

# Competitiveness of Maputo as a regional port

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# Table of contents

<b>1</b>	<b>Introduction</b>	<b>9</b>
1.1	Project background	9
1.2	Objective and scope	9
1.3	Reporting	11
<b>2</b>	<b>The potential hinterland</b>	<b>12</b>
<b>3</b>	<b>Costs of the logistic chains</b>	<b>13</b>
3.1	Introduction	13
3.2	Rail transport costs	14
3.2.1	Capacity	14
3.2.2	Distances and costs	14
3.3	Road transport costs	15
3.4	Port costs	17
3.4.1	Terminal handling charges	17
3.4.2	Charges on the ship	17
3.4.3	Scanning charge	19
3.4.4	Sum of port related charges	21
3.4.5	Importance of the scanning charge	22
3.5	Maritime transport costs: liner shipping	23
3.5.1	Southern Africa in the liner shipping network	23
3.5.2	Shipping lines calling at Maputo	24
3.5.3	Container freight rates	25
3.6	Maritime transport costs: non-liner shipping	26
<b>4</b>	<b>Competition by port sector</b>	<b>28</b>
4.1	Introduction	28
4.1.1	General remarks on competitive position	28
4.1.2	Present and future port throughput	29
4.1.3	Transit trades	33
4.2	Containers	33
4.2.1	Containers by category	33
4.2.2	Development in time	34
4.2.3	Competing ports	34
4.2.4	The competitive position at present	35
4.2.5	Possible development in the future	36
4.2.6	The competitive position in the future	37
4.3	Sugar exports	38
4.4	Coal exports	39

4.5	Magnetite exports	40
4.5.1	Present situation	40
4.5.2	Future development	41
4.6	Citrus exports	42
4.7	Steel products	43
4.8	Ferro chrome and chrome ore exports	44
4.9	Imports of cereals	45
4.9.1	Wheat and maize in bulk	45
4.9.2	Wheat and maize in bags	45
4.9.3	Rice in bags	45
4.10	Timber products	45
4.10.1	Woodchips exports	45
4.10.2	Timber bundles	46
4.11	Dry bulk	46
4.11.1	Clinker imports	46
4.11.2	Other dry bulk	46
4.12	Break bulk	46
4.12.1	Aluminium billet exports	46
4.12.2	Granite exports	47
4.12.3	Car terminal	47
4.12.4	Other dry break-bulk cargo	47
4.13	Petroleum products and other liquid bulk	47
4.13.1	Petroline pipeline project	47
4.13.2	Bulk liquids	48
4.14	Competitive position with respect to Zambian foreign trades	48
4.15	Competitive position with respect to Swaziland foreign trades	49
<b>5</b>	<b>Overview competitive position</b>	<b>50</b>
5.1	Cost difference and market share of Maputo routings	50
5.2	Impact of costs on market share	53
5.3	Importance and impact of the scanning charge	53







# 1 Introduction

## 1.1 Project background

Recently, the Mozambican Government has expressed its concern regarding the continued competitiveness of Mozambican ports, particularly Maputo. In particular, since the concessioning of the port to MPDC in April 2003, Government has not made a comprehensive review of the port charges levied in Maputo in relation to corresponding charges in Nacala, Beira, Durban, Richards Bay, Dar es Salaam, and to some extent Mombasa. Traffic levels through Maputo have not increased at the rates expected when the port was concessioned – partly due to constraints in the transport routes feeding to the port from Zimbabwe, Swaziland and South Africa, and possibly due to tougher competition from Durban and Richards Bay. Recently there have also been complaints from various shippers and interest groups on the possible negative impact of the scanning charges imposed by the recently awarded concession for scanning containers at the Maputo Port and other border crossings.

Therefore, this project was commissioned to study the general competitiveness of Maputo port in the context of the region including southern Mozambique, the Maputo corridor, and neighbouring areas (e.g., Durban, Richards Bay, Beira, Nacala, etc.). This study will help Government confirm the role of the port in regional growth, and also identify areas in which it may not be competitive, and areas in which it would need improvement so as to continue playing its role as an important regional port.

## 1.2 Objective and scope

The objective of this review is to improve the knowledge of the Client on the competitiveness and the role of the port of Maputo in the region, and the impact of various levels of port charges, including security and scanning requirements, on trade flows in the region. Upon the recent introduction of the scanning charges, serious fears have been expressed by various stakeholders, shippers and port users that the impact of the introduction of the scanning charges on levels of trade through the port would be very significant. Government feels that scanning charges are to be viewed within the context of all other port charges.

This review will establish the overall competitiveness of Maputo as a regional port in comparison to other ports in the area such as Durban, Richards Bay, Beira, Nacala and Dar es Salaam and will examine in detail the various transport costs including land transport costs, port charges, scanning charges, shipping costs, etc. through Maputo for the import and export of key commodities, including transit goods.

The study tasks include the following elements:

1. Review of cargo flows of potential hinterland of Maputo
  - (i) Review in detail of the current operations at the Port of Maputo;
  - (ii) Identification of the major commodities likely to ship through Maputo, including imports, exports and transit goods;
  - (iii) Identification of the major alternative routes (and ports) for the flow of the above commodities;
2. Comparison of the alternative routings
  - (iv) Identification of the key determinants for the choice of the transport route for the key commodities;
  - (v) Comparison of the advantages, disadvantages, constraints and economics of shipping the key commodities through alternative ports, such as Durban, Richards Bay and Dar es Salaam, as may be applicable;
  - (vi) Review in detail of the charges in Maputo and their coverage on various types of goods and compare them with the corresponding charges and coverage in other ports in the region (Beira, Nacala, Durban, Richards Bay, Dar es Salaam) and world-wide, and comment on their validity and levels;
3. Future developments impacting trade through Maputo
  - (vii) Review of the likely investments in the Maputo Corridor and neighbouring areas that would generate traffic for Maputo and how that is likely to be affected by the level of service and port charges prevailing in Maputo compared to its competitors;
  - (viii) Determine the likely impact of the level of port charges and scanning fees levied on exports, imports and transit goods, particularly on possible diversions to other ports in the region, and on the economy broadly;
4. Recommendations
  - (viii) Recommendation of key actions to be taken to maintain the relative competitiveness of Maputo as a regional port and ensure the most economic flow of goods along the alternative routes in the region.

The cargo flows routed through the port of Maputo consist of captive flows, such as the imports for the southern part of Mozambique, and of non-captive flows that have the potential to be routed through Maputo, provided all port choice attributes (comparative costs and quality of service aspects) work advantageous. In terms of road distance, Maputo is well located compared to Durban for traffic generated by areas north of Johannesburg. Considering distances via rail the advantage is even bigger. The actual low market share of Maputo for the trades generated by these regions shows that aspects such as maritime transport costs, port costs and efficiency and border crossing costs are not compensated by the distance advantage. However, this does not imply that the situation cannot change.

For the non-captive trades, where Maputo has the potential to increase its market share, cost comparisons will be made measuring the competitive position in terms of costs and quality of service aspects, together referred to as generalized costs. For some trades these generalized costs can completely be quantified, but for other trades only a partly quantification is possible. Comparison of the generalized costs per routing will result in

statements on future market shares. In case the generalized costs are not completely available, statements on market shares will be made based on supplementary information obtained from interviews.

The future market shares will be assessed based on the present situation (“status quo” market shares) and on changed policies leading to improved, trade facilitation measures and pricing of infrastructure. The outcome of this analysis will lead to a set of recommended key actions as mentioned under point (ix) of the Scope of Work.

