2014

Towards efficient port pricing : a specific look into South African tariff methodology

Nokuzola Ethel Mchizwa
World Maritime University

WORLD MARITIME UNIVERSITY

Malmö, Sweden

TOWARDS EFFICIENT PORT PRICING: A SPECIFIC LOOK INTO SOUTH AFRICAN TARIFF METHODOLOGY

By

NOKUZOLA ETHEL MCHIZWA

South Africa

A dissertation submitted to the World Maritime University in partial

Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

In

MARITIME AFFAIRS

(SHIPPING MANAGEMENT AND LOGISTICS)

2014

DECLARATION

I certify that all the material in this dissertation that is not my own work has been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

(Signature): 

(Date): 22 September 2014

Supervised by: Professor Ilias Visvikis

World Maritime University

Assessor: Professor Shou Ma

Institution/organisation: World Maritime University

Co-assessor: Dr Kyriaki Mitroussi

Institution/organisation: Cardiff University

ACKNOWLEDGMENT

I would like to express my humble gratitude to God for the blessings he continuously brings into my life. I am thankful to my parents, especially my dad, my biggest fan, for teaching me the value of striving for continual growth and instilling in me the hunger to learn. I am saddened that I will not be sharing this achievement with him as he passed during the course of my studies.

Special thanks to Professor Ilias Visvikis for his supervisory prowess and guidance. To Professor Daniel Moon and World Maritime University staff, thank you for sharing your expertise and experiences, I have learnt a lot. To World Maritime University library team (Mr Chris Hoebeke and Ms Anna Volkova), I thank you for your support. To the World Maritime University student services team, thank you for making my studying experience away from home to be this memorable.

I am sincerely indebted and thankful to the South African Maritime Safety Authority (SAMSA) and their partners for affording me a fully paid scholarship to study at the World Maritime University. To all my colleagues of S14, especially the Shipping Management and Logistics and Port Management specializations, I thank you for lifetime memories that we created during our classes and field trips.

I would like to thank the World Maritime University family for the love and support you afforded me when I lost my dad, it all meant a lot. To my fiancé, Aluwani Ramulifho, I thank you for the love, the support and care that you have given to me, I am really looking forward to future projects together. I am grateful that through this MSc programme, I have grown as a young maritime professional, experienced international travel which has always been my dream, and have found my life partner.

ABSTRACT

Title of Dissertation: **Towards Efficient Port Pricing: A Specific look into South African Tariff Methodology**

Degree: **MSc**

South African trade with the rest of the world is primarily through the ports, given the geographical location of the country, its resources and trade partners. The competitiveness of the national ports therefore has a direct bearing on the competitiveness of the trade industry. The South African economy would be severely constrained without the necessary ports infrastructure in place, however, the efficiency of that infrastructure and pricing to use the infrastructure are of critical importance. In recent times industry participants and government have raised a concern about skewed pricing and high rates of the South African ports.

The management structure of the port, elasticity of demand for port service and the source of port funding determine the method used for port pricing. This thesis serves to examine how the factors of the port pricing of the South African ports system can be used to achieve efficient port pricing. A number of shortcomings of the currently applied pricing model were discovered and discussed but the primary shortcoming is that the model provides inadequate incentives for the port management to apply effort in order to maximise efficiency. After considering the current pricing system and how the users are affected, the most critical element to pricing in South African ports is the requirement for practical encouragement of intra-port and inter-port competition.

It was also discovered that costs alone, especially accounting based costs that the tariff model is based, should not determine the tariffs levels. Therefore a pricing method that incorporates other objectives should be considered, hence the suggested CPV approach. This method of pricing will afford the port authority to pursue multiple objectives that will be beneficial to the authority, its customers and the country as a whole.

KEYWORDS : Port Pricing, port competition, price elasticity of demand, revenue requirement

LIST OF TABLES

LIST OF ABBREVIATIONS

AEG	Academic Expert Group
CAPEX	Capital expenditure
CAPM	Cost of Equity
CPI	Consumer Price Index
CPV	Cost Performance and Value approach
DMS	Dimson Marsh and Staunton
DORC	Depreciated Optimised Replacement Cost
ESCAP	Economic and Social Commission of Asia and the Pacific
ETIMC	Excessive Tariff Increase Margin Credit
GEAR	Growth, Employment and Redistribution
JSE	Johannesburg Stock Exchange
MRP	Market risk premium
NPA	National Port Authority
RAB	Regulatory Asset Base
RC	Replacement Cost
RODs	Regulator's Record of Decision
SAPO	South African Port Operations
SAR&H	South African Railways and Harbours
SATS	South African Transport Services
TFR	Transnet Freight Rail
TNPA	Transnet National Ports Authority
TPT	Transnet Port Terminals
UNCTAD	United Nations Conference on Trade and Development
WACC	Weighted Average Cost of Capital

TABLE OF CONTENTS

Chapter 1: Introduction

The demand for transport services is derived from demand for goods and is consequently a function of industrial production, economic growth, and international trade (Meersman, et al., 2002). Any improvements in the economic efficiency of a seaport will improve economic welfare by increasing the producers' surplus for the originators of the goods being transported and consumers' surplus for the final consumers of the goods being imported" (Goss, 1990) Pricing of ports is significant in the choice of port decision, in terms of generalised port of call costs. Generalised cost is the sum of amount paid, costs of delays, time costs, and the risk of damage or loss. The impacts that can be realised by the economy from inefficient ports can be substantial. As competition among intermodal routes of the logistics chains increases, the efforts of ports to establish a competitive advantage that allows them to remain in business also increases. Previously, geographical location of a particular port, the depth of the port's navigational channel or the security offered by the port was often enough to provide a competitive edge, to date, this is no longer adequate. In the present day, competitive advantage is derived from providing better services to port users.

Ports form part of a chain thus focusing on port costs is a device to examine a component of South African logistics costs because ports serve not to only the strategic role of trade facilitation, but also help to shape the economic growth and development of the entire Southern African region. There have been concerns raised that the port prices are high and continue to increase because the pricing model incentivises port price levels that are not at the interest of the country. This has attracted attention on the topic with initiatives to provide solutions being required. The main question that this thesis serves to address is how an efficient pricing system can be executed in the South African ports sector, taking into account the objectives and constraints of the port system. This thesis will base its investigation on the

notion that the management structure of the port, elasticity of demand for port services, and the source of port funding determines the method used for port pricing. These factors will be examined individually in order to determine how they can be used in achieving efficient port pricing. The background of the port management of South Africa and its effect on port pricing will be analysed. This will be followed by an empirical analysis of price elasticity of demand for port services. An investigation of the currently applied port pricing model will be conducted through an analysis of each component of the model. The paper concludes by exploring an alternative pricing method that may be used to achieve efficient results.

1.1. South African port pricing background

Pricing by ports and operators within ports is historically determined (Meersman et al., 2002). South African port pricing history has shaped how pricing is conducted to date. In the period from 1833 to 1908 there was an era referred to as the pre-Union period, where all the ports were operating and managed independently of each other as specified by the associated colonial railways. Each port determined and administered its tariff rates and generated its own revenue. With each port authority operating exclusively, competition was high as each port wanted to attract as much throughput as possible (Chasomeris, 2002).

In 1909 the South African Railways and Harbours (SAR&H) was formed and was in operation until 1981. The formation of SAR&H saw all ports being combined into one administration and management. The SAR&H also included railways and a uniform tariff structure mechanism was introduced. The uniform tariff structure called to the end the competitive environment that had once operated in the national ports system. The SAR&H undertook to run its operations according to business principles producing sufficient revenues and provided preferential cheaper rates to agricultural and industrial sectors. With the pooled ports revenues, each port revenue contribution was not to be easily identifiable. The Harbours and railways were separated in 1911. With this mechanism, the revenues generated through cargo handling activities like stevedoring and warehousing fell into the railway revenue stream, with wharfage charges being split into two thirds for the ports and one third allocated to the railway stream (Chasomeris, 2002).

Through the South African Transport Services Act of 1981, the SAR&H was converted into South African Transport Services (SATS). SATS was formed as a state-owned business enterprise. This bought changes to the pricing policy within the ports system. The previous incentivizing of the agricultural and industrial sector that was introduced during the SAR&H era was done away with; with SATS advocating to developing a transport system that would serve favourably to the all national economic interests. SATS did however inherit the uniform port pricing mechanism across all ports and this lead to cross inter-port subsidization. SATS separated the cargo handling operations away from the railway related business and placed them on the port related business.

In 1989 things changed with the introduction of Transnet (Pty) Ltd. Transnet is a public company that is wholly government owned and prior to 2002, it operated in many 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 was a division of Transnet that administered the port functions. Portnet administered its ports on a national level setting uniform tariff structure and competition amongst ports still did not exist. The era also inherited the uniform pricing mechanism across all national ports (NEDLAC, 2007).

The national port transport system has been profoundly shaped by the wharfage that was introduced in 1925. Wharfage is charged in order to gain revenues that are used to pay for landside equipment and infrastructure (UNCTAD, 1995). The wharfage charge has been carried through into the current pricing system through cargo dues. Wharfage is a category of general tariffs levied by port authorities on a unit basis (for example per ton, cubic meter, or per TEU). The wharfage was levied on ad valorem basis at a fixed rate based on the value of cargo declared on the manifest. The port authority also justified that the ad valorem charges would be at par with changes in prices and exchange rate fluctuations, which will save the authority from continuously changing the tariff rates. Through this pricing mechanism, low valued exports were kept at competitive levels. The authority also specified that the wharfage ensured that the ability to pay of cargo owners was realized. The wharfage was said to be discriminatory as it favoured low valued cargoes. This violated both the cost based and equity based pricing mechanisms. Suggestions of changing the wharfage were being rejected on the basis that low valued cargo would have to pay more, and export competitiveness would have been disadvantaged. The port authority was able to charge the value based prices as there was

no competition in between ports. During the wharfage pricing regime, Portnet was a major source of revenue for Transnet. The gains were divided amongst all Transnet divisions which lead to cross subsidization in between transport modes (Chasomeris, 2002).

In the wharfage pricing mechanism, cargo functions subsidized marine functions which lead to ship owners to underpay on the services they utilized whilst on the other hand cargo owners overpaid. The White Paper on National transport policy came with the change to the structure of the Portnet as a division of Transnet. The restructuring resulted into two port related divisions within the national transport system; the port authority called the National Ports Authority (NPA) and port operations division named the South African Port Operations (SAPO). The national port authority was to control and coordinate the port infrastructure and the terminals were to be leased to interested participants, including SAPO. SAPO on the other hand is the division that took over the cargo handling function and controlled all the terminals. Complementary tariff structure was the order of the day (NEDLAC, 2007).

