627-641.

Liston, C., (1993). Price-cap versus rate-of-return regulation. Journal of Regulatory Economics, 5(1), pp.25-48.

Lyons, G., Rohr, C., Smith, A., Rothnie, A. and Curry, A., (2021). Scenario planning for transport practitioners. Transportation Research Interdisciplinary Perspectives, 11, p.100438. Available at:

https://www.researchgate.net/publication/353803241_Scenario_planning_for_transport_practitioners#fullTextFileContent. (Accessed 30 June 2023).

Mafuwane, B., (2012). Chapter 4: Research design and methodology. University of Pretoria, pp.67-95. Available at: https://repository.up.ac.za/bitstream/handle/2263/24016/04chapter4.pdf. (Accessed 30 June 2023).

Mahmoud, M., Liu, Y., Hartmann, H., Stewart, S., Wagener, T., Semmens, D., Stewart, R., Gupta, H., Dominguez, D., Dominguez, F. and Hulse, D., (2009). A formal framework for scenario development in support of environmental decision-making. Environmental Modelling & Software, 24(7), pp.798-808. Available at: https://www.researchgate.net/publication/220274818_A_formal_framework_for_scenario_development_in_support_of_environmental_decision-making#fullTextFileContent. (Accessed 30 June 2023)

Mandelker, G.N. and Rhee, S.G., (1984). The impact of the degrees of operating and financial leverage on systematic risk of common stock. *Journal of financial and quantitative analysis*, *19*(1), pp.45-57.

Martin., H. (2016). Introduction to Real Options: Foundations of Financial Engineering, Available at: http://www.columbia.edu/~mh2078/FoundationsFE/RealOptions.pdf. (Accessed: 13 April 2022).

Martins, F.S., da Cunha, J.A.C. and Serra, F.A.R., (2018). Secondary data in research–uses and opportunities. PODIUM sport, leisure and tourism review, 7(3). Available at: https://www.researchgate.net/publication/328363920_Secondary_Data_in_Research_-_Uses_and_Opportunities. (Accessed 30 June 2023).

Mchizwa, N.E., (2014). Towards efficient port pricing: a specific look into South African tariff methodology. Available at: https://commons.wmu.se/cgi/viewcontent.cgi?article=1465&context=all_dissertations. (Accessed 30 June 2023).

McMillan, J.H., & Schumacher, S. (2010). Research in Education: Evidence-Based Inquiry, 7th Edition. Pearson. One Lake Street, Upper Saddle River, New Jersey 07458.

Meersman, H., Van de Voorde, E., & Vanelslander, T. (2003). Port Pricing. Considerations on Economic Principles and Marginal Costs. European Journal of Transport and Infrastructure Research, 3(4). Available at: https://doi.org/10.18757/ejtir.2003.3.4.4248. (Accessed 30 June 2023).

Meyiwa, A. and Chasomeris, M., (2020). South Africa's port doctrine: dilemmas and the way forward. *Maritime Studies*, *19*(2), pp.179-191. Ava

Moriarty, J.P., (2012). Theorising scenario analysis to improve future perspective planning in tourism. Journal of Sustainable Tourism, 20(6), pp.779-800.

Mudronja, G., Jugović, A. and Škalamera-Alilović, D., (2020). Seaports and economic growth: Panel data analysis of EU port regions. *Journal of Marine Science and Engineering*, *8*(12), p.1017.

Muhammad., K.S., (2016). Introduction to Research. Curtin University. Available at:https://www.researchgate.net/publication/325846733_Introduction_to_Research. (Accessed: 2 November 2022).

Myers, S.C., and Turnbull, S.M., (1977). Capital budgeting and the capital asset pricing model: Good news and bad news. *The Journal of Finance*, *32*(2), pp.321-333.

National Ports Act 12 of 2005. c.5. Government Gazette. Cape Town. Available at: https://www.gov.za/sites/default/files/gcis_document/201409/a12-051.pdf. (Accessed 2 March 2022).