### 1.3 Reporting

This report presents the results of the review of the competitiveness of Maputo as a regional port. It has the following chapters:

- Chapter 2: Definition of the potential hinterland
- Chapter 3: Assessment of the costs of inland transport, cargo transfer in port and maritime transport for the most important transit cargoes through the port of Maputo
- Chapter 4: Assessment of the competitive position of Maputo per commodity type on the basis of the differences in costs of routings via Maputo and Durban in particular
- Chapter 5: Overview of the competitive position of the port of Maputo and a description of the importance and impact of the scanning charge.

## 2 The potential hinterland

Maputo is well located to accommodate the overseas trade of the northern part of South Africa, Zimbabwe and to a lesser degree countries such as Botswana, Zambia, Malawi and the Democratic Republic of Congo (DRC). This area is the transit hinterland of the port of Maputo. For this transit hinterland it competes with all ports in the range between Dar es Salaam and Cape Town. The competing ports differ per hinterland area. Apart from the transit hinterland, Maputo has a captive area in southern Mozambique. In 2006 the transit cargoes amounted to 40% of the total throughput.

Figure 2.1. Southern Africa



This study will focus on the hinterland areas where Maputo has the best chance of competing with Durban, i.e. Zimbabwe and Swaziland and in detail the northern provinces of South Africa.

## 3 Costs of the logistic chains

### 3.1 Introduction

The competitive position differs strongly per sector: Mozambican imports and exports or transit imports and exports. For the overseas imports and exports of Mozambique, the port of Maputo practically has no competition from other ports in Mozambique or from outside Mozambique. The geography of the country makes competition with the ports of Beira and Nacala negligible for overseas Mozambican imports and exports. For similar geographical reasons in combination with the costs of border crossing, there is also practically no competition with the ports of South Africa. The imports and exports of the southern part of Mozambique therefore are a captive market for the port of Maputo. This means that the costs of imports and exports of Mozambique can increase substantially without endangering the market share of the port of Maputo.

The choice of sea port is determined by the total costs of the logistic chain of imports and exports including inland transport, cargo transfer in port, maritime transport and storage facilities along this chain. The full costs of the logistic chain also concern the costs of handling in the overseas port of origin or destination and the costs of related inland transport. It is, however, reasonable to assume that these costs do not affect the competitive position of the Southern African ports.

The costs of the cargo routings via Maputo, Durban, Richards Bay and Dar es Salaam will be compared for the supply chains of the various imports and exports of the transit hinterland. The costs include inland transport costs and time, border crossing costs and time, cargo transfer and storage costs in port, seaborne transport costs and service frequency. These costs are generally referred to as generalised costs and concern all costs that are incurred by the importer and exporter in the hinterland, either directly via the transport bills or indirectly through extra storage costs and higher or lower value of the goods.

Apart from the generalised costs there also may be other factor such as strategic considerations to choose certain routings. The most important one is to keep alternative routings open in order to put some pressure on providers of the competing routings and to keep routings open in order to cope with disruptions in the preferred routing.

At present there are capacity limitations, for instance at the Ressano Garcia railway line or at certain port terminals, that limit the number of supply chain options through the port of Maputo.

Finally, it should be noted that the costs and prices of transport services being mentioned in the sections hereafter, are broad indications of the real level. For commercial reasons the quotations provided by the logistic service providers being interviewed, such as rail operators, terminal operators and shipping companies, may include an element of bias. Where possible the prices were compared with those obtained from other sources.

## 3.2 Rail transport costs

### 3.2.1 Capacity

At present the capacity of the Ressano Garcia (RG) Line is limiting South African exports through the port of Maputo, of goods such as coal and magnetite. If capacity would be larger, additional shipments of for instance coal and magnetite would be carried via the RG Line.

It is stated that at present the RG Line railway accommodates per week:

- 22 coal trains
- 7 magnetite trains
- 6 general cargo trains including wagons with containers, ferrochrome and agricultural products.

During the last years, capacity at the RG Line was limited due to a program of improvement works, which will be finalised in 2008. The capacity will then be increased to 40-45 trains per week.

In Mozambique a train consists of 30 to 40 wagons. In South Africa this is different: for instance trains with magnetite from Phalaborwa sometimes have 60 wagons, to be reduced at Komatipoort before they cross the border into Mozambique.

At present the viability of dedicated container trains between City Deep in Johannesburg and Maputo is being investigated by certain logistic service providers.

Further improvements of capacity at the RG Line can be achieved by implementing signalling and traffic control systems, or by increasing the number of rail sidings where trains can pass each other.

### 3.2.2 Distances and costs

The figures in table 3.1 clearly show the advantage of the port of Maputo in terms of distances transport distances compared to the ports of Durban and Richards Bay.

Table 3.1 Distances by rail between major centres and seaports (in km)

Location	Country	Maputo	Durban	Richards Bay
Johannesburg	South Africa	584	720	
Witbank	South Africa	407	820	600
Nelspruit	South Africa	188	830	
Polokwane	South Africa	550	1050	
Phalaborwa	South Africa	374	1083	895
Bulawayo	Zimbabwe	1044	1880	1800
Harare	Zimbabwe	1269	2069	
Mbabane	Swaziland	260	566	371

On all connections railway costs are not proportional with distance, so that the cost advantage is less than the difference in distance suggests or even concerns a disadvantage. Unit costs per ton-kilometre are low on the high volume lines connecting Richards Bay with the coal mines and on the lines connecting Durban with Gauteng, where exports are better balanced by imports. A sample of rates for heavy 20 ft containers provided by TRANSNET is given in table 3.2.

Table 3.2 Railway rates for heavy 20ft containers in USD

Location	Maputo	Durban
Johannesburg	296	337
Witbank	243	367
Nelspruit	177	370
Polokwane	286	437
Phalaborwa	233	447
Bulawayo	435	687
Harare	503	744
Mbabane	199	291

Source: based on a sample of recent quotations by TRANSNET

A similar set of quotations by TRANSNET for coal and magnetite on a per ton basis shows a variation in rates from USD-cent 4.7 to 5.8 per ton.

### 3.3 Road transport costs

Inland transport costs by road depend on the type of truck, crew costs, the condition of the road, the competitive situation of the road haulage industry, the occurrence of waiting times because of congestion or border crossing and the probability of getting a return

cargo. The high road transport costs for the Southern African landlocked countries are subject of World Bank sponsored studies<sup>1</sup>.

The industrial centres of Gauteng and Mpumalanga generate incoming and outgoing cargoes concerning both overseas and domestic trade. Together this leads to a greater availability of return cargoes between South African ports and the industrial centres than between Maputo and these centres and thereby to lower trucking costs.

The Maputo Corridor Logistics Initiative (MCLI) presents a number of freight rates for 20 ft containers carried between Maputo and Durban and the major centres of the Maputo corridor. The figures in table 3.3 show that Maputo has lower rates than Durban for all locations except for Johannesburg/Pretoria, which is cheaper to/from Durban because of the availability of return cargo.

Table 3.3 Road haulage costs between locations in the corridor and seaports per 20 ft container in USD

Corridor location	Maputo	Durban	Maputo per km	Durban per km
Johannesburg/Pretoria	1075	625	1.79	1.08
Middelburg	875	1111	2.10	1.91
Witbank	875	1063	2.10	1.83
Nelspruit	625	1563	2.56	2.21
Swaziland	625	1288	2.80	2.29

Source: MCLI Publication on Maputo Corridor-Cost Comparisons

The road haulage costs in South Africa range from 3 to 6 USD-cent per ton kilometre<sup>2</sup>, depending on the conditions of the road and the lorry's backhaul situation. For this study we apply the rates as presented in the table below.

Table 3.4 Road haulage costs in USD per tonkilometre

Location	Maputo	Durban
Johannesburg/Pretoria	0.051	0.031
Middelburg	0.060	0.055
Witbank	0.060	0.052
Nelspruit	0.073	0.063
Swaziland	0.080	0.065

Source: Regional Road Transport, How competitive? - Barney Curtis, World bank Feedback Workshop, Pretoria, 12th march 2008

<sup>1</sup> Gaël Raballand and Patricia Macchi 'Study of transport costs and prices in Sub-saharan Africa. The Southern Africa Case. March 2008.