NPA was later changed and named Transnet National Ports Authority (TNPA) and SAPO named Transnet Port Terminals (TPT). All ports in South Africa are administered at national level by TNPA. The main objective of the authority is to own, manage, control and administer the port in order to guarantee that the ports are functioning in an efficient and economic manner. In achieving this objective, the authority provides, plans, maintain and develop infrastructure in the ports. The authority also needs to ensure that adequate, affordable and efficient port services and services are provided. The Authority employs a uniform pricing method across all ports therefore there is no price competition between the ports.

In 2002, a tariff reform exercise was performed and resulted in ad valorem charges to be replaced by cargo dues. The tariff has not been reviewed since and there is currently a proposal which is being considered by the Ports Regulator in an effort to review the tariff method. The tariff revision is based on proposing the revenue requirement model to be adopted as a pricing model for the port charges, this will be discussed later. The Ports Regulator was introduced through the National Ports Act 12 of 2005. The office of the Ports Regulator came into effect in May 2007 and the key functions of the Ports Regulator include economic regulation of national ports in order to achieve government strategic objectives, promotion of equity access to the national ports and to monitor the port authority in order to

guarantee that the port authority performs its functions as outlined in the National Ports Act (Chasomeris, 2002).

Since 2007, when the Port regulator was formulated the port authority is required to submit proposals of any tariff changes for the approval of the Ports Regulator. After receiving the application or proposal for tariff changes, the Ports Regulator then calls stakeholders of the ports system to make submissions and comments on the port authority proposed port tariff application (Chasomeris, 2011). The Ports Regulator then assesses the proposal of TNPA and submissions from the stakeholders and applies the National Ports Act 12 of 2005, National Commercial Port Policy of 2002 and the Ports Regulator Directives of 2008 in order to make a decision on the port tariff application. The Directives of the Ports Regulator set out that the Regulator should ensure that port authority recovers its investments; recover its costs of operations and attain a sufficient return to cover the opportunity of the capital employed in the production of its services. The tariffs are still uniform across all ports, port related investments are made by the national body with individual ports controlling their day-to-day operations.

1.2. The functions of the port authority

The port authority is responsible for the management of the national commercial port system as a landlord port authority. Being a landlord-type port authority, it owns all the port land in the country and manages the eight South African commercial ports, namely Saldanha Bay, Cape Town, Mossel Bay, East London, Port Elizabeth, Ngqura, Durban and Richards Bay. Each of the ports operates within a complementary port system to support a defined customer base as informed by its natural hinterland with defined markets which determines the nature of services and facilities and the types of cargo handled at each port.

The service that the port authority provides is categorised into two groups, the basic port infrastructure and operational services to its users. According to the South African Ports Act, the revenue generated from the port authority services is to be used to maintain the already existing and provide future infrastructure and marine fleet. The South African ports system is self-funded and does not receive any financial assistance from the government. The port infrastructure and maritime services provisions are categorised in five market segments, containers, dry bulk; liquid bulk, break-bulk and automotive.

It is desirable to have a port structure that is in line with cost structure of the port so that the infrastructure cost can be related to its revenue stream in order to facilitate comparisons between cost and revenue (UNCTAD, 1995). Table 1 below outlines the service provision and revenue streams of the port authority, there are five main revenue streams, TNPA receives revenue through the leasing of port land, provision of wet infrastructure, dry infrastructure, ship repair services and from marine service provision.

Table 1: Port Authority port infrastructure and revenue system.

Port Infrastructure		**Revenue Stream**
Port land	Port land is leased to terminal operators and other port service and port facility providers in the port(s).	Lease income (rentals)
Wet infrastructure	Lighthouse services infrastructure (lighthouses, buoys, beacons and electronic / radio navigation equipment) , port control and safety, entrance channels, breakwaters, turning basins, aids to navigation within port limits, vessel traffic services, maintenance dredging within ports.	Light dues, port dues, vessel traffic services fees
Dry infrastructure	Quay walls, roads, rail lines, buildings, fencing, port security, lighting (outside terminals).	Cargo dues, berth dues
Ship repair services	Provide and maintain repair facilities as well as the cranes utilised in such facilities.	Preparation fee, docking and undocking fees (vessels at repair facilities), Berth dues (vessels at repair quays)
Marine services	Pilotage, tug assistance, berthing, running of lines, floating cranes	Pilotage dues, tug assistance fees, berthing fees, running of line fees, floating crane hire fees

Source: Transnet National Port Authority.

1.3. The objectives of the study

This thesis serves to investigate methods of improving the port pricing to become more efficient. It provides an empirical analysis to investigating price elasticity of the ports services. This is because the more inelastic the demand is changes in prices would have significant welfare losses to the economy. The current port pricing methodology, revenue requirement model that TNPA applies will be examined. An alternate port pricing approach and its applicability to the South African ports system will be explored.

1.4. Scope and limitations of the study

TNPA receives revenue through the leasing of port land, provision of wet infrastructure, dry infrastructure, ship repair services and from marine service provision. The analysis of port pricing will apply to pricing for all the other services, except for port land provision revenue. The port land provision is priced based on individual contracts between the port landlord and its tenants and therefore does not form part of this thesis analysis.

The initial thought of analysis was to explore alternative models that could be used to compare with the revenue requirement application to port pricing determination and a model with better results would be selected. This exercise proved difficult because other pricing models required information that was not available for this research; as an alternative the research focuses on developing an approach to port pricing for the South African port system.

The study suggests changes to the revenue requirement that can be done to make the model serve to more efficient results but does not test these suggestions. This is because some of these suggestions require resources that were not available when the research was conducted. For example the valuation of the regulatory asset base and calculation is suggested to be revisited but this will require an appointment of qualified property valuators. The study also suggests a more disintegrated ports system structure with each port priced using assets of each port but the actual analysis of how beneficial this could not conducted because data that is available from the port authority is aggregated for all the ports into one figure.

1.5. Conclusion

The history of the South African ports has a major impact on its current pricing practices as it resulted to high tariff levels for cargo dues resulting from the migration from the ad-valorem based wharfage charge, which depended on the value of the cargo. The need for pricing reform is required markets environment change, therefore in order to be competitive; ports need to make continuous improvements in terms of their service provision and optimal levels of their prices.

Chapter 2 discusses the theoretical and applied methods to port pricing by providing an in-depth analysis on already existing literature on the subject. Chapter 3 provides the research methodology. Chapter 4 investigates the importance of an efficient port pricing method by analysing the price elasticity of demand for South African ports services and provides and analysis of its implications. It further explores the currently applied pricing model. Chapter 5 investigates a pricing approach that would serve positively to the South African ports system. Chapter 6 provides a conclusion and recommendations for the thesis.

Chapter 2: Literature Review

2.1. Introduction

Port pricing is one of the areas that several topics to port capacity, port competition, strategy, policy and regulation are attended to instantaneously. The right price for port services can lead to prosperity and growth of a port whilst the wrong price can lead a port to extinction or increase in inefficiency and use of subsidies. Ports that have some level of monopoly power are able to charge higher prices to customers without much reduction in demand but high port prices hurt the trade that the port is supposed to serve. Low port prices on the other hand may increase the number of clients that the port would have to service but congestions may be experienced and investment costs may not be recovered in the long run (Haralambides & Veenstra, 2002). Port pricing is therefore strongly influenced by the structure of the maritime industry and the bargaining powers of the industry participants.

This chapter sets out to critically review the port pricing literature that is currently available in providing light for the subsequent chapters of this paper. The first section discusses the theoretic studies as provided by different schools of thought on the subject. This will be followed by an analysis of the practical port pricing behaviour recorded to date in the different ports of the world. The chapter will then conclude providing a summary of the findings and a way forward for the paper as informed by the observations.

Port pricing policy recognises two basic approaches, the economic and the financial approach. The economic approach relates to port pricing based on marginal cost and also considers the effects and benefits the port provide to its users. The financial approach on the other hand is based on accounting costs that allows the port to recuperate the fixed and variable costs it incurs in providing the facilities and services and also gain adequate rate of return on its investments. Simply, a port using the financial approach seeks to achieve a profit and the port using economic approach serve to nurture local economic activities and

development. In 1975, UNCTAD published its report on port pricing which advocated for ports to give primary consideration to the economic costs rather than the accounting costs in setting port prices (UNCTAD, 1975).

2.2. Economic pricing approach

Port management reasonably focus on the responsibility of focusing in producing good financial results each year with limited appreciation of welfare economics. The importance of welfare economics in the pricing system is that it goes beyond accounting for private costs but also include social costs also (Goss & Stevens, 2001).

Marginal cost pricing is supported because of its potential to increase economic welfare. Marginal cost is the change in total cost that arises with a unit change in the activity level. (Goss & Stevens, 2001) Ports have substantial fixed costs and marginal costs can be arguably low, therefore causing differing views surrounding the use of marginal cost pricing. Some authors argue that port prices should be based on short-run marginal costs. The short-term marginal cost pricing advocates that short-run marginal cost indicates the precise difference in costs between acceptance and refusal of the additional user. Also, short term marginal cost pricing sound plausible on economic allocation perspective but practically, it would make port charges vary strongly over time making port charges unpredictable. An alternative is the use of average short run costs. The average short run cost in certain conditions can be estimated by the long run marginal costs (Meersman et al., 2003). Haralambides et al., (2001) asserts that with assumption of certain conditions being made, long-run marginal cost pricing is the most efficient pricing method.

Theoretically the use of marginal cost as a pricing method is sound but practical application is hard. Bennathan and Walters (1979) as cited from Meersman et al., (2003) qualify this argument to a certain extent by saying that setting port prices to be equal to marginal costs can only be best applied in a perfectly competitive and free economy or in an efficient socialist economy (Meersman et al., 2003). These kinds of economies hardly exist in the current economic environment. A report issued by Academic Expert Group (AEG) to the European Commission argued that in ports, particularly those operating in a competitive environment, marginal cost pricing is not so straightforward whereas full cost recovery, in combination with the user pays principle, can form a workable basis for fair and efficient

pricing. (Haralambides H. , 2000) There is still no consensus on the issue and empirical research would serve to clear the issue and there is still research still being written on the matter.