Neuman, W. L. (2006) Social Research Methods: Qualitative and Quantitative Approaches 6th Edition, Pearson International Edition, USA.

Notteboom, T., A. Pallis and J-P Rodrigue., (2022). Port Economics, Management and Policy, New York: Routledge, Available at: https://doi.org/10.4324/9780429318184. (Accessed: 10 March 2022).

OECD (2011) Competition Concerns in Ports and Port Services, - Submission by the US Department of Justice and the US Federal Trade Commission, Paris. Available at: https://www.justice.gov/sites/default/files/atr/legacy/2011/07/29/273457.pdf. (Accessed 30 June 2023).

Operation Phakisa. (2014). Open day Operation Phakisa president speech. Available at: http://www.operationphakisa.gov.za/Pages/Home.aspx. (Accessed: 10 March 2022).

O'Sullivan, E., Rassel, G., Berner, M. and Taliaferro, J., (2016). Research methods for public administrators. Routledge. 52 Vanderbilt Avenue, New York.

Oum, T.H., Waters, W.G. and Yong, J.S., (1990). A survey of recent estimates of price elasticities of demand for transport (Vol. 359). Washington, DC: World Bank. Available at: https://documents1.worldbank.org/curated/pt/573201468766481035/pdf/multi-page.pdf. (Accessed 15 May 2022).

Pieterse, D., Farole, T., Odendaal, M. and Steenkamp, A., (2016). Supporting export competitiveness through port and rail network reforms: A case study of South Africa. *World Bank Policy Research Working Paper*, (7532). Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2741187. (Accessed 20 May 2023).

Porter, M. E., (1985). The Competitive Advantage: Creating and Sustaining Superior Performance. A Division of Simon & Shuster Inc. New York: Free Press. (Republished with a new introduction, 1998).

Ports Regulator (2013a). Regulatory Manual for the Tariff Year 2014/15". Available at: http://www.portsregulator.org. (Accessed: 16 April 2020).

Ports Regulator (2013b), "Record of Decision: Tariff Application by the National Ports Authority for the Tariff Year 2013/2014", available at: http://www.portsregulator.org. (Accessed: 10 March 2020).

Ports Regulator (2018a), Methodology for the Valuation of the National Ports Authority's Regulatory Asset Base", available at: http://www.portsregulator.org. (Accessed: 17 April 2022).

Ports Regulator (2018b), "Record of Decision: Weighted Efficiency Gains from Operations", available at: http://www.portsregulator.org. (Accessed: 17 April 2022).

Ports Regulator (2019), Record of Decision: Tariff Application by the National Ports Authority for the Tariff Years 2020/21-2022/23, available at: http://www.portsregulator.org. (Accessed: 17 April 2022).

Ports Regulator (2020a), Port Tariff Methodology For Tariff Years 2021/22 – 2023/24", available at: http://www.portsregulator.org. (Accessed: 16 April 2020).

Ports Regulator (2020b). Benchmarking South African port administered prices against a sample of international ports: Global Ports Pricing Comparator Study 2020/21 Port Tariffs, available at: http://www.portsregulator.org. (Accessed: 17 April 2022).

Ports Regulator (2021), Record of Decision: Tariff Application by the National Ports Authority for the Tariff Years 2022/23 – 2024/25, available at: http://www.portsregulator.org. (Accessed: 28 January 2023).

Ports Regulator (2022), Discussion Document Port Tariff Methodology for Tariff Years 2024/25 – 2026/27: Published for Consultation: 15 December 2022, available at: http://www.portsregulator.org. (Accessed: 28 January 2023).

Fallon, J., Cunningham, M. and da Silva Rosa, R., (2021). Methodological issues in estimating the equity beta for Australian network energy businesses. Available at: https://www.aer.gov.au/system/files/Report%20to%20the%20AER%20-%20Methodological%20issues%20in%20estimating%20the%20equity%20beta%20for%20Australian%20network%20energy%20businesses%20-%2030%20June%202021.pdf. (Accessed 30 June 2023).