<sup>2</sup> Regional Road Transport, How competitive? Barney Curtis, World bank Feedback Workshop, Pretoria, 12<sup>th</sup> march 2008



## 3.4 Port costs

The port costs consist of terminal handling charges (THC) per ton or TEU, the charges on the ship and the scanning charge.

### 3.4.1 Terminal handling charges

The THC consists of the stevedoring charge and the charge for shore-handling and receiving/delivery of cargo. In Maputo the charge for loading is about 14% lower than for discharge, thus favouring exports.

According to a study done by Jacobs in 2005<sup>3</sup> the THC for exports from Maputo are 18% below those of Durban, while those for imports are 92% higher. **Check calculations** MCLI shows rates for exports of Maputo being 17% below those of Durban.

Table 3.5 Terminal handling charges MIPS in USD per unit

		20'	40'	average/TEU
Stevedoring	discharge	110	198	106
Shore-handling/ receiving	discharge	140	252	135
Total	discharge	250	450	241
Stevedoring	loading	96	173	92
Shore-handling /delivery	loading	120	216	116
Total	loading	216	389	208

Source: MIPS Tariff 2008

### 3.4.2 Charges on the ship

The charges on the ship consist of charges for pilotage, towage and mooring services, port entry and berthing fees, the ISPS charge and a contribution to the dredging fund. The various charges for Maputo are given in table 3.6.

<sup>3</sup> Republic of Mozambique: Railways and Ports Restructuring Project -Transport costs study, Final Report, December 2005, Jacobs Consultancy

Table 3.6 Marine service tariff for the port of Maputo

	Description of service	Rate in USD
1	<b>Pilotage</b>	
1,1	Standard Charge per Service	450,00
1,2	Variable Charge per Service per Tonne GRT	0,0112
1,3	Cancellation Fee, if less than 2 hours prior to Departure Time	225,00
1,4	Variable Charge per Cancellation per Tonne GRT	0,0112
2	<b>Tugs</b>	
2,1	Standard Charge per Hour	300,00
2,2	Variable Charge per Hour per Tonne GRT	0,0112
2,3	Fuel Surcharge on Tug Services, 2.1 plus 2.2	25,00%
3	<b>Mooring gang</b>	
3,1	Standard Charge per Hour	150,00
4	<b>Mooring launch</b>	
4,1	Standard Charge per Hour	150,00
5	<b>Port entry and berth fees</b>	
5,1	Port Entry Fee, inwards only	700,00
5,2	Port Entry Fee, vessel less than 500 GRT	350,00
5,3	Berth Fee, per Tonne GRT per day alongside	0,0331
5,4	Inner Anchorage, (Buoy 17), per Tonne GRT per 24hrs	0,0112
5,5	Trawler, per Day alongside	275,00
6	<b>ISPS service charges</b> , inwards only	150,00
7	Dredging Fund, vessels more than 5,000 GRT, inwards only	500,00
8	<b>Light dues</b> , per Tonne GRT	0,2
9	<b>Other dues</b> such as immigration, customs etc. per call	1,200

Source: MPDC 2008

The ports charges consist of a fixed part and a part varying with the size of the ship in Gross Register Tons (GRT) and the time ships spend in port. The latter varies with the amount of cargo loaded and discharged. The typical amount for a 35,000 bulk carrier spending two days in port comes at USD 21,000 per call.

The sum of port costs per TEU or per ton is assessed for a sample of 10 different commodities being of importance for the competitive position of Maputo. Per commodity the assessment is as follows:

1. Containers. The average size of containerships calling is about 1250 TEU with a corresponding GRT of 13,750. The port costs including the tariffs given in table 3.6 comes at USD 12,099 or USD 0.88 per GRT. This corresponds with USD 52.30 per TEU for the average call size of 230 TEU.
2. Sugar in bulk is shipped in varying consignments of about 13,600 tons with bulk carriers of about 14,000 GRT or 20,000 dwt. Total port costs come at USD 13,600, USD 0.97 per GRT and USD 0.97 per ton loaded.
3. Other goods. Similar calculations are done for coal, magnetite, citrus products etc. These are presented in table 3.7.

It appears that the rate per GRT increases from USD 0.67 for large bulk carriers to USD 0.97 for the smaller ones. This reflects the fact that the fixed costs per call such as the marine charges are divided over a greater number of GRTs. The amounts per ton handled show a bigger variation, reflecting the variation in the call size. For goods such as chrome

ore and timber the consignment sizes in terms of tons handled are small in relation to the ship's carrying capacity in deadweight tons (dwt). As a result the charges in terms of tons handled are high. For coal and magnetite the quantities of tons handled are close to the dwt carrying capacity, resulting in low costs per ton handled.

The resulting charges per ton or TEU handled are given in table 3.7. The costs vary from a low USD 0.50 per ton of coal to a high USD 13.60 per ton of timber import. For containerised cargoes the charge is USD 53 per TEU.

Table 3.7 Costs of marine charges per TEU or ton for Maputo

Cargo type	Dwt/ TEU	GRT	call size TEU/ton	Share call size	USD GT/call	USD TEU/ton
Containers TEU	1,250	13,750	230	18%	0.88	52.6
Sugar bulk	20,000	14,000	10,000	50%	0.97	1.4
Coal	50,000	35,000	45,000	90%	0.67	0.5
Magnetite	50,000	35,000	45,000	90%	0.67	0.5
Citrus TEU	1,250	13,750	230	18%	0.88	52.6
Steel products	20,000	14,000	10,000	50%	0.97	1.4
Ferro Alloys/Chrome ore	50,000	35,000	3,000	6%	0.67	7.8
Grain	20,000	14,000	10,000	50%	0.97	1.4
Forestry products TEU	1,250	13,750	230	18%	0.88	52.6
Timber imports	20,000	14,000	1,000	5%	0.97	13.6

### 3.4.3 Scanning charge

#### *Scanning in Mozambique and in Maputo*

In mid 2006, the Mozambican Government granted a concession to Kudumba Development Ltd, for placing and operating x-ray scanners at all ports, land borders and airports, for which it is entitled to charge a fee. So far, Kudumba has placed scanners at Maputo International Airport and at Maputo port. Plans exist to install rail scanners at the Ressano Garcia border post.

On July 1<sup>st</sup> 2006, a scanning charge became effective in the port of Maputo. This charge caused a lot of protest in the transport community, mainly because of the nature of the charge and because of the level of the charges. After several rounds of negotiations, the situation for cargo to and from the port of Maputo is currently as follows:

- In theory, 100% of all cargo is scanned once on Mozambican soil. For transit cargo, this means it is either scanned at the land border or in the port.
- In practice, about 35% of road cargo through the port of Maputo is currently scanned. Customs decides which cargo is to be scanned.
- Rail traffic into and out of the port is currently exempt as until now no scanners have been placed at the railway line. This will change once the scanners at the railway lines will be installed.
- All import, export and transit cargo through the port of Maputo is subject to the scanning charge, whether it is actually scanned or not. This fact caused most of the protests against the scanning charge.

Imports are charged higher than exports and transit cargoes are charged less. The various rates are given in table 3.8 in such a way that they correspond with the commodities discussed in this report.