2.2. Financial pricing approach

Port management using the financial pricing approach reasonably focus on the responsibility of concentrating in producing good financial results each year with limited appreciation of other objectives it can pursue. The main objective of a port using financial approach to port pricing is concerned with returns that it can get on its investment. There is not much literature on this approach to pricing. This could be because many researchers advocate that the economic approach, the implementation of marginal cost pricing is the main requirement towards efficient port pricing (Haralambides, Verbeke, Musso, & Bennachio, 2001). The port may also focus on wanting to achieve a certain objective and not explicitly refer to it as wanting to increase its financial returns. For example the port can advertise that it wants to increase throughput, whereas the end results that it actually wants is better returns on its investment.

There is also a school of thought on the port pricing subject that suggest that the point of departure to port pricing management is to start from the heterogeneous nature of ports which incorporates all its market players and their possible conflicting objectives (Meersman, Vanelslander, & van de Voorde, 2003). For example ports want to maximise their throughput, realise return on their investment. The port user on the other hand wants quality service, quick turnaround and a transparent charging system.

2.3. Strategic pricing

Strategic port pricing is based on the premise that port charges are linked to the port strategic objectives. This simply means that pricing can be a very useful tool in achieving the objectives and targets of a strategic plan of a port. The principle of this model is that the cargo and users elasticity to demand of the port services is different with different prices. Strategic pricing plans are made up of specific strategies such as investment in facilities and equipment; improvements in operational efficiency, market-oriented pricing or promotion of the port or specific services. For example a port that has an objective of promoting economic development could be priced to favour exports over imports (Acciaro, 2013). Van Niekerk

(2004) also argues that specific objectives of the ports should ascertain the structure and level of the tariffs.

One of the important factors to port pricing is the degree of market power that the port has on its users. An analysis on the relationship between price level implementation and port model revealed that when an oligopoly model is applied, landlord ports yield the highest profit for the port authorities and highest price for the port users. This is partly because of the complementarity of the port authority and the port service providers where each ignores the effects of their mark-up on the port user. Ports operating in competitive environment however result in efficiency gains and substantially lower port charges (Meersman et al., 2003). The South African ports system is characterised as having some level monopolistic power as there is only one port authority. The degree of market power in such a ports system can lead to inefficiencies if not properly managed.

Increasing competition in between ports and competition between modes of transport has led to other ports to maintain the traditional method of negotiating tariffs with shipping lines in accordance with service agreements based on for example the number of ship calls, loading and discharge volume, etc. In these instances marginal costs can be used as a ceiling or the floor price (Bichou, 2009).

2.4. Port pricing in practice

There is substantial theoretical work that has been developed around port pricing but there is limited empirical research available on the application of actual pricing strategies in individual or regional ports. Methodologically, most papers that have been written on port pricing utilise conceptual economic models and game theory. According to Acciaro the scarcity in empirical research on this topic is due to the confidential classification of pricing information by ports and also due to difficulty of obtaining reliable port data (Acciaro, 2013). Furthermore, in some cases port charges and data are confidential and difficult to obtain. It is therefore worth noting that there are significant research opportunities on the topic. On the few studies available, the port charges structure is analysed but there is no information on how each port determines its price level. The report from the Economic and Social Commission of Asia and the Pacific (ESCAP) region outlines that the model tariff structure was developed and shared to provide a common framework for the presentation of port

prices. However, the task of actually determining prices within the structure was left to the decision of individual ports. Information on how each of these countries and ports do the determination process is not publicly available (ESCAP, 2002).

In Europe, port pricing has attracted a substantial amount of research studies in order to explore an application of harmonised approach to the substantial differences in the funding and pricing methods being employed; because the varied legal, cultural, port management style traditions (Meersman et al., 2003). For South Africa, as highlighted in the previous chapter there has been some amount of changes in the methodology of port pricing in the years which have been based on the governance and management structure of the port system. There is however no publicly available record of the determination process of such methodologies prior to 2009. Since 2009, when the ports regulator started operation, the tariff determination process is publicly available and public participation is required in the process. Chasomeris (2002) highlighted that South Africa has substantial challenges in addressing terms of improving overall port performance and port pricing; and the areas that still require attention include the limited level of competition in the ports and the inefficient pricing system (Chasomeris, 2002).

2.5. Conclusion

It is generally accepted to port managers and those who fund ports that port price should be cost-related, although there is no clear guideline on which cost base should be used; that prices should allow for cost recovery and should also meet certain objectives that are specific to a port under discussion. It is clear though that any port pricing system and price determination process should have a clear relationship between port facilities and users. It should also be kept in mind that the price a port user has to pay is his cost, which will in turn determine his own pricing behaviour (Meersman et al., 2003). The best port pricing approach would incorporate the heterogeneous nature of ports because of the diversity in terms structure, scope and type of operations; and taking into account the different market players, with different possibly conflicting interests and objectives. There is limited information to provide answers on the overarching question of whether, and how, an efficient pricing system can be implemented in practice in the port sector. There is also no visible attention on developing the strategic port pricing approach into application in port pricing models.

The next chapters set to investigates port pricing development of the South African ports system. The methodology to analysing the objectives of the study is discussed in the next chapter.

Chapter 3: Research Methodology

3.1. Introduction

This study uses both qualitative and quantitative research methodologies. As it tools, it uses secondary data analysis and also a regression analysis. Secondary data analysis will involve an analysis of an existing dataset regarding port pricing in South Africa collected from various sources which include the Transnet National Ports Authority, the Ports Regulator of South Africa and other industry bodies and will also include book and journal articles. Regression is the process of describing and evaluating the relationship between given variable and one or more other variables. It is basically an effort to describe movements in one variable with reference to movements of the other variable (Brooks, 2008). The regression analysis is to be conducted using the classical linear regression model (CLRM) using EViews statistical software.

One of the objectives of this thesis is to test the responsiveness of the port users to the price changes therefore highlighting how future price changes can influence the South African transport system and economic growth. The model to test this relationship is outlined below. The focus will then shift to the current port pricing system and secondary sources will be used for this analysis. The alternative pricing approach suggestion will be explored using secondary data sources.

The responsiveness of the port users to the price changes is to be analysed using the price elasticity of demand theory. Price elasticity of demand is defined as the percentage change in quantity demanded with respect to a one percent change in the price. Price elasticity therefore measures the responsiveness of quantity demanded to changes in price. Price elasticity greater than one is termed price elastic. Price elasticity of one is called unit elastic and price elasticity less than one is called price inelastic. For a price elastic commodity, small

increments in price cause a significant change in volume while a price inelastic commodity, changes in price affect volume movements marginally (Mankiw, 2011). Price elasticity is given by the following formula:

$$\epsilon = \frac{\%\Delta Q}{\%\Delta P} = \frac{\partial Q}{\partial P} \cdot \frac{P}{Q} \qquad (1)$$

Where: ϵ is the price elasticity, P is the price, and Q is the quantity

3.2. Data

The data used in this research thesis is obtained from the TNPA website (TNPA, 2014). The data is for all the South African ports. There are five main commodities that are transported through South African ports, dry bulk, liquid bulk, break-bulk, automobiles and containers. Data was only available for the dry bulk, break-bulk and container cargo therefore the analysis is going to focus on these three cargo types. The study will consider imports and exports of the three cargo types separately. The period of analysis is from December 2007 to June 2014. Two variables are to be considered for each commodity group, the volume and the cargo dues charged on the commodities passing through the ports. The data contains the volume of traffic of the import and export commodities, measured in metric tons. It also includes the price levied as cargo dues on the commodities all ports per ton in the case of dry bulk and break-bulk and per container for containerised commodities. Monthly intervals of data were used.

Cargo dues only change in April annually, therefore annual data observations could be done to capture the annual changes but the data for the cargo dues prices prior to December 2007 could not be sourced. Therefore using annual data could yield too few observations for any sound analysis. Since the analysis will be to test volume changes against changes in port charges, it seemed appropriate to use cargo dues as a port price indicator. Using vessel related analysis would have proved unrealistic as some vessels do not call into port for cargo related activities but may call for bunkers or repairs and these are not differentiated on the ports authority statistical portal. Price elasticity for volumes of cargo throughput can be affected by various other factors other than port charges including economic climate, trade policies, the weather. For the purposes of this study, all other factors are assumed to be constant.

3.3. Model and variables

The classical linear regression model (CLRM) is to be used to conduct the analysis. The CRLM explains the value of a dependent variable (Q) in terms of a set of explanatory variable (P) in and an unobservable random variable (ε):

$$Q = \alpha + \beta P + \varepsilon \quad (2)$$

Five assumptions are made for the CLRM in order to show that the ordinary least squares (OLS) estimation technique has the appropriate properties and for the hypothesis tests of the coefficient estimates to be validly be conducted will be tested below. The first assumption is that the average of the errors is zero. Including an intercept (α) in a regression equation ensures that this assumption is not violated. The second assumption is that the variance of errors (ε) is constant. This assumption is called homoscedasticity. The third assumption is that the CLRM the covariance between disturbance terms over time is zero. Simply, it is assumed that the error terms are not correlated with each other, known as autocorrelation. The fourth assumption is that the independent variables are non-stochastic. Each regression equation to be estimated it to contain only one explanatory variable therefore there is no need to conduct a test on this assumption. The fifth assumption is that the disturbance errors are normally distributed. Log-returns of the volume variables and price variables were used in order to estimate the equations using EViews statistic software. The regression equation is presented as by follows:

$$lnQ = \alpha + \beta \cdot lnP + \varepsilon \quad (3)$$

where: *Q* and *P* are defined as before, *a* and *b* are parameters to be estimated using the regression.

The stationarity of a series can influence the properties leading to false regressions. If the variables of the regression are not stationary then the standard assumptions of asymptotic analysis will not be valid, meaning that the "t-ratios" will not follow a t-distribution. The unit root test was used to test the following null hypothesis (H_0) that the series contains a unit root against the alternative (H_1) that the series is stationary (Brooks, 2008).

The twelve variables were tested for stationarity and table 3 below presents the results. It shows that the break-bulk imports variable is stationery. The break-bulk exports, bulk imports, bulk exports, container imports and container exports variables are also stationary. The break-bulk imports cargo dues variable contains a unit root and is therefore not

stationery. The break-bulk exports cargo dues variable, bulk imports cargo dues, container imports cargo dues variable, and container exports variables are not stationary. Variables that contained a unit root were converted to first difference and the container exports cargo dues and container exports cargo dues variable became stationary. The four remaining four variables had to be converted into second difference to become stationary.

Table 2: Stationarity Test Results.