Rodrigue, J.P. and Notteboom, T., (2020). Ports and economic development. *T. Nottleboom, P. Athanasios, & J.-P. Rodrigue, Port Economics, Management and Policy. Routledge*. New York.

Rosenberg, B. and Guy, J., (1976). Prediction of beta from investment fundamentals: part one. Financial Analysts Journal, 32(3), pp.60-72.

Rubinstein, M.E., (1973). A mean-variance synthesis of corporate financial theory. *The Journal of Finance*, *28*(1), pp.167-181.

Ruffino, D. (2010). Real Options. Encyclopedia of Quantitative Finance. Available at: https://www.researchgate.net/publication/314050971_Real_Options. (Accessed 30 June 2023).

SAASOA, (2021). Comments on Transnet National Ports Authority's tariff application for the 2022/23 financial year. 30 December 2021. Available at: http://www.portsregulator. org/ports_reg_011.htm. (Accessed: 29 November 2022).

Samawi, G.A., Mdanat, M.F. and Arabiyat, T.S., (2017). The role of energy supply in economic growth: Evidence from the oil importing countries. International Journal of Energy Economics and Policy, 7(6), p.193.

Saunders, Mark & Lewis, Philip & Thornhill, Adrian & Bristow, Alex. (2019). "Research Methods for Business Students" Chapter 4: Understanding research philosophy and approaches to theory development. Available at: https://www.researchgate.net/publication/330760964_Research_Methods_for_Business_Students_Chapter_4_Understanding_research_philosophy_and_approaches_to_theory_development. (Accessed 30 June 2023).

Scaramelli, S., (2010). *The Determinants of Port Competitiveness: The Case of Valencia*. Masters Dissertation. Erasmus University. Available at: https://thesis.eur.nl/pub/33269. (Accessed 30 June 2023).

Schmidt-Scheele, R., (2020). The plausibility of future scenarios: Conceptualising an unexplored criterion in scenario planning. Bielefeld: transcript Verlag. DOI: https://doi.org/10.1515/9783839453193.

Schwardt, T.A. (2007). The SAGE Dictionary of Qualitative Inquiry. Third Edition. Sage Publishing. University of Illinois, Urbana-Champaign.

Stander, H.J. and Pienaar, W.J., (2005). Land freight issues in South Africa. SATC 2005.

Sullivan, T. (1978), 'The Cost of Capital and the Market Power of Firms', Review of Economics and Statistics, vol. 60, pp. 209-217.

Suwanpargpraek, Jatuporn, (1988). "Port pricing, a case study on cost-based charging policy for coastal ports in Thailand". World Maritime University Dissertations. 843. Available at: https://commons.wmu.se/cgi/viewcontent.cgi?article=1843&context=all_dissertations. (Accessed 30 June 2023).

Suykens, F. and Van de Voorde, E., (1998). A quarter a century of port management in Europe: objectives and tools. *Maritime policy and management*, *25*(3), pp.251-261.

Synergies Economic Consulting (2017). Determining a WACC estimate for Port of Melbourne: A report prepared in context of the Pricing Order. Available at: https://www.synergies.com.au/wp-content/uploads/2020/01/Port-of-Melbourne-WACC-report-310517-FINAL.pdf. (Accessed 30 June 2023).

Thapa-Parajuli, R., Aryal, S., Alharthi, M. and Paudel, R.C., (2021). Energy consumption, export performance and economic growth in a landlocked developing country: The case of Nepal. AIMS Energy, 9(3), pp.516-533. Available at: https://www.aimspress.com/article/doi/10.3934/energy.2021025?viewType=HTML. (Accessed 30 June 2023).