Table 3.8 Scanning charge per trade - July 2007

Cargo type	Unit	rate
<b>Import</b>		
Containers full	per container	100.00
Containers empty	per container	8.00
Vehicles new	per vehicle	50.00
Vehicles used	per vehicle	30.00
Dry bulk, liquid bulk and breakbulk	per ton	1.70
Minerals	per ton	0.90
Other imports	per ton	1.90
<b>Export</b>		
Containers full	per container	50.00
Containers empty	per container	10.00
Ferrochrome	per ton	0.75
Coal and magnetite	per ton	0.20
Minerals	per ton	0.40
Scrap metal	per ton	1.90
Sugar (bulk and bagged)	per ton	0.62
Cereals	per ton	0.75
Citrus and other fruit	per ton	0.75
Other exports	per ton	1.90
<b>Transit</b>		
Containers full	per container	25.00
Containers empty	per container	10.00
Vehicles	per vehicle	15.00
Minerals	per ton	0.75
Steel	per ton	0.60
Sugar (bulk and bagged)	per ton	0.75
Other transits	per ton	0.90

Source: Kudumba Development Ltd

#### *Scanning practices in Maputo compared with Rotterdam*

The current practice for scanning of cargo in the Port of Rotterdam is as follows:

- Bulk cargo is generally exempt from scanning; only containers are subject to scanning.
- Only a small percentage of containers is actually scanned, working out to less than 1% of the total container throughput.
- There are two scanning locations, one each near the two main container terminal locations.
- Customs operates the scanners and decides which containers are scanned, using a risk analysis.

The costs involved in scanning can be divided in two elements: 1) the operation of the scanning equipment and 2) the transport to and from the scanning area. In the Port of Rotterdam, as in most other Western European ports, the scanning is free of charge to the cargo owner. The scanners are operated by Customs, who also bear the costs. Transport to and from the scanning area is carried out by the container terminal operator, for which a fee is charged to the cargo owner, often referred to as a scanning fee. In Rotterdam, this transport fee amounts to 100 Euro per container on average (it is distance related).

In some cases, governments or port authorities bear (part of) the costs involved in scanning order to protect their competitive position. In Rotterdam for instance, the Port Authority used to pay for a share in the transport costs to and from the scanner, but this practice was stopped.

#### *Scanning practices in Maputo compared to other African ports*

The practice of concessioning the scanning of cargo in ports to a private party is not uncommon in Africa. The rates charged by the scanning concession holders are often comparable to those in Maputo, up to 100 USD per container.

In Dar es Salaam, a concession for scanning of containers and or the introduction of a risk assessment system is in the hands of Tiscan, a subsidiary of the Swiss-based Cotecna Group that provides scanner services for Customs and revenue authorities around the world. In Africa, they operate scanners in Tanzania, Ghana, Nigeria, Senegal and Togo, amongst others. The costs of scanning in Dar es Salaam are entirely covered from the 1.2% FOB import processing fee charged by the Tanzanian Revenue Authority on all eligible importers. Part of this fee is paid to Cotecna; the rest goes to TRA for administrative costs. On a per ton basis, this means an average charge of 10 USD/ton<sup>4</sup>.

#### 3.4.4 Sum of port related charges

The summary of port related charges for Maputo, i.e. THC, marine charges and scanning charges is given in table 3.9. The costs of marine charges in Maputo are on average 26% below those of Durban.

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<sup>4</sup> Based on imports

Table 3.9 Comparison port related charges for Maputo and Durban in USD per ton or TEU

Cargo type	Durban	Maputo			
	total	total	total	total	total
Containers	333	292	214	52.6	25.00
Sugar bulk	12	10	8.21	1.4	0.75
Coal	7	6	5.28	0.5	0.20
Magnetite	7	6	5.28	0.5	0.20
Citrus	325	286	208	52.6	25.00
Steel products	14	12	9.62	1.4	0.60
Ferro Alloys/Chrome ore	22	18	9.38	7.8	0.75
Grain	10	9	6.45	1.4	0.75
Forestry products	80	61	7.62	52.6	0.75
Timber imports	28	22	7.62	13.6	0.75

### 3.4.5 Importance of the scanning charge

For the assessment of the competitive position of Maputo we have to concentrate on transit cargoes, as for transit cargoes there is a choice of port of call. The scanning charge can be set against the transport costs and transport cost differences of the alternative routes. As stated, the impact of the charge on imports and exports is negligible.

The share of the scanning charge in the total of all port related charges appears to vary from 1.2% for forestry products to 8.8% for citrus. See table 3.10.

For the assessment of the competitive position it is important to compare the charge with the difference between all port charges in Maputo and Durban. As stated, port charges in Maputo are lower. The scanning charge appears to absorb a considerable part of this difference, varying from 4% for forestry products to 65% for grain and 61% for containers.

Table 3.10 The scanning charge for transit cargoes compared to the total of port charges

	share in total of port charges	share of difference
Containers (full)	8.6%	61%
Sugar bulk	7.3%	49%
Coal	3.3%	17%
Magnetite	3.3%	17%
Citrus	8.8%	63%
Steel products	5.2%	30%
Ferro Alloys/Chrome ore	4.2%	18%
Grain	8.8%	65%
Forestry products	1.2%	4%
Timber imports	3.4%	13%

## 3.5 Maritime transport costs: liner shipping

### 3.5.1 Southern Africa in the liner shipping network

With 23 shipping lines, Southern Africa is well connected to the major economic centres of the world and with Asia in particular. Most of the lines have weekly and fixed day per week schedules. The total annualised capacity of these lines comes at 1.75 million TEU one way or 3.5 million incoming and outgoing together. See Table 3.11.

The ships deployed on the North Europe route range from 1,300 to 4,800 TEU of which the largest are employed by MSC. MACS deploys hybrid vessels such as ro-ro ships and multi-purpose ships with an average container capacity of 820 TEU. They offer one roundtrip every 8-9 days and call at Maputo on inducement, i.e. when sufficient cargo is available.

North America is connected by MSC with one call per week. Maputo is not a port of call in this service.

Asia is well connected with both end-to-end services and passing services, in total 16 lines. The passing lines connect Asia with South America (6 lines) and with West Africa (also 6 lines) and call at Southern African ports on their way between these regions both inbound and outbound. Most lines offer weekly services. The ships range in size from 1,500 to 4,600 TEU, of which the biggest are employed by Maersk/Safmarine on their Safari end-to-end route. MOL/PIL employs 2,300 TEU ships on their West Africa service making a roundtrip every 8 days. Maputo is called at on inducement on the eastbound trip to Asia loading containerised ferrochrome in particular.

On all trade routes the ships employed are considerably smaller than those employed on major east – west routes connecting the world major industrial centres of North America, Europe and the Far East. This means that the advantages of economies of ships size are not yet fully utilised. The current introduction of ships of 10,000 TEU and greater on the Europe-Far East routes, will lead to shifts of ships to other routes. It is expected that ships of 5,000-6,000 TEU will soon call at Southern African ports through these cascading effects putting a downward pressure on freight rates.

Table 3.11 Shipping routes linking Southern Africa by major trade route

Connection with	Number of lines	Frequency of lines	Annualised capacity (TEU)	No of Lines calling at Maputo
North Europe	5	Most: 7 days One: 9 days	600,000	1
South Europe	1	14 days	17,000	1
North America	1	7	128,000	none
Asia	16	Most: 7 days	1,000,000	1
All trades	23		1,745,000	

Source: Derived from Drewry Annual Container Market Review and Forecast – 2007/08

In 2006, the total throughput of Southern African ports was 4.5 million TEU which corresponds in broad terms with the shipping capacity offered. The throughput figure is somewhat higher than the shipping capacity offered, as the throughput also includes container feeder and regional services, while these are not included in the capacity offered by the mainlines. The container throughput level of Mozambican ports is small compared to the South African ports as can be seen in table 3.12.

The small share in total South African throughput corresponds with the small share in the shipping capacity offered by the main lines calling at Maputo, as discussed above. The mainlines call at inducement, have a frequency of less than once per week and, in the case of the passing line connecting with the Far East, only call at the eastbound leg.