Variable	Augmented Dickey-Fuller test	Probability
Break Bulk Imports	Test statistic: - 6.498062 Critical values: 1% level: - 4.080021 5% level: - 3.468459 10% level: - 3.161067	0.000
Break Bulk Exports	test statistic: - 5.601081 Critical values: 1% level: -4.080021 5% level: -3.468459 10% level: -3.161067	0.001
Bulk Imports	test statistic: - 6.902930 Test critical values: 1% level: -4.081666 5% level: -3.469235 10% level: -3.161518	0.000
Bulk Exports	Augmented Dickey-Fuller test statistic: - 8.198245 Test critical values: 1% level: -4.080021 5% level: -3.468459 10% level: -3.161067	0.000
Container Imports	Augmented Dickey-Fuller test statistic: - 6.510490 Test critical values: 1% level: -4.080021 5% level: -3.468459 10% level: -3.161067	0.000
Container Exports	Augmented Dickey-Fuller test statistic: - 14.75621 Test critical values: 1% level: -4.080021 5% level: -3.468459 10% level: -3.161067	0.001
Break Bulk Imports Cargo Dues	Augmented Dickey-Fuller test statistic: - 2.940165 Test critical values: 1% level: -4.080021 5% level: -3.468459 10% level: -3.161067	0.1560
Break Bulk Exports Cargo Dues	Augmented Dickey-Fuller test statistic: - 2.939441 Test critical values: 1% level: -4.080021 5% level: -3.468459 10% level: -3.161067	0.1562
Bulk Imports Cargo Dues	Augmented Dickey-Fuller test statistic: -	0.1490

	2.964029 Test critical values 1% level: -4.080021 5% level: -3.468459 10% level: -3.161067	
Bulk Exports Cargo Dues	Augmented Dickey-Fuller test statistic: -2.940740 Test critical values: 1% level: -4.080021 5% level: -3.468459 10% level: -3.161067	0.1558
Container Imports Cargo Dues	Augmented Dickey-Fuller test statistic: -1.786169 Test critical values: 1% level: -4.080021 5% level: -3.468459 10% level: -3.161067	0.7021
Container Exports Cargo Dues	**Test statistic**: - 1.589837 **Test critical values:** 1% level: -4.080021 5% level: -3.468459 10% level: -3.161067	0.7882

After the stationary test and variables were corrected for stationarity, a regression with the volume of each cargo group being the dependent variable and the cargo dues charge as the independent variable was conducted and the results are presented in table 3 below. The regression probability shows that there is no correlation between break-bulk imports and break-bulk cargo dues at all levels of significance. The t-statistic and probability computations also show that there is no statistically significant relationship between break-bulk exports and break-bulk export cargo dues. There is also no significant relationship between bulk volumes, both imports and exports with their respective cargo dues. Container exports and imports have no significant relationship with their respective cargo dues. Diagnostic tests are then conducted to test the five assumptions of the CLRM.

Table 3: First Regression Coefficient Results

	α	**β**	**R-Squared**
Break-Bulk Imports	12.86817 (295.2047) {0.0000}	-1.846682 (-0.921538) { 0.3597}	0.011196
Break-Bulk Exports	13.47953 (403.0734) {0.0000}	0.971058 (0.631646) {0.4878}	0.005292
Bulk Imports	15.11168 (701.5879) {0.0000}	0.690839 (0.697313) {0.4537}	0.006442
Bulk Exports	16.26623	0.608912	0.011102

	(1127.545) {0.0000}	(0.917604) {0.3618}	
Container Imports	12.05829 (781.7480) {0.0000}	-1.002398 (-1.508505) {0.1356}	0.029071
Container Exports	12.04692 (767.2300) {0.0000}	-0.369867 (-1.550977) {0.1251}	0.030681

Key: () - T-Statistic {} – Probability

Table 4 shows the results of diagnostic tests. The White test was used to examine whether the regression equations were homoscedastic. The F-statistic and Chi-squared statistics shows that all the regression are homoscedastic. The autocorrelation was tested using the Breusch-Godfrey test; only the regression for break-bulk imports had no autocorrelation. The Newey-West approach was used to correct the autocorrelation in the regression residuals. The Jarque-Bera normality test was conducted. The results show that the residuals are normally distributed.

The Ramsey RESET test was conducted to examine whether the relationship of the dependent variable in each equation and the explanatory variables is linear or not. The linearity results are presented in table 4. In all the regressions, the t-statistic and F-statistic indicate that the variables have a linear relationship with each other.

Table 4: Regression Diagnostic Tests.

	Homoscedasticity	**Autocorrelation**	**Normality**	**Linearity**
Bulk Imports	(0.4673) {0.4607}	(0.0000) {0.0000}	(12.90235) {0.001579}	0.5887
Bulk Exports	(0.3608) {0.3543}	(0.0012) {0.0016}	(84.06894) {0.000000}	0.6975
Break Bulk Imports	(0.3261) {0.3197}	(0.3762) {0.3615}	(4.856533) {0.088190}	0.4891
Break Bulk Exports	(0.6101) {0.6044}	(0.0000) {0.0000}	(3.306262) {0.191450}	0.4877
Container Imports	(0.5003) {0.4939}	(0.0000) {0.0000}	(3.606717) {0.164745}	0.7167
Container Exports	(0.5839) {0.5781}	(0.0001) {0.0001}	(10.31171) {0.057660}	0.3559
Key	() F- Statistic {} Chi-squared statistic	() : F- Prob. {} Chi-Square Prob.	() – Jarque-Bera {} - Probability	t-statistic and F-statistic

After all the diagnosis tests were conducted and all the assumptions of the CLRM were fulfilled. The results of the regressions are presented in table 5. There is no significant relationship between break-bulk imports and break-bulk cargo dues. There is no correlation between break-bulk exports and its cargo dues. There is also no significant relationship between bulk imports and bulk import cargo dues. The bulk exports volume changes and bulk exports cargo dues do not have a statistically significant relationship. Container exports have a significant negative relationship with container exports cargo dues. Container exports are negatively correlated to container cargo dues.

Table 5: Regression results after correction from diagnosis tests.

	α	**β**	**R-Squared**
Break-Bulk Imports	12.86817 172.9699 0.0000	-1.846682 -1.347538 0.1819	0.011196
Break-Bulk Exports	13.47953 297.2035 0.0000	0.971058 1.155593 0.2515	0.005292
Bulk Imports	15.11168 (701.5879) {0.0000}	0.690839 (0.697313) {0.4537}	0.006442
Bulk Exports	16.26623 1127.545 0.0000	0.608912 0.917604 0.3618	0.011102
Container Imports	12.05829 503.6639 0.0000	-1.002398 -2.120072 0.0373	0.029071
Container Exports	12.04692 516.7375 0.0000	-0.369867 -4.139269 0.0001	0.030681

3.4. Conclusion

This chapter presented the tools to be used in answering the main objectives of this research paper. Secondary data sources analysis and regression results to answer the objectives of the thesis. The model for calculating the elasticity of demand for port services was presented and tests were conducted to ensure that the results that will be obtained are statistically sound. The results of the regression estimates show relatively low R-squared, this is because of the decision to include only one explanatory variable to be analysed, this was due to data constrains. The results of the CLRM are going to be used to form an analysis of the responsiveness of the trade volumes passing through the ports to pricing methods of the port. Port price sensitivity of volumes can serve as a basis for the ports authority to devise port

prices that are differentiated according to commodity type and trade direction given their relative sensitivity.

Chapter 4: Research Analysis

4.1. Introduction

It is industry accepted that efficient port prices should be implemented. Devising a method of attaining these efficient price levels is left to each one to figure out because there is no one solution to this determination. The method used to price port services depends on many factors; these include the sources of funding, the structure and management of the port, regulation and the elasticity of demand for port services (Haralambides & Veenstra, 2002). This section serves to investigate how the South African ports system uses and can use its elements in attaining efficient port prices. The first section will discuss the elasticity of demand for port services by analysing the results of estimation of the CLRM. This will be followed by an analysis of the method employed by the port management under the guidance of the ports regulator in determining the port price levels.

4.2. The price elasticity of demand for port services

The South African ports transport a wide range of commodities and the main cargo types are dry bulk, liquid bulk, break-bulk, automobiles and containers. The analysis only focuses on the dry bulk, break-bulk and containers as data to conduct analysis for the automobiles and liquid bulk could not be sourced. The hypothesis is that South African trade volumes through the ports are price inelastic. The hypothesis is based on the notion that the degree of price elasticity of demand is determined by the availability of alternatives or substitutes and whether the good is a luxury or a need. There is a limitation in substitute port service being available as all commercial ports on the South African coastline are owned and controlled by the same port authority. Neighbouring country ports are far from the industrial centres that would benefit from having alternative port service. Secondly, trade needs the maritime transport service because of the economies of scale that this transport mode provides in comparison to other transport modes. The geographical location of South Africa in relation to

its trading partners also supports the use of maritime transport in relation to other modes. This therefore leads to the belief that port users do not change their trading behaviour in relation to port price changes.

The CLRM results revealed that, other things remaining constant there is no significant relationship between dry bulk import and exports passing through the port with port charges. It also revealed that there is no statistically significant relationship between break-bulk imports and exports with their respective port prices, other things remaining constant. Container exports and container imports have a significant negative relationship with port prices, ceteris paribus. A 1% increase in container imports cargo dues will lead to a 1% decrease in import containers (as shown in table 5), other things remaining the same. The estimated elasticity is slightly above 1 in absolute value, therefore if can be inferred that demand for container imports is relatively unit elastic. An increase of 1% of cargo dues will lead to a 0.37% reduction in container export volumes, other things being equal. The elasticity for container exports is less than 1 therefore container exports are price inelastic.
The findings are contrary to Suykens and Van de Voorde (1998) who argue that the overall demand for port services is inelastic but port specific demand elasticity is high (Meersman et al., 2002). Haralambides (2002) revealed that in Europe there is high sensitivity of demand for port services to changes in prices. For example, the study measured how much change in container volumes would result if the dredging costs were to be recovered from user charges for the port of Hamburg. It was discovered that a price increase of 10 Euros (about 5%) to its terminal handling charges per TEU would lead to a 15.3% (about half a million TEU) reduction in container traffic (Haralambides, 2002) The overall effect of increases in port prices leads to loss in consumer surplus and to some extent can be passed on to society consumers. This is because of roll-on effects that increases in port prices could have to the logistics supply chains and to the final consumer. The difference in these results may be because of the difference in competition levels between these two regions. Europe is characterised with port price changes forming a major consideration to port management in making decisions for its customers. Ports that are leaders in pricing and performance measures around the world are located in regions characterised by a high degree of port competition (NEDLAC, 2007).