Transnet (2021), Integrated Report. 25 October 2021, Johannesburg. Available at: https://www.transnet.net/InvestorRelations/Pages/Annual-Results-2021.aspx. (Accessed 5 December 2022)

Transnet (2022a). Transnet National Ports Authority Tariff Application for Financial Year 2023/24. Available at: https://www.transnetnationalportsauthority.net/Port%20Tariffs/Documents/Tariff%20Application%20FY%20202324-%2001%20August%202022.pdf. (Accessed 30 June 2023).

Transnet (2022b). Integrated Report. Available at: https://www.transnet.net/InvestorRelations/Pages/Annual-Results-2020.aspx. (Accessed 5 December 2022).

Truen, S., (2022). Rail access pricing framework for South Africa. SA-TIED. Available at: https://sa-tied.wider.unu.edu/sites/default/files/SA-TIED-Report-Truen_0.pdf. (Accessed 30 June 2023).

UNCTAD (1995). Strategic port pricing. Geneva, Switzerland. Available at: https://unctad.org/system/files/official-document/sddport2_en.pdf. (Accessed 30 June 2023).

Van der Mescht, J., (2006). Revisiting the road versus rail debate. SATC 2006. Available at: https://repository.up.ac.za/bitstream/handle/2263/6100/093.pdf?sequence=1. (Accessed 30 June 2023).

Van der Merwe, P. (1996). The Research Process: Problem Statement and research design. Available at: https://repository.up.ac.za/bitstream/handle/2263/24016/04chapter4.pdf. (Accessed 30 June 2023).

Vartanian, T.P., (2010). Secondary data analysis. Oxford University Press. DOI: https://10.1093/acprof:oso/9780195388817.001.0001.

Walliman, N., 2010. Research methods: The basics. Routledge, Available at: https://www.taylorfrancis.com/books/mono/10.4324/9780203836071/research-methods-basics-nicholas-walliman (Accessed: 12 October 2022).

Weinreich, N.K. (2009). Integrating Quantitative and Qualitative Methods in Social Marketing Research. Available at: http://www.social-marketing.com. (Accessed 8 September 2022).

Wilmsmeier, G., (2012). Infrastructure charges: Creating incentives to improve environmental performance. Available at:

https://www.cepal.org/sites/default/files/publication/files/36275/FAL-309-WEB-ENG_en.pdf. (Accessed 20 May 2022).

World Bank, (2003). Port reform toolkit: Effective decision support for policymakers. The World Bank. DOI: https://doi.org/10.1596/0-8213-5046-3.

Zhang, X., (2012). The Role of Operating Leverage in Asset Pricing (Doctoral dissertation, Master thesis finance. School of Economics and Management. University of Tilburg. 61p). Available at: http://arno.uvt.nl/show.cgi?fid=127151. (Accessed 30 June 2023).

Zuccollo, D.R., 2013. The Baltic Dry Index: a leading economic indicator and its use in a South African context (Doctoral dissertation, University of the Witwatersrand, Faculty of Commerce, Law and Management, School of Economic and Business Sciences). Available at: https://wiredspace.wits.ac.za/server/api/core/bitstreams/78399090-ff27-4d09-a276-d06f914457ec/content. (Accessed 30 June 2023).

Appendix 1: Ethical Clearance Certificate

Mr Mondli Eugene Mbele (208527340)
Graduate School of Business and Leadership
Westville

Dear Mr Mondli Eugene Mbele,

Original application number: 00017581
Project title: Evaluating the rate of return pricing methodology for ports in South Africa: A scenario analysis

Exemption from Ethics Review

In response to your application received on 5 September 2022 , your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW.**

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:
Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours sincerely,

[redacted]
Digitally signed by Ana Martins
Date: 2022.09.05 18:08:01 +02'00'
Adobe Acrobat version: 2022.002.20191

Prof Ana Martins
Academic Leader Research
Graduate School of Business and Leadership

UKZN Research Ethics Office
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Website: http://research.ukzn.ac.za/Research-Ethics/