Table 3.12 Container throughput of Southern African ports in 2006

Port/country	Throughput in 1000 TEU	Share in %
Nacala	34	0.8%
Beira	54	1.2%
Maputo	63	1.4%
Total Mozambique	151	3.3%
Richards Bay	3	0.1%
Durban	2,335	51.5%
East London	42	0.9%
Port Elisabeth	407	9.0%
Cape Town	765	16.9%
Total South Africa	3,552	78.3%
<b>Total region</b>	<b>4,535</b>	<b>100.0%</b>

Source: Containerisation International, CFM

### 3.5.2 Shipping lines calling at Maputo

The container lines calling at Maputo in order of decreasing importance include:

1. Ocean African Container Lines (OACL), a joint venture between Safmarine Container Lines and Grindrod, provides feeder services from Durban to East African ports for the Maersk group. The ships are fully cellular and range from 750-1000 TEU.
2. MSC provides feeders from Durban with fully cellular and ro-ro ships of about 1000 TEU on the route Durban-Maputo-Beira-Nacala-Dar es Salaam-Mombasa-Durban.
3. MOL: have a direct call every 8 days eastbound to Singapore and Shanghai on their Far East-East Africa/West Africa line, with fully cellular ships from 1600 to 2100 TEU. Maputo is called at on inducement.

Furthermore there are:

- Messina Lines provides a linkage with the Mediterranean through the Suez Canal once per fortnight with ro-ro ships of about 1300 TEU. Maputo is called on inducement.



- MACS lines have a route connecting with West Europe every 8-9 days with a mixture of non-cellular containerships of 1000-2000 TEU calling at Maputo on inducement. They also operate a feeder service from Durban with small feeder of about 200-300 TEU.
- CMA/CGM and Delmas (in the same group): direct calls from Middle East, Dubai, Nava Sheva, Karachi every 12 days with a 1700 TEU ship
- Zim lines: not frequently.
- Mozline operates cabotage services with ships of about 200 TEU.

Note that all mainlines call at more than one South African port and in case of passing lines both on the eastbound and westbound leg of a roundtrip.

### 3.5.3 Container freight rates

As stated above, logistic service providers are not very willing to provide their prices. This affects the rates given hereafter.

The scarcity of direct liner services with the main origins and destinations of Mozambican foreign trade makes that the sea freight will be high and that the resulting quality of service in terms of transit time, frequency and service reliability will be low. For the trade with North America, Europe and the Far East therefore the freight rate will be on a cost plus basis and thereby be equal to the rate of Durban plus feeder costs which equal USD 700<sup>5</sup>. It should be noted that part of these costs will be absorbed by the mainline freight rates, to what extent is not clear. In the costs calculation that follow we will assume that the extras costs in case of transshipment are USD 400 per 20 ft container.

A number of exemplary freight rates for Maputo are given in Table 3.13. The rates include costs of double handling in Durban.

The freight rates in the opposite westbound direction from Southern Africa to the Far East are considerably lower and estimated to be about 40-60% less because of the lower level of trade. The rates shown by MCLI for the export of 20 ft containers is USD 881 compared to USD 2300 according to table 2.13, i.e. 62% less.

Although the number of direct services is little and infrequent, the mere existence of them will exert pressure on the freight rates of mainline feeder line services, making that the difference compared to Durban will be less than the additional USD 700 of feeder transport. This applies in particular to the trade with South Europe and the exports through Maputo to the Far East. For the analysis of the competitive position of Maputo the difference in costs of the competing supply chain routings is more important than the absolute amounts.

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<sup>5</sup> i.e. freight rate of USD 600 plus USD 100 Bunker Adjustment Factor (BAF)

Table 3.13 Some exemplary container freight rates to Maputo as per mid 2008 in USD

To Maputo from	20'	40'	20' BAF	40' BAF	total 20'	total 40'
Kobe	2,350	4,700	479	958	2,829	5,658
Shanghai	1,825	3,650	479	958	2,304	4,608
Singapore	1,825	3,650	479	958	2,304	4,608
Tilbury	1,535	3,070				
Genoa	1,515	3,030				

Source: Major freight forwarder in Maputo

### 3.6 Maritime transport costs: non-liner shipping

Large bulk shipments include exports of aluminium, coal, magnetite, granite, bulk sugar and ferrochrome and imports of petroleum products, alumina, sulphur and cereals. The size of the bulk carriers ranges from small coastal tankers to Panamax dry bulk carriers.

We assessed the shipping costs for a number of exemplary shipments of bulk goods through Maputo and Durban. The costs for instance of exports of sized coal from Maputo to Turkey with a bulk carrier of 25,000 dwt and loaded to 95% come at USD 41.50 per ton. From Durban the distance by sea is a bit more, but the time in port is a bit shorter. The net effect is that cost difference is negligible. See table 3.14.

In the case of a trip to the Far East the distance advantage is less. The costs of exports of magnetite from Maputo to Shanghai with a bulk carrier of 45,000 dwt and loaded to 95% come at USD 42.70 per ton and the cost from Durban USD 41.90 per ton, which is USD 0.80 less.

For trips to West Europe or North America, where ships pass the Cape of Good Hope, there is a distance disadvantage, resulting in more days spent at sea leading to an extra cost of USD 3.20 per ton. The cost differences of other shipments are given in the table 3.14.

Table 3.14 Shipping costs via Maputo and Durban for a sample of trades

Commodity	Port 1	Port 2	Ship size dwt	Roundtr dist nm	Speed knots	Days at sea	Days in port	round trip days	charter rate USD/day	Fuel cons. tpd	Charter fixed costs	fuel costs	Total costs	load degree	Cons. size	USD /ton	Add costs Maputo
Coal	Maputo	Izmir	25,000	9,784	15	27.2	6	33.2	19,605	22.4	650,452	334,242	984,695	95%	23,750	41.46	
Chrome ore	Maputo	Shanghai	25,000	13,584	15	37.7	6	43.7	23,750	22.4	1,038,667	464,059	1,502,726	70%	17,500	85.87	
Magnetite	Maputo	Shanghai	45,000	13,584	15	37.7	6	43.7	27,494	30.0	1,202,417	622,600	1,825,017	95%	42,750	42.69	
Magnetite	Maputo	Shanghai	75,000	13,584	15	37.7	6	43.7	37,278	38.7	1,630,294	803,773	2,434,067	50%	37,500	64.91	
Sugar	Maputo	Rotterdam	35,000	14,358	15	39.9	6	45.9	23,750	26.5	1,089,730	580,368	1,670,097	95%	33,250	50.23	
Grain	Maputo	Houston	35,000	17,022	15	47.3	6	53.3	23,750	26.5	1,265,480	688,050	1,953,529	95%	33,250	58.75	
Coal	Durban	Izmir	25,000	10,230	15	28.4	4	32.4	19,605	22.4	635,531	349,479	985,010	95%	23,750	41.47	0.01
Chrome ore	Durban	Shanghai	25,000	13,762	15	38.2	4	42.2	23,750	22.4	1,002,910	470,140	1,473,050	70%	17,500	84.17	-1.70
Magnetite	Durban	Shanghai	45,000	13,762	15	38.2	4	42.2	27,494	30.0	1,161,023	630,758	1,791,781	95%	42,750	41.91	-0.78
Magnetite	Durban	Shanghai	75,000	13,762	15	38.2	4	42.2	37,278	38.7	1,574,170	814,306	2,388,475	50%	37,500	63.69	-1.22
Sugar	Durban	Rotterdam	35,000	13,804	15	38.3	4	42.3	23,750	26.5	1,005,681	557,974	1,563,655	95%	33,250	47.03	-3.20
Grain	Durban	Houston	35,000	16,468	15	45.7	4	49.7	23,750	26.5	1,181,431	665,656	1,847,087	95%	33,250	55.55	-3.20

## 4 Competition by port sector

### 4.1 Introduction

#### 4.1.1 General remarks on competitive position

The ports in the Southern and Eastern African range, from Dar es Salaam in the north to Cape Town in the south, show overlaps of their hinterlands demonstrating a degree of competition. In the past, Maputo was constructed to serve the industrial and mining region of Johannesburg and it matched Durban in terms of overall throughput. Over the years things have changed because of the strong industrial development of South Africa and the political developments in the region.