In order to protect the interest of the port users with demand elasticity as shown for containers can be gained through competition or regulation. South Africa has very limited

exposure to port competition; this includes both intra-port and inter-port competition. Inter-port completion refers to competition between ports and intra-port completion refers to completion between terminals or service providers within the same port. Inter-port competition is constrained because TNPA is the only legally recognised port owner and employs a complementary system in terms types of cargo being handled by each port. Regulation, through the introduction of the office of the ports regulator can only provide relief based on market and academic research which does have limitations but a change in competition structure can yield more efficient results.

The non-significance of the relationship between dry bulk and break bulk cargo to changes in port price, and also the low R-squared value given by the models is an indication that there are other significant factors that drive the demand for goods passing through the ports. As a trade facilitator ports should ensure that it does not create trade barriers.

4.3. Port pricing determination

In order for the port authority to make changes to the port charges the port authority must submit its proposal for changes to the ports regulator for approval. The port authority uses the required revenue method to motivate its application for the tariff changes. The ports authority filed its first tariff application in September 2009 for the implementation from financial year 2010/2011. The financial year of the ports authority starts on 1 April and ends 31 March (TNPA, 2009). Five tariff applications have been made to date. Since the tariff determination process was introduced there have been significant differences between what the ports authority proposes and what gets granted by the Ports Regulator. This chapter examines the benefits and limitations of currently applied revenue requirement model by investigating each of the model elements.

Table 3 shows the port authority tariff changes proposals and the actual increases allowed by the ports regulator for all the financial years to date. In the 2010/2011 financial year the TNPA requested a 10.62% increase but the ports regulator approved only 4.42%, which is less than even half the percentage increase requested. In financial year 2011/2012 an 11.91% increase was proposed but only 4.49% was allowed which is still a significant variance. In the financial year 2012/2013 an 18.06% increase was requested, but the ports regulator approved a 2.76% increase. In the financial year 2013/2014 a 5.4 % increment was tabled to the

regulator, but for the first time, a reduction in cargo dues was given as ruling by the ports regulator, with reductions of up to 43.2% for container exports. This was a substantial development because it also indicated that when the proposal was reviewed the ports regulator took time to also consider commodity related implication to the port pricing. In the financial year 2014/2015 the ports authority requested a 14.39 increase but 5.95 was approved for all cargo dues and an 8.15% increase for some bulk cargo commodities and marine services. The variance of the proposed increases and the allowed is because of the contradictory treatments application of the revenue requirement components.

Table 6: The TNPA proposed port tariff and Ports Regulator.

Year	**Proposed Tariff change by the Ports Authority**	**Actual Tariff Change Allowed by the Ports Regulator**
Financial year 2010/2011	10.62% increase	4.42% increase
Financial year 2011/2012	11.91% increase	4.49% increase
Financial year 2012/2013	18.06% increase	2.76% increase
Financial year 2013/2014	5.4% increase	Cargo dues tariffs reduction as follows: Container exports - reduced by 43.2%; Container import cargo - reduced by 14.3% Motor vehicles (Ro-Ro)export - reduced by 21.1% The remainder of the tariffs in the tariff book retained at the same level as for the 2012/2013 tariff year
Financial year 2014/2015	14.39% increase	All cargo dues to increase by 5.9% expect: • 8.15% tariff increase in Dry Bulk Cargo Dues for Coal, Iron Ore and Manganese • 8.15 % tariff increase on all Marine Services and related tariffs

Source: Author compiled using data from Transnet National Ports Authority Tariff applications 2010 -2015 and the Ports Regulator of South Africa Record of Decision 2010 – 2015.

The revenue requirement is then converted into tariffs, which are presented in the form of a detailed tariff book in the format as outlined in table 8 as will be discussed later.

5.2. Revenue Requirement

The revenue requirement is estimated using the following formula (TNPA, 2013b):
Revenue Requirement = Regulatory Asset Base ("RAB") x Weighted Average Cost of Capital (WACC) + Operating cost + Depreciation + Taxation Expense – (+) Claw Back + (-) Excessive Tariff Increase Margin Credit (ETIMC) (4)

4.3.1. Regulatory Asset Base ("RAB")

The Regulatory Asset Base (RAB) reflects the total value of the assets of TNPA. This is the most important element as it accounts for 55% of the revenue requirement (TNPA, 2012a). The main components of RAB are fixed assets, capital work-in-progress and the working capital. Fixed assets are made up of the real estate business assets which are rented out to external operators for limited period use and marine business assets. Capital work-in-progress consists of assets that are not yet used for users' benefits. The last element of the RAB, working capital, consists of inventories that are used to maintain port facilities; plus trade receivables and operating cash; less trade payables which include operating costs and capital expenditure (CAPEX).

There are many methods available for valuing assets and are used in different ways to fulfil certain objectives and circumstances. According to Foster and Antmann (2004) it is not unusual to find about 2:1 variances in between asset valuation methodologies. This suggests that a substantial amount of skill needs to be employed in deciding on the valuation method given the impact that it has on the overall tariff. There are two main approaches to evaluating assets, the economic value approach and replacement cost based approach. The economic value approach determines the asset value based on its capacity to generate cash. The replacement cost based approach refers to the value of the asset in relation to the cost of buying the asset at its historic cost or at a cost that is adjusted to price changes that have materialised to the lifetime of the asset. It can also include the effects of inflation, depreciation and changes in technology (Foster & Antmann, 2004). TNPA uses the Depreciated Optimised Replacement Cost (DORC) which is founded on replacement cost approach (TNPA, 2013a). The DORC individually calculates the cost of asset replacement

based on the age of the asset and the established depreciation schedule of the asset. The way TNPA applies the DORC method needs to be revisited because some of the assets were inherited by TNPA at low or no cost at all from the government but the authority charges its users full market value of these assets, whereas only the costs of maintenance and operation should be considered (MOGS, 2013).

As discussed in Chapter 1, TNPA is part of the freight group Transnet Ltd. consisting of the container terminals operator, Transnet Port Terminals (TPT) and rail service provider, Transnet Freight Rail (TFR). The ports authority is consequently a landlord to its sister company which sometimes affords TPT and TFR special treatment than other operators. Some assets within the port precinct that belong to the TFR and TPT have been included in the asset base. An example of this is the inclusion of the Durban Bayhead shunting yard which is exclusively utilised by TFR and is calculated on the ports authority asset base. TFR also does not pay any rent towards utilising this facility because the ports authority argues that as a landlord it should provide access to its facilities (NPCC, 2013). This would hold if this was public access but it is being exclusively used by one operator and the user pays principle is dishonoured as all the port users have to pay for these assets.

The main drawback with the inclusion of the work-in-progress capital in the regulatory asset base is that the user does not derive benefit from the incomplete facilities, therefore violating the main requirements of the "user-pays principle" that the pricing system is based on. TNPA selects to include work-in-progress in the RAB value at the value that they possess during the pricing calculations in order to avoid significant increases in RAB that would result if the assets are bought in once commissioned. TNPA also argues that construction can take from 24 to 36 months to build tying-in capital and port facilities (TNPA, 2012a). In the formula, there is provision to accommodate momentous revenue requirement increases through the Excessive Tariff Increase Margin Credit (ETIMC) there is no reason to include work-in-progress capital to avoid significant increases. Practically also, the work-in-progress would not really reflect its true value as for example it takes about 6 months for the tariff determination process for each year to be conducted, the value of the work-in-progress could have changed dramatically in that time period although this would make no difference to the user as he would still be not deriving benefits from these assets. The work-in-progress assets should be included on the RAB once these assets have been commissioned.

The work-in-progress capital inclusion may have significant price consequences for the port user. An example of this would be when the ports authority purchased land that would be developed into a port, the acquisition of the Durban International Airport site. This caused an increment to the RAB by 1, 8 billion rands (about $1, 8 million) which had an impact in the percentage increase proposed by the ports authority (TNPA, 2012c). The Ports Regulator however ruled that this amount should not form part of the asset base calculation as no port user would be deriving any benefit from the purchase until it has become an actual port (Ports Regulator of South Africa, 2013).The user pays principle is also violated by the inclusion and calculation of assets (RAB) of all the ports into one. This means that asset base upgrades that are done in one port are paid by all the port users who may have benefited from the upgrade or not.

CAPEX is calculated based on forecasts calculations of the trade volume growth. The main commodities that are handled by the South African ports are coal, iron ore, containers, automotive, steel, fruit, ferrochrome, petroleum products and manganese. Trade volumes of these commodities are not only affected by the domestic economic climate but are also threatened by the global economic challenges. The port authority gathers cargo volume and vessel forecasts primarily from terminal operators and shipping lines and these are used for the ports authority future revenue expectations (TNPA, 2013a). Since the applications to review are done in August, it may be helpful to consider the actual volumes that the ports authority is handling for that particular year as it will provide a more realist picture than just budgeted or envisaged volumes because the trading environment changes. The capital expenditure projections should also include analysis information regarding the impact that each project will have on throughput, efficiency performance and future investment patterns.

4.3.2. Weighted Average Cost of Capital (WACC)

The cost of capital reflects the return that the port authority must gain in order to compensate the investors on the risk that they take in employing their funds on the business (TNPA, 2012a). WACC incorporates all sources of funding and also takes into account the gearing of debt and equity within the organisation. The vanilla WACC is used and is calculated using the following formula:

$$WACC = K_e(1- g) + k_{d*}g \quad (5)$$

Where: K_e – post-tax cost of equity; k_d - TNPA estimated pre-tax cost of debt; g- TNPA gearing

A post-tax cost of equity and pre-tax cost of debt is observed in WACC calculation. Since debt is a tax deductible expense and equity is taxable, an allowance, through an addition of tax expense to the revenue requirement equation needs to be made (discussed in 4.3.4 below).

K_e – (Cost of Equity) = R_f (Risk free rate) + β * MRP (market risk premium) (6)

The cost of equity is calculated using the Capital Asset Pricing Model (CAPM) which is given by the tax-free risk-free rate; plus the product of Beta (β) and the market risk premium (MRP). The South African Reserve Bank ("SARB") bonds with over 10 years maturities are used for the risk-free rate. By default, the MRP is a forward-looking concept and cannot be observed but should be estimated by analysing excess returns on the market over a long period interval. There are two approaches used to estimate MRP, the theoretical or prospective approach which both have their own limitations. The historical approach compares the historical returns on equities with returns on risk free assets government bonds and Treasury bills. It based on actual data which is plausible but the main drawback is that economic conditions, inflation, interest rates and market trends change over time and may lend the historical estimates inappropriate. MRP is sensitive to the choice of measurement period, the averaging approach and risk free rate used making estimation results for MRP to vary considerably. Recent historical approach studies calculate the MRP to be between 5% and 8%. Prospective approach is based on expectations of academic, investors and managers of returns through either surveys or an implied premium approach. Prospective MRP ranges between 6% and 8% (Deloitte, 2014).

In order to calculate MRP, the port authority proposed to use the historical Dimson, Marsh and Staunton (DMS) approach. The DMS is an annually published dataset of 23 countries (including South Africa) annual risk estimates using returns from the year 1900. The main advantage of the DMS is that its values are generally stable over time from year to year. An arithmetic mean, which measures the average of the annual returns for the period under consideration, would then be applied. After that the excess market returns are obtained by removing the risk free rate as given by bonds. The ports regulator on its 2012/13 record of decision however suggested for the historic returns observed in the past 75 years by the

Johannesburg Stock Exchange (JSE) to be used (TNPA, 2012b). The JSE returns yield a lower MRP than the DMS approach.

Beta (β) is to measure the non-diversifiable risk for an individual company, compared with the market as a whole. It measures how the company returns are correlated with the market returns. If the beta is greater than one, the security is more volatile than the market average. A beta less than 1 indicates that the risk is lower than the average of the market. TNPA is not a listed company and it is therefore difficult to obtain beta from trading data and the comparator approach is used instead. For the purposes of estimating beta, TNPA firstly proposed to use 11 port companies as comparator firms. The appropriate use as proxies to beta calculation was questioned and the authority changed and is now using the Johannesburg Stock Exchange (JSE) Top 40 companies for this calculation. The JSE Top 40 companies were selected because these companies are active both in the domestic and international market and seen as a close enough reflector of the business risk that the ports operate under. The 5-year average equity beta of these JSE Top 40 companies is then used as it provides with avoids the short term shocks and also avoids long term obsolete trends (TNPA, 2013a). The competitive environments that the port authority and the JSE Top 40 companies operate are different and therefore are not subjected to the similar risks. Firstly the Top 40 companies are constantly subjected to competition and they need to strive to gain their competitive edge both in the national and international arena. The port authority on the other hand is a regulated operator holding a monopoly for its services.

Cost of debt is the amount of cost incurred by the business in compensating its creditors. As highlighted above, TNPA is a subsidiary of its parent company, Transnet Ltd, is not able to detect its optimal capital structure directly and does not observe its own cost of debt (TNPA, 2012a). The cost of debt of TNPA then given by the average embedded cost of debt of its parent company. This also highlights the inherent complication that the freight logistics conglomerate structure brings to the port pricing topic. Given its financial position, TNPA as an individual entity may be able to get loans at a lower rate than Transnet. Company structure change of the authority and Transnet Ltd would bring significant changes to the process.

4.3.3 Operating expenses

The operational expenses are based on the forecast of costs for the tariff period under consideration. These include costs incurred by the port authority and some overheads incurred for the parent company (TNPA, 2013a). There is no available explanation on how the costs are apportioned in between the subsidiaries towards the upkeep of the parent company. As shown in table 7 in the financial year 2011/12 Transnet accounted for 9.96% of TNPA actual total operating costs. In 2012/13 it accounted for 11.8% and 10.94% in 2013/14 TNPA actual operating costs. Another cause of concern is the amount that TNPA budgets for Transnet costs which have an impact on the revenue requirement. The budget for 2012/13 was 93% more than the actual amount of operating costs in 2011/12 and accounted for 14.96% of the operating expenses that were included in the revenue requirement proposal in 2012/13. In 2013/2014 the Transnet overheads costs were 15.58% of operating costs on the revenue requirement.

Under the revenue requirement method, there is no incentive for the port authority to control its operating costs. An increase in operating costs is translated to higher revenue requirement rather than a decrease in its profit. These uncontrolled operating costs saw actual operating costs of financial year 2012/13 being 3 109 million rands and increasing by 16.92% in 2013/14. The budget for the 2012/13 was 25.34% higher than actual operating costs of the previous financial year. In 2013/14 budget had a difference of 34.77 % to the previous actual operating costs.

Table 7: TNPA operating costs (*Rm-million rands)

	Actual Financial Year 2011/12 (Rm)*	**Budget Financial Year 2012/13** (Rm)	**Actual Financial Year 2012/13** (Rm)	**Budget Financial Year 2013/14** (Rm)	**Actual Financial Year 2013/14** (Rm)
TNPA Total operating cost	2 505	2 956	2 742	3 537	3 237
Transnet Group Costs	269	520	367	653	398
Group Percentage to TNPA Operating Costs	**9.69%**	**14.96%**	**11.80%**	**15.58%**	**10.94%**
Total Operating cost	2 774	3 477	3 109	4 190	3 635

Operating cost percentage increase from previous actual costs	**19.83%**	**25.34%**	**12.07%**	**34.77%**	**16.92%**

Source: Author compiled using data from Transnet National Ports Authority Tariff applications 2012 -2015

In order to address and internalise operating costs would be to use an alternative model of pricing, the Rate of Return approach. This method will require the ports regulator to determine and set a rate of return that the ports authority would have to receive, increases in the operating expenses would lower the return. Application of the rate of return also has its short comings and would need to be researched in order to be implemented. A rather simple approach to controlling the operating costs of the ports authority would be to cap the costs in relation to the Consumer Price Index (CPI) and give an additional percentage allowance to accommodate increase in activities, say about 3% (SAASOA, 2013). The South African Reserve Bank employs the inflation targeting method and CPI range is 3-6 percent, therefore operating expenses can be capped at about 10% for the following year.

Since the port authority is not a legal entity for which tax is calculated and paid, the notional tax allowance is used in order to establish the tax that the authority would have paid. With this approach two important factors are missed, organisations receive tax shied on nominal tax, not on the real tax. The assets are depreciated on a straight line basis over 40 years for the service life of each of the asset in the RAB for the tariff period being reviewed, (TNPA, 2012a). The drawback with this approach is that there is no evidence to support that the usefulness of life of the assets of the port authority are 40 years. It is also inconsistent with the method used to valuate RAB.

A claw back mechanism is to correct for differences between actual and forecast outcomes in previous tariff periods. It used in order to ensure that the port authority or the port users do not gain or lose out from inconsistencies between what is forecasted at the time of the tariff application and what is observed that may arise because of errors in information, and shocks in the system (TNPA, 2012a). This is a good way of trying to correct for the port users but the drawback is that the claw-back does not identify from which area of ports authority the claw-back is from therefore providing a blanket solution where in truth some port users would have been more disadvantaged by the process than the others. A disaggregated port

system where each port is considered individually would serve positively to resolving this matter.

The Excessive Tariff Increase Margin Credit (ETIMC) is included in the revenue requirement in order to offset against significant future tariff increases that would result from future capital expenditure programmes (TNPA, 2012a). The increasing of the ETIMC is an indication of the inefficiencies of the revenue requirement, what is plausible is that such over recoveries can be used to offset future high increase requirements. Since ETIMC is revenue collected from port users it should be presented as a separate reserve in TNPA's regulatory balance sheet and the financial return on it deducted from the revenue requirement.

4.4. Conclusion

The pricing method being utilised is an accounting pricing method and all applications have an accounting analysis behind with limited accommodation of the actual implications that might arise for the port user, and the traffic volumes implications for the port authority. There had been hard economic times since the economic crisis but there was no relief or even freezing of increases that was provided by the ports authority to support its clients.

For any given port, if it charges port users more than what they can benefit, the port user may call at an alternative port or dramatically, may stop trading using this mode of transport therefore no cargo for the port or transfer the increased costs to their consumer. South African container importers and exporters do not have economically sound alternate ports to call, ceasing to do business is rather too dramatic and the transfer of costs to the consumer is the likely outcome. This will eventually have negative effect on the economy. The South African trade volumes through the ports are price inelastic, as proven for containers highlights the importance of the ports to the economy. Therefore increasing port price levels will harm the trading competitiveness of the containers as the traders will have to absorb these costs. Whether these prices are absorbed by the transport providers or get transferred to the end customer, thus causing inflationary behaviour would be an interesting area of research that this paper does not cover.

The "one size fits all" methodology that is observed in the ports authority pricing system possess a threat to the trade, in some trades the consequence is more severe than others as

observed from the regression results. Goss and Stevens (2001) highlights that uniform tariff systems covering more than one port are still operational in countries with central port administrations like Israel (also in South Africa) and argues that the uniform tariff system should be replaced with charges that reflect the structure, level of demand and also costs of each port individually. It will serve to great benefit if the ports authority would incorporate the demand elasticity of each commodity type when port price changes are being determined. Since ports are there to serve the trade, it is worthwhile to understand and consider each trade impacts before making price adjustments.

The differences between the tariff increases applied for and the tariff increases approved by the ports regulator can be partly explained by the differences in application of how individual items in the formula are valued as discussed. There is not much reference from Regulator's Record of Decision (RODs) that allows for clear calculation and observable reconciliation of the two sets of calculations. This leads to likelihood that there may be other factors that the ports regulator takes into consideration when doing it approves the rates. These may include its own market research and consultations with industry participants and government. An example of this is the financial 2013/14 (as shown in the table 6 above) where TNPA requested for a 5.4% on all the tariffs but the ports regulator responded with a cargo differentiated price changes. One is not able to draw such differentiation from only the information that is provided by TNPA on its applications.

Chapter 5: CPV Approach for South African port pricing

5.1. Introduction

Generally, strategic planning is a process an organisation elects strategies or directions that will emphasize its strengths and pursues market opportunities whilst at the same time protecting it from threats from the market and compensates for its weaknesses. Port management is implemented in three parts: the planning and development philosophy of a port which includes its goals and objectives; the port investment criteria and policies; and the port pricing polies and techniques. Pricing is most important factor in the process of ports implementing its strategic plan. Strategic port pricing can be defined as "the use of pricing as a mechanism for achieving competitive advantage" (United Nations Commission on Trade and Development, 1995). Pricing can also be used to generate funds that are required to make investments in port infrastructure needed in order to increase port capacity and thus ease delays and reduce costs to port users waiting for access.

The South African tariff is based on four core principles namely: cost recovery, user pays principle, required revenue and competitiveness. Cost recovery principle is based on the conception that each tariff should be able to recover the costs that the ports authority incurs in providing the infrastructure and service. The user pays principle infers that each port user should contribute towards the access and right to the infrastructure and services of the port that they utilise. This means that port users pay for the facilities and services they use. The revenue requirement principle refers to the tariff methodology that can be disaggregated to each tariff in order to cover operational costs, taxation, and depreciation and for the ports authority to gain a fair return on its assets. The competitive principle refers to the consideration that the pricing system takes on common practice (TNPA, 2012a).