The situation in the past suggests that at present the port of Maputo has a market share below its potential. It could be increased once the railway connections between the port and the inland consumption and production centres are improved, their capacity expanded and cost and time of border crossings brought to a minimum. These factors are well listed in a recent study funded by USAID<sup>6</sup>.

The high throughput level of South African ports corresponds with a high market share which as such makes their position stronger. The large throughput base makes it viable to make investments in ports to accommodate big ships and leads to a high frequency of shipping services in combination with the use of big ships. It also makes it viable to invest in more storage facilities. The combined effect results in short inter-arrival of liners ships and low transport costs, which effect is often referred to as a hub-port effect.

The hub-port effect can be demonstrated by comparing the container services calling at Durban and Maputo. In Durban the largest ships calling are 4500-5000 TEU and employed by Maersk on the routes connecting the Far East. According to shipping circles these ships will soon be replaced by 6500 TEU ships. This will put pressure on the freight rates. The liner ships calling at Maputo measure 1600 -1800 TEU being operated by MOL. Similar effects apply to hinterland transport services by road and rail, especially with regard to the availability of return loads that help keeping inland transport costs at a lower level.

The competition Maputo faces from other East African ports varies per hinterland area:

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- <sup>6</sup> *‘Maputo Corridor Summary Project: A Transport Logistics Diagnostic Tool Study’*, United States Agency for International Development, United States, March 2008.

- From Beira with respect to Zimbabwe;
- From Nacala with respect to Malawi;
- From South Africa with respect to the nearby part of South Africa and all the areas mentioned above.

It should be noted that competition with Dar es Salaam for cargoes to and from the Copper Belt in practice does not exist. The Copper Belt is, as far as Zambia is concerned served for 48% by South African ports, 46% by Tanzanian ports and the remainder by Beira. See Section 4.14. For this study we will concentrate on the competition for the nearby South African parts which offer the largest potential for Maputo. These are the provinces of Gauteng, Mpumalanga and Limpopo.

#### 4.1.2 Present and future port throughput

##### *Total throughput*

The throughput of the port of Maputo and the terminals in Matola amounted to 6.64 million tons per annum (mtpa) in 2006. Of this 4 mtpa are under concessions and sub-concession by MPDC and 2.6 mtpa outside MPDC concessions. The MPDC concessions include 1.45 mtpa handled on MPDC's own account, which can be categorised in 15 different cargoes. MPDC has 5 terminals under sub-concession such as the MIPS container terminal, the STAM bulk sugar terminal, the TCM coal and magnetite terminals and the FPT citrus terminal. Outside the MPDC concession are three terminals in Matola of Mozal, STEMA and the petroleum terminal. The annual throughput per terminal and type of cargo is given in table 4.1.

In the period 2004-2007 total throughput increased from 5.6 to 6.6 mtpa. According to documents on the start of the CFM concessioning initiatives in 1998 the total volume was 3.16 mtpa in 1997 and was expected to increase to 9.2 mtpa in 2006, corresponding to an annual increase of 12.6% per year. The present level of 6.6 mtpa corresponds with an annual increase of 8.5%, which is still a strong growth.

In 2006 670 ships called at Maputo and Matola.

##### *Envisaged future development*

MPDC made a forecast for the concession period from 2006 to 2017. The forecast is presented here as it reflects the future importance of the various port sectors and shows an annual increase of 9.1% for all sectors. Per category the situation is as follows:

- The future throughput of the **terminals outside the concession**, the berths of the Mozal plant, the STEMA terminal and the petroleum terminal together are expected to increase with a low 2% per year. Petroleum products are expected to increase with 11.2%, but the Mozal and STEMA cargoes are not expected to increase.
- The volumes handled on **MPDC's own account** are anticipated to increase with 11.6% per year. Existing markets such as ferro-alloys and chrome and grain in bulk are expected to show strong increases. While the arise of new markets, starting from

zero such as timber products, aluminium billets, granite, car and some bulk liquids cause the high growth.

- The 5 terminals under **MPDC's sub-concession** will increase with 12.2%. MIPS will be the strongest grower with 14.6%, the coal and magnetite terminals will be about average, while the sugar and citrus terminals will be about average.

Detailed growth figures are given in table 4.1. The overall anticipated growth picture is positive and higher than as realised over the period 1997-2006.

The high growth figures reflect the increase of the South African and Mozambican import and export trades and also an increase in the market share of the port of Maputo in the transit trades. The increase in market share is the result of a package of ongoing measures, such as the expansion of the Ressaño Garcia railway lines, the expansion of some terminal capacities, the measures to ease border crossing and the start of container block trains. The strong increase of the local market strengthens Maputo's position on the transit market.

Table 4.1 Port throughput forecast by sector

	Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2006-2017
A	sub-concession tonnage															
1	MIPS Containers 1000 tons	475	572	595	658	757	870	1,001	1,151	1,323	1,522	1,750	2,013	2,315	2,662	14.6%
2	STAM bulk sugar	379	352	428	430	500	600	700	800	850	850	850	850	850	850	6.4%
3	TCM coal (Matola)	1,000	1,000	800	850	950	1,000	1,250	1,500	1,750	2,000	2,250	2,500	2,750	3,000	12.8%
4	TCM magnetite (Matola)	300	721	700	700	800	900	950	1,000	1,250	1,500	1,750	2,000	2,250	2,500	12.3%
5	FPT citrus	106	98	68	65	85	105	121	127	133	140	147	154	162	170	8.7%
B	MPDC own account handling															
1	Steel	49	72	88	92	101	111	150	200	250	250	250	250	250	250	10.0%
2	Ferro alloys & chrome	403	404	505	750	900	1,000	1,150	1,250	1,350	1,450	1,500	1,575	1,654	1,736	11.9%
3	Sugar (bagged)	20	25	40	45	45	45	45	45	45	45	45	45	45	45	1.1%
4	Grain (bulk)	50	60	70	70	125	131	138	145	152	160	168	176	185	194	9.7%
5	Food aid (bagged)	20	15	15	10	15	10	15	10	15	10	15	10	15	10	-3.6%
6	Timber logs & woodchips	10	10	-	-	150	200	250	300	350	350	350	350	350	350	
7	Timber bundles	-	-	-	-	20	40	60	80	84	88	93	97	102	107	
8	Rice (bagged)	230	250	250	240	250	250	250	250	250	250	250	250	250	250	0.0%
9	Cement clinker (bulk)	30	95	90	95	95	95	95	95	95	95	95	95	95	95	0.5%
10	Aluminium billets	-	-	-	-	-	-	-	-	150	150	150	150	150	150	
11	Other break bulk	50	67	103	210	252	302	363	435	523	549	576	605	635	667	18.5%
12	Other dry bulk	41	120	280	100	110	121	133	146	154	161	169	178	187	196	-3.2%
13	Granite terminal	-	12	10	25	50	100	150	200	250	300	350	400	450	450	
14	Bulk liquids terminal	-	-	-	5	25	45	65	85	100	100	120	120	150	150	
15	Car terminal	-	-	-	5	35	65	95	125	155	185	185	185	185	185	
	MPDC total	903	1,130	1,451	1,647	2,173	2,515	2,959	3,366	3,923	4,143	4,316	4,486	4,703	4,835	11.6%
	Concession total	3,163	3,873	4,042	4,350	5,265	5,990	6,981	7,944	9,229	10,155	11,063	12,003	13,030	14,017	12.0%
16	Mozal	1,820	1,889	1,931	1,705	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	-0.6%
17	STEMA	260	272	296	235	235	235	235	235	235	235	235	235	235	235	-2.1%
18	petroleum	325	347	368	380	426	477	534	598	670	750	840	941	1,054	1,180	11.2%
C	Non-concession total	2,405	2,508	2,595	2,320	2,461	2,51	2,569	2,633	2,705	2,785	2,875	2,976	3,089	3,215	2,0%
	<b>Total port tonnage</b>	<b>5,568</b>	<b>6,381</b>	<b>6,637</b>	<b>6,670</b>	<b>7,726</b>	<b>8,502</b>	<b>9,550</b>	<b>10,577</b>	<b>11,934</b>	<b>12,940</b>	<b>13,938</b>	<b>14,979</b>	<b>16,119</b>	<b>17,232</b>	<b>9.1%</b>
	Vessel calls	575	640	670	672	773	773	868	881	994	1,078	1,161	1,248	1,343	1,436	7.2%