It is worth noting that all the ports authority principles are based on only financial basis. A method that will incorporate both financial and operational performance of the ports system will serve to benefit both the ports authority and its customers favourably as it will make the port have a competitive advantage and at the same time the port users would be receiving operative efficient service that the port can offer. Since port beneficiaries all have different goals and objectives to derive from the port infrastructure and services, it is well noted that a mechanism that will set prices in such a way that all port stakeholders may be taken into account is required. Port pricing mechanism should have three elements: cost, performance and value (UNCTAD, 1995).

This chapter analyses the Cost-Performance-Value approach as a port pricing technique that TNPA can adopt as suggested by UNCTAD (1995). The current port pricing determination being followed process is a start and should also incorporate the elements as going to be discussed below. The CPV was selected because it allows port management to achieve different sets of objectives that will benefit both the port and its users. The CPV approach also affords flexible limits to pricing. The minimum price (floor limit) that the port can accept is the extra cost that the port authority incurs in serving the port user. The ceiling or maximum limit, that the port can charge is the value that is received by the user for the provision of the service. Efficient allocation of resources can serve to increase productivity which can lower the floor, making port services cheaper to its users without incurring extra costs. The ceiling can also be raised by providing more capacity. The selection of which element is suitable element that can be used for each tariff is determined by examining the tariff structure and function of the port, the level and charging unit of a particular tariff item.

The TNPA Tariff book sets out the tariffs that the port authority charges for its service provision; these are outlined in table 8 below. The ports authority levies port charges on the vessels and cargoes. Vessel specific charges include light dues, vessel traffic services, port dues, berth dues, pilotage, tug assistance, floating crane, ship repair services and miscellaneous vessel and berthing services. Cargo related port charges are cargo dues. Something worth noting, berthing dues are charged for the provision of the berthing infrastructure and there are also berthing services charge in order to tie and untie the vessel to the berth levied per vessel. Operationally if one is to operate on a berth, the vessel has to be tied to the quay; therefore berthing dues should incorporate the service of tying and untying.

Table 8: TNPA Port Service Charges.

	Service Rendered	Application/ Charging Unit
Light dues	The provision of navigation aids to vessels along the South African coast	Raised per vessel (per gross ton) at the first port of call
Vessel Traffic Services	The provision of vessel traffic services, safety of the port environment and port control	Raised per vessel (per gross ton) at all ports
Port dues	The provision and maintenance of entrance channels, breakwaters, turning basins, navigational aids (beacons and buoys inside port limits) and maintenance dredging inside the port	Raised per vessel (per gross ton), linked to the time that the vessel remains in port
Berth dues	The provision and maintenance of repair quays and other non-cargo quay (berth) infrastructure	Raised per vessel (per gross ton), per 24-hour period
Cargo dues	To recover the cargo contribution towards the provision and maintenance of basic port infrastructure	Raised per unit of cargo, differentiated between different commodities
Pilotage	Pilotage assistance to vessels entering/leaving the port	Raised as a basic fee per service, plus per vessel (per gross ton)
Tug Assistance	Tug assistance to vessels entering/leaving the port	Raised per service, based on the size of the vessel (per gross ton)
Miscellaneous Tug/Vessel services	Tanker fire watch, firefighting and standby services	Raised per service, per hour
Berthing Services	Berthing services to tie/untie vessels at the berth	Raised per service
Running of Vessel Lines	Running of lines for vessels entering, leaving or shifting	Raised per service
Floating Crane Services	Floating crane services rendered to the vessels	Raised per service, per hour
Ship Repair Facilities	Preparation, Docking and Undocking of vessels at repair facilities	Raised per service
Dry-dock, floating dock, synchrolift and slipways	Dry-dock, floating dock and synchrolift fees	Raised per service for the use of a facility, based on the size of the vessel (per gross ton)

Source: Transnet National Ports Authority

5.2. Cost based pricing

This is a historical port pricing approach. The cost element is based on the premise that the port authority should recover the costs incurred in order to provide the facilities and services, therefore the user should pay for these costs. TNPA currently applies the cost based pricing method to all its tariff categories and the necessary changes to make that process more efficient were discussed in the previous chapter. Also, instead of using cost based pricing for all tariffs the port can only use this method to charge for pilotage, towage, berthing, and equipment hire. The other tariffs can be charged using the performance and value approach as outlined below. The key hypothesis of the CPV approach is that cost alone should not determine the level of tariffs and that is why the next section explores the application of performance and value elements to the South African port system.

5.3. Performance-based pricing

The performance approach refers to a pricing mechanism that is to promote better utilisation of port assets. This element encourages efficient behaviour of the users of port facilities which can be achieved by using the facility optimally, by taking into account both the time the facility is used and the time the users waiting in line to use it. It requires a calculation of the optimum level for the port assets and when the level of utilization is below the optimum, the tariff is decreased and the tariff is increased when the level of utilisation is above the optimum level.

One of the key concerns raised by the ports users is that the ports have low levels of performance which at the end of the day increase costs for the users. Firstly because TNPA port costs are high in comparison to other ports and also through waiting for ports service as this affects vessel operating costs through extended port stays. Comparison study done by the Ports Regulator in April 2012 on port productivity revealed that out of the benchmarked container ports, the South African Durban and Cape Town container ports had the highest port call costs and had the lowest productivity. A realisation was made that if terminal operators increase their productivity, costs incurred at the South African ports can be lower.
The current port pricing system does not have any incentive or penalty currently in place to award or reprimand efficient performance, and the user pays even though the service provision can be improved. Therefore the performance based pricing could potentially lead to port efficiency. The main performance based tariffs are berth hire, which is paid for through

berth dues as table 8 above shows and transit storage. The pricing of berth usage should encourage speedy turn-around and have high berth productivity.

In order to ensure efficient cargo clearance times, which will increase capacity and possibly throughput, transit storage pricing can be a god tool. Transit storage can apply performance based tariff by considering the characteristics of the activity. Cargo owners decide whether to take short or long term storage. Ports users who require long-term storage may want to use the port facilities as long as possible and the port need to ensure that the time allowed for cargo is sufficient for the user to collect but also not occupy space that the port could be using for accommodation of more cargoes, therefore increasing its throughput. The willingness of cargo owners to pay for transit storage depends on the costs of storing the cargo in a warehouse outside the port the double handling costs. Four parameters need to be considered when dealing with transit storage: free time, opening daily rate, rate of increase in daily charges and intervals between escalations. Transit storage pricing requires knowledge of dwell times for cargo distribution.

There should be sufficient time allowed for importers to clear and collect their cargo from the port before incurring storage costs. The temporary storage should ensure that rates are set in such a way that cargo dwell time is minimised and throughput is maximised. In order to execute this, dwell times for the distribution of cargo types should be known and well taken care of in the planning and pricing structure. Performance-based pricing can also be practical to encourage port users to apply efficient practices while using port facilities. For example, the port authority can offer rebates to ships that start to work, give or take, one-hour after berthing and by applying surcharges, or fines, to those that start after, say, three hours. The success of this method is highly dependent on the quality of assessment, operational and commercial conditions and requires careful consideration, an in depth operational information for a detailed analysis to be conducted.

5.4. Value-based pricing

The value-based pricing element is estimated through port users' willingness to pay the price that the port is charging for their services and facilities. It is basically, the port users' reaction to price changes. This is based on the notion that different users have different levels of demand and price changes their trading behaviour.

An exporter competing with many suppliers from other countries or regions will have a range of options over where to deliver their goods to at a competitive price which will be determined by the logistics costs. On the other hand an importer who competes with local producers of similar goods, other things being equal, and the sensitivity to price will depend on the delivered cost relative to the prices to the local goods. Importers and exporters therefore have to decide on which transport route to choose based on the logistics costs. Lack of alternative transport routes, like in South Africa can leave importers and exporters with no choice but to pay the higher fees or stop trading. For importers and exporters this may mean competitive advantage on price is lost. The value element suggests that port price should be structure on what the traffic can bear which can be assessed by the value that the users place on the service provision, as the results of the price elasticity analysis revealed.

In order to allocate benefits, the charges should be reflective of the user, the users' demand characteristics. Value-based tariffs can be applied on port dues on ships and on cargoes. The port dues are charged to cover the costs of acquiring and maintaining the waterside infrastructure and dredging. In South Africa, charged based on the size and the type of vessel. Cargo dues are charged in order to acquire, develop and maintain the landside infrastructure. It is important to differentiate between a pricing method that is perceived customer value and pricing based on the value of the product. The pricing system based on the value of cargo is not considered to be advantageous because the owner of expensive cargo pays more even if handling of his cargo is easier than the low cost cargo. It also requires a system to check the value of the cargo, for example, physical inspections of the cargo which can interfere with port performance. The value based element advocates for pricing to be differentiated according to their cargo types value and price sensitivity. Therefore you can have separate cargo dues for containers, dry bulk, liquid bulk, break-bulk, depending on which trade direction the cargoes are going.

5.5. Conclusion

Pricing is not about only about getting revenues but should be about better utilisation of the facilities of the port, attracting more volumes and find ways of decreasing average costs. There had been talks from the authority on including performance agreements as part of their licence agreements with port operators. When this materialises, it would be a good step in the right direction but a price performance related method would serve even a great deal in

getting the port to be efficient. Theoretically, it is easy how the performance can be recorded but the actual calculations of optimum occupancy rates are not easy to carry out for all assets, because of lack of data and the mathematics involved. However, the ports authority should thrive to incorporate such calculations in their tariff determination process.

The port pricing formula should be designed to be consistent with the objectives of the ports. The Cost, Performance, Value (CPV) is an approach where the ports can utilise in order to achieve multiple objectives within the constraints imposed by its financing requirements and the external competitive environment.

Chapter 6: Recommendations and Conclusion

The main objective of this thesis was to investigate how the South African port system can develop an efficient port pricing mechanism taking into account the environment it operates in and the objectives it serves to achieve. This chapter serves to provide recommendations and provide a conclusion to the thesis.

6.1. Recommendations

After considering the current pricing system and how the users are affected and providing an alternative solution, the most critical element to pricing in South African ports is the requirement for practical encouragement of intra-port and inter-port competition. Lack of competition within and between the national ports provides little incentive to improve management and productivity levels in the ports. One key and yet complex issue that needs to be attended to is the Transnet governance structure. Decision making of TNPA is limited to the Transnet group, TNPA decisions and policy objectives may be overlooked in order to achieve goals that are considered important for the Group or even other divisions. Decision process also is prolonged with this bureaucracy, resulting in significant delays in decision making on key investments. There is also pricing and competitive conflict of interest in having TNPA, a port landlord and TPT, a terminal operator as sister companies. In order to achieve competitive, possibly efficient results TNPA should transition into being an autonomous entity. This transition can be advantageous as clear responsibilities can be drawn and bureaucratic intervention in decision-making will be minimized. It will also afford the authority to have its financial credit and taxation system as an entity that are based on its business performance rather than decisions that are made by its parent company, making easier calculations and inferences to the revenue requirement model.

Each port should be able to decide on its own investment, operation, pricing and management of resources and improve competition. One of the key bases of the CPV approach, hence the suggestion of its application to South African ports is that it is applied to individual ports in guiding the port authority and operators, but it cannot be usefully applied by a national port authority to set a nationwide port tariff (UNCTAD, 1975). Each port has its own natural defined hinterland with specific client base and market, which defines the nature of port services and facilities that are provided, and the types of commodities that each port can handle. Therefore, each port operates and develops its own pricing system within support a defined customer base and facilities that each port possesses. The ports authority needs to adopt the "no two ports are the same" ideology into the pricing system. The blanket solution to port pricing, is not good to the ports users as the benefit derived is not the same. This will lead to a simple tariff determination process, analysed in individual port. The first suggestion would be for the complementary system to be removed and allow for competition in between ports, even if they all belong to the same port authority. This would make the user pays principle achievable.

Costs alone, especially accounting based costs should not determine the tariffs levels. Therefore a pricing method that incorporates others objectives should be considered, hence the suggested CPV approach.

6.2. Conclusion

The trading business is highly dependent on the maritime transport system, especially the container sector and therefore in order not to hurt the trade by making traders lose their competitive advantage, the national ports authority needs to employ methods that do not only pertain to their costs but also look at the port system as an instrument at the service of trade policy.

It is important that the port authority keeps in mind that the pricing method of a port should be designed to last for many years achieving not only present pricing objectives but also future ones. The ports authority needs to consider its strategic position and ensure that it does not lose its competitive advantage through inefficient pricing. In coming years as the economic climates and neighbouring ports developments can change for the better, making worthwhile for the port users to change ports of call, especially for transhipments and cargo

that goes through South African ports but are destined for neighbouring landlocked countries. There have been some manufacturers based in the Gauteng region in the past few years who have taken some of their cargo to the neighbouring port, Port of Maputo because of high cost levels and low efficiency of South African ports (NAAMSA, 2013).

Another important element is the proactive attitude that is required on the port authority part and the will to understand the port users' needs and requirements. Therefore the port authority needs to invest in analysing its customers' business and requirements in order to provide tailor made service and pricing system rather than a one size fits all solution. Port performance can serve to improve port productivity without heavy capital investment; therefore employing pricing method that applauds performance will serve positively even for future investments.

In protecting the inelastic demanders of port services, regulation will have to be intensified or competition be increased. This thesis proposed that competition should be increased. The main reason for a call for increased competition rather than regulation is that the regulator can only rely on market and academic studies determining the efficient level of costs which may or may not be accurate as they will be dependent on assumptions and theory rather than practical market operations. Competition allows for incentives for firms to strive for efficiency.

There are a number of drawbacks with the implementation of the revenue requirement model. Primary to these shortcomings is that the model provides inadequate incentives for the port management to apply effort in order to maximise efficiency because revenues are significantly linked to capital expenditure and operating expenses. Consequently this can lead to over-staffing, poor and unjustified investment decisions, inefficiency, lack of responsiveness to customer needs and result in high prices.

The disbanding of Transnet is an extreme measure that would attract some level of political and economic implications and therefore may not be feasible in the near future. But TNPA can however allow each of the eight ports to have autonomous day to day and strategic investment decisions. Port infrastructure developments are not the same for the ports and the user-pay principle is violated if the user of another port in another part of the country pays for developments that were not done to the port that they used. The tariff system is uniform for

all ports even though each port has its own unique characteristics that may give different outcomes to port prices, and even creating competitive edge for some ports. Whether or not to pursue an increase in competition is an important government policy decision which will have a major impact on the future of the freight logistics and South African economy at large.

REFERENCES

Acciaro, M. (2013). A Critical Review of Port Pricing Literature : What Role for Academic Research? *The Asian Journal of Shipping and Logistics*, 207-228.

Bichou, K. (2009). *Lloyd's Practical Shipping Guides: Port Operations, Planning and Logistics.* London: Informa Law.

Brooks, C. (2008). *Introductory Econometrics for Finance.* New York: Cambridge University Press.

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

Chasomeris, M. (2011). Port Pricing in South Africa. *European Conference on Shipping Intermodalism & Ports.* Chios, Greece.

Deloitte. (2014, September). *ICCC*. Retrieved from Discount rate for PNG Ports Corporation Limited: http://www.iccc.gov.pg

ESCAP. (2002). *Economic and Social Commission for Asia and the Pacific - Comparative Analysis of Port Tariffs.* New York: United Nations.

Foster , V., & Antmann, P. (2004, July). The Regulatory Challenge of Asset Valuation:A Case Study from the Brazilian Electricity Distribution Sector. *Energy Working Notes: Energy and Mining Sector Board - The World Bank Group*. Retrieved from http://www.iccc.gov.pg/images/Attachment_2_WACC.PDF

Goss, R. (1990). Economic Policies and Seaports - The Economic Functions of Seaports. *Maritime Policy and Management*, 207-219.

Goss, R., & Stevens, H. (2001). Marginal cost pricing in ports. *International Journal of Maritime Economics*, 128-138.

Haralambides. (2002). Competition, Excess Capacity, and the Pricing of Port Infrastructure. *International Journal of Maritime Economics*, 323-347.

Haralambides, H. (2000). *ATENCO: Analysis of the Cost Structure of the TEN-Ports.* Rotterdam: Erasmus University.

Haralambides, H. E., & Veenstra, A. W. (2002). Port Pricing. In C. Grammenos, *The Handbook of Maritime Economics and Business* (pp. 782-802). London: Informa Professional.

Haralambides, H., Verbeke, A., Musso, E., & Bennachio, M. (2001). Port Financing and Pricing in the European Union: Theory, Politics and Reality. *International Journal of Maritime Economics*, 368-386.

Meersman, E., Vanelslander, T., & van de Voorde, E. (2003). Port Pricing. Considerations on Economic Principles and Marginal Costs. *EJTIR*, 371-386.

Meersman, H., Strandenes, S., & Van de Voorde, E. (2003). Port Pricing: Principles, Structure and Models. *EJTIR*, 371-386.

Meersman, H., Van de Voorde, E., & Vanelslander, T. (2002). Port Pricing Issues:Considerations on Economic Principles, Competition and Wishful Thinking. *IMPRINT-EUROPE Thematic Network: Implementation Reform of Transport: Pricing-Identifying Mode Specific Issues.* Brussels.

MOGS. (2013). *Mining, Oil and Gas Services response to the Ports Regulator - Tariff Application 2013/14.* Retrieved from http://www.portsregulator.org/images/documents/MOGS_submission_Comments_14-15.pdf

NAAMSA. (2013). *National Association of Automobile Manufactures of South Africa response to Ports Regulator*. Retrieved from http://www.portsregulator.org/images/documents/NAAMSA_Sumission_Comments_14-15.pdf

NEDLAC. (2007). *Administered Prices Study on Economic Inputs - Ports Sector.* Retrieved from https://www.thedti.gov.za/industrial_development/docs/fridge/CHINA_METALS.pdf

NPCC. (2013). *National Ports Consultatitive Committee response to the Ports Regulator - Tariff Application 2013/14.* Retrieved from Ports Regulator South Africa: http://www.portsregulator.org/images/documents/NPCC_Response_to_the_NPA_2014_15_Tariff_Submission_Comments_14-15.pdf

PNG Ports Corporation. (2014, September). *About PNG Ports Corporation*. Retrieved from PNG Ports Corporation: http://www.pngports.com.pg

Ports Regulator of South Africa. (2013). *Record of Decision.* Retrieved from Ports Regulator of South Africa: http://www.portsregulator.org/images/documents/Final_PR_ROD_201314.pdf

SAASOA. (2013). *South African Association of Ship Operators and Agents response to the Ports Regulator.* Retrieved from Ports Regulator of South Africa: http://www.portsregulator.org/images/documents/SAASOA_Comments_14-15.pdf

Thomas, C., & Maurice, S. (2008). *Managerial Economics.* McGraw-Hill Higher Education.

TNPA. (2009). *Transnet National Ports Authority 2010/11 Tariff Application to the Ports Regulator*.

TNPA. (2012a). *Position Paper on Tariff Methodology for the Setting of Tariffs by Ports Regulator*. Retrieved from

http://www.portsregulator.org/images/documents/Position_paper_on_Transnet_National_Ports_Authority_18_Sep.pdf

TNPA. (2012b). *Transnet National Ports Authority: Proposal for new tariff structure.* Retrieved from Transnet National Ports Authority: www.portsregulator.org

TNPA. (2012c). *Transnet National Port Authority2013/2014 Tariff Application to the Ports Regulator.* Retrieved from http://www.portsregulator.org/images/documents/tariff_aplication_to_ports_regulator_fy_13_14.pdf

TNPA. (2013a). *Transnet National Ports Authority Proposed Tariff Methodology - Q&A.* Retrieved from http://www.portsregulator.org/images/documents/TNPA_Proposed_Tariff_Methodology_Responses_2_Apr_2013_FINAL.pdf

TNPA. (2013b). *Transnet National Ports Authority 2014/15 tariff application to the Ports Regulator.* Retrieved from http://www.portsregulator.org/images/documents/Tariff_Application_Financial_Year_2014_2015.pdf

TNPA. (2014). *Transnet National Ports Authority Port Statistics*. Retrieved from Transnet National Ports Authority: www.tnpa.net

UNCTAD. (1975). *United Nations Commission on Trade and Development Port pricing.* United Nations.

UNCTAD. (1995). *United Nations Commission on Trade and Development: Strategic Port pricing.* United Nations Commission on Trade and Development. Retrieved from http://unctad.org/en/Docs/sddport2_en.pdf

UNCTAD Secretariat. (1975). *United Nations Conference on Trade and Development.* Retrieved from United Nations Conference on Trade and Development: http://r0.unctad.org/ttl/docs-un/td-b-c4-110-rev1/en/TD%20B%20C4%20110%20Rev1e.pdf

United Nations Commission on Trade and Development. (1975). *Port Pricing.*

Van Niekerk, H. (2004). *Ports Restructuring, Policy and Regulation: South African case*. Retrieved from www.cepal.org/transporte/perfil/iame_papers/.../Van_Niekerk.doc