Source: MPDC



### 4.1.3 Transit trades

An important part of port throughput concerns transit trades: a volume of 2.66 mtpa in 2006, which is 40% of the total. The major part of this 1.98 mtpa (75%) concerns South Africa, 0.39 mtpa Zimbabwe (15%) and 0.26 mtpa Swaziland (10%). There are some incidental trade with Botswana, Zambia and Malawi. These volumes are negligible. See table 4.2.

From statistics of Mozambican ports it can be shown that South African and Swaziland transit is only via Maputo, that transit for Zambia is only via Beira, that Beira dominates in transit for Zimbabwe and Malawi, where Maputo has the smaller share in Zimbabwe and Nacala in Malawi.

Table 4.2 Mozambican transit trades by hinterland country and port in 2006 and 2007 (1000 tons)

	2006				2007			
	Maputo	Beira	Nacala	all ports	Maputo	Beira	Nacala	all ports
South Africa	1,983	0	0	1,983	2,219	0	0	2,219
Zimbabwe	394	1,038	0	1,432	326	1,000	0	1,326
Malawi	0	619	108	727		737	218	955
Zambia	0	127	0	127		125	0	125
Swaziland	264	0	0	264	160	0	0	160
Others	17	7	0	24	3	3	0	6
<b>Total</b>	<b>2,658</b>	<b>1,791</b>	<b>108</b>	<b>4,557</b>	<b>2,708</b>	<b>1865</b>	<b>218</b>	<b>4,791</b>

Source: CFM Statistics March 2008

## 4.2 Containers

### 4.2.1 Containers by category

With 35%, the national imports are the largest category of containers handled in Maputo. Transit exports are the second largest category with 16% and, if the re-stowage of empties for exports are added, transit exports come at 19%. The high share of empties 38% demonstrates the imbalanced character of the national and transit trades, where the imports of consumables and capital goods concern 40 ft containers and the exports of transit cargoes concern heavy mining products are preferably carried in 20 ft containers.

The majority of containers in transit handled in Maputo are generated by South Africa and of these the majority is stuffed in Maputo and carried in non-containerised form. This concerns in particular ferro chrome and stainless steel exports. The costs can be reduced, if it would be possible to stuff the containers at the exporter's premises. The scarcity of empty 20 ft containers in South Africa is the reason. Initiatives are taken to change this and the increase in containerised imports of Mozambique may increase the availability of empties. As discussed below, there are plans to run block trains between Maputo and South Africa, which will be a stimulus. It should be noted that at present only about 1000-units are carried by train.

Table 4.3 Container trade by category in 2006

Category	TEU	share
Imports		
- National	21.746	35%
- Transit	1	0%
Exports		
- National	3.746	6%
- Transit	9.913	16%
Cabotage	1.394	2%
Restow	1.865	3%
Empties	23.851	38%
<b>Total</b>	<b>62.516</b>	<b>100%</b>

Source: MIPS

#### 4.2.2 Development in time

The container throughput of Maputo shows a strong annual increase of 16% over the period 2001 – 2007. Transit exports show an above average growth of 23%, while the largest category of national imports show a below average growth of 14%.

Table 4.4 Development of container throughput of Maputo by category

year	imports		exports		cabot.	restow.	empties	total	ann. growth
	national	transit	national	transit					
2001	12,639	547	1,097	4,418	1,669	1,214	10,841	32,425	13.8%
2002	13,041	79	868	4,732	1,621	1,075	13,594	35,010	-65.0%
2003	13,635	443	1,323	5,198	2,202	1,028	15,657	39,486	25.3%
2004	17,966	0	1,749	6,228	1,682	862	15,862	44,349	23.2%
2005	20,131	8	2,901	8,947	2,403	898	18,800	54,088	-5.5%
2006	21,746	1	3,746	9,913	1,394	1,865	23,851	62,516	16.1%
2007	27,458	1	4,249	15,484	1,192	2,972	28,991	80,347	17.8%
<b>average</b>									<b>16.3%</b>

Source: MIPS

#### 4.2.3 Competing ports

In 2006 the MIPS container terminal had an annual throughput of 62,500 TEU or 595,000 tons. In the same year Durban had a throughput of 1,860,000 TEU or 22,000,000 tons.

The container ports of the Mombasa - Cape Town range have a total throughput of 4.5 million TEU. See table 4.5. The data on containers clearly show the dominance of the South African ports with 78% of the total and the small share of 3% of the Mozambican ports.

Table 4.5 Container throughput by port in the Mombasa – Cape Town range in 1000 TEU (2006/07)

Port/Country	1000 TEU	Share in %
Nairobi	479	11%
Dar es Salaam	353	8%
Nacala	34	1%
Beira	54	1%
Maputo	63	1%
Mozambique total	151	3%
Richards Bay	3	0%
Durban	2,335	51%
East London	42	1%
Port Elisabeth	407	9%
Cape Town	765	17%
South Africa total	3,552	78%
<b>Total</b>	<b>4,535</b>	<b>100%</b>

Not included are some smaller ports

Source: Containerisation International and national sources

#### 4.2.4 The competitive position at present

The costs of the competitive routings of Maputo can be assessed by adding the costs of inland transport, cargo transfer in port and maritime transport. This is done for the exports of 20 ft containers in transit to the Far East for a number of inland origins in Southern Africa. After adding up all costs per routing, the routings via Maputo are set against those via Durban. A description of the costs per element of the chain can be found in Section 2.3 “Costs of logistics chains”.

Road and rail transport via Maputo is cheaper for most inland origins with the exception of road transport from Johannesburg. Despite the longer inland distance of a shipment from Johannesburg via Durban, the higher likelihood to get return cargoes makes the Johannesburg – Durban route cheaper.

With respect to port costs the Maputo routing is cheaper as well. The high cost of the Maputo routing is caused by the maritime transport part of the routing. The lack of mainline connections makes feeder transport necessary, resulting in an extra cost for the connection of USD 400 per 20 ft container on average<sup>7</sup>. The comparison of the total costs per routing in Table 4.6 shows that container shipments via Maputo are in most cases more expensive than those via Durban.

The cost advantage with respect to inland transport and port charges is eroded by the additional feeder costs. Only for options with road transport for origins such as Polokwane and Swaziland there appears to be an advantage. The present low volume of

<sup>7</sup> The costs of feeder transport are about USD 700 per 20 ft container. This, the amount of USD 400 involves some cross-subsidisation from direct to indirect shipments. In a recent presentation by MCLI the difference is noted to be about USD 285. This makes that cost difference for shipments from the Witbank – Nelspruit range shift to the advantage of Maputo.

transit export of 18,000 TEU in 2007 against more than one million TEU for Durban<sup>8</sup> is the result.

The scanning charge is USD 25 per container and amounts to 20% of the costs disadvantage of the Middelburg/Witbank area and 15% of the Nelspruit area.

Table 4.6 Cost of competitive routings for containers in USD per 20 ft container (under present circumstances)

Container table	Road		Rail		Additional costs Maputo	
	Maputo	Durban	Maputo	Durban	Road	Rail
<b>A. Inland transport costs</b>						
City Deep/Joburg	1,075	625	296	337	450	-41
Middelburg/Witbank	875	1,111	243	367	-236	-124
Nelspruit	875	1,063	177	370	-188	-193
Pietersburg/Polokwane	625	1,563	286	437	-938	-151
Swaziland	625	1,288	-	-	-663	0
Bulawayo	-	-	435	687	0	-252
Harare	-	-	503	744	0	-241
<b>B. Port costs</b>	292	333	292	333	-41	-41
<b>C. Trade with Asia</b>						
Export rates	2,304	1,604	2,304	1,604	400	400
Import rates	3,840	3,140	3,840	3,140	400	400
<b>D1 Total costs exports</b>						
City Deep/Joburg	3,671	2,562	2,892	2,274	809	318
Middelburg/Witbank	3,471	3,048	2,839	2,304	123	235
Nelspruit	3,471	3,000	2,773	2,307	171	166
Pietersburg/Polokwane	3,221	3,500	2,882	2,374	-578	208
Swaziland	3,221	3,225	2,596	1,937	-303	359
Bulawayo	2,596	1,937	3,031	2,624	359	107
Harare	2,596	1,937	3,099	2,681	359	118
<b>D2 Total costs imports</b>						
City Deep/Joburg	5,207	4,098	4,428	3,810	809	318
Middelburg/Witbank	5,007	4,584	4,375	3,840	123	235
Nelspruit	5,007	4,536	4,309	3,843	171	166
Pietersburg/Polokwane	4,757	5,036	4,418	3,910	-578	208
Swaziland	4,757	4,761	4,132	3,473	-303	359
Bulawayo	4,132	3,473	4,567	4,160	359	107
Harare	4,132	3,473	4,635	4,217	359	118

Note: A negative figure indicates lower costs for Maputo routing

#### 4.2.5 Possible development in the future

The cost comparison concerns the container transport environment in Maputo as it exists now, which is characterised by a low level of maritime container traffic, an absence of

<sup>8</sup> It may be assumed that a substantial part of the container throughput of Durban of 2.5 million TEU, is generated by the areas of Gauteng, Mpumalanga and the northern provinces. The one million TEU is certainly not too high.

dedicated container block trains and a disadvantageous situation with respect to return cargoes. All together these characteristics lead to high cost per unit.

There appears to exist a vicious circle: at one side the low level of container trade leads to high transport costs while at the other side the high transport cost leads to a low level of trade. To some extent the low level is caused by physical and administrative factors such as the capacity restrictions of the Ressaño Garcia Line and delays in border crossing due to customs procedures. The ongoing programme to improve these factors will make it easier to break the vicious circle.

In its most recent forecast MPDC foresees an annual increase of 14 to 16% for the period up to 2017, which compares rather well with the growth of 16.3% as experienced over the period 2001-2007. This will lead to an annual throughput level of 325,000 TEU in 2017. See table 4.1. A new masterplan study, commissioned by Dubai World Ports, analyses the consequences of a potential of 1 million TEU. Both studies are signs of the belief of important stakeholders, that Maputo has a greater potential. This implies that the vicious circle can be broken resulting in lower maritime and inland transport costs. It should be noted that strong increases of local container demand will also be a stimulus for breaking the vicious circle.

#### 4.2.6 The competitive position in the future

The competitive position is also assessed under the alternative assumptions. The first assumption is that the increase in container trade over time will lead to more direct calls of liner services. This will put pressure on the freight rates of lines requiring feeder transport and as a result freight rates will go down. At present these rates are USD 400 higher for services requiring transshipment now and then. It is assumed that the difference will be reduced from USD 400 to USD 100 per 20 ft container.

The second assumption is that regular container block trains will connect Maputo with City Deep, Middelburg/ Witbank and Nelspruit reducing railway costs with USD 100 per 20 ft container.

It appears that the additional costs of the Maputo decrease, leading to a situation where the Maputo routings become cheaper for most inland origins. See table 4.7.

Table 4.7 Cost difference of competitive routings for containers in USD per 20 ft container (under possible future circumstances)

Total costs exports	Cost difference		Share scanning charge	
	road	Rail	road	rail
City Deep/Johannesburg	509	-82	5%	-31%
Middelburg/Witbank	-177	-165	-14%	-15%
Nelspruit	-129	-234	-19%	-11%
Polokwane	-878	-192	-3%	-13%
Swaziland	-603	59	-4%	42%
Bulawayo	59	-193	42%	-13%
Harare	59	-282	42%	-9%

Note: A negative figure indicates lower costs for Maputo routing

### 4.3 Sugar exports

Sugar in bulk is exported by South Africa, Mozambique and Swaziland and is expected to increase over the years. MPDC foresees an increase in the throughput volume of 6.4% annually. South Africa is in a position where it is both importer and exporter with a surplus for the northeast part of the country.

At present the export of sugar in bulk is restricted by the capacity of the STAM terminal, which has specialised equipment to handle and store raw sugar. The capacity will be expanded in the nearby future. The raw sugar is transported by rail via the RG Line (South Africa, Nelspruit area), the Goba Line (Swaziland) and the Limpopo Line (Zimbabwe). Domestic sugar accounts for 20% of which 30% is carried by rail. The improvement of the RG Line will strengthen the position of Maputo versus Durban.

From South Africa, TSB Sugar has 160,000 tons to be carried annually, divided 50/50 over rail and road, all transported through Maputo. The season is from December to May. The volumes can be increased to 200,000 tons annually, if needed. All sugar is shipped through Maputo from their factories in Malelane and Komatipoort. Production can increase slightly, but the export volumes are influenced by the development of local consumption and also by imports such as from Brazil.

At present the block trains are working well, while trucks lose some time at the border leading to problems in their turnaround time.

Sugar is shipped by bulk carriers of 25-40,000 dwt in full ship loads. The exports go to:

- Northwest Europe 50%
- South Europe 40%
- Far East 10%

The comparison of the cost for three origins in South Africa shows the advantage of the Maputo routing compared to the Durban routing. For bulk sugar the scanning charge is USD 0.62 per ton, which is a small part of the cost advantage of the three locations in South Africa.

Table 4.8 Cost of competitive routings for sugar per rail in USD per ton

	Maputo	Durban	Additional Cost Maputo
Malelane	9.5	41.5	-32.0
Komatipoort	7.2	36.6	-29.4
Matsapha/Mbabane	12.2	33.6	-21.4
Port	10.3	11.9	-1.5
Sea	50.2	47.0	3.2
Total costs by inland origin			
Malelane	70.1	100.4	-30.3
Komatipoort	67.7	95.5	-27.8
Matsapha/Mbabane	72.8	92.4	-19.7

Note: A negative figure indicates lower costs for Maputo routing

Representatives of TSB informed us that they ship sugar from Durban to Cape Town by sea, as this is cheaper than by rail. They tried to do the same with a shipment of 50,000 tons of sugar from Mpumalanga via Maputo to Cape Town. In practice it appeared that there were too many add-on costs in the port before getting the sugar on the ship, amounting to about USD 440 per ton. Therefore they decided not to proceed with this trial.

Bagged sugar is coming from Swaziland and some from Zimbabwe. Most is exported to the Coca-Cola factory in Mombasa by liner ships. Quantities are expected to remain constant.

#### 4.4 Coal exports

South African exports of heating coal are an important market for the port of Maputo. The volumes come from the Witbank area, which is well located for using Maputo as there is a distance advantage. With respect to transport costs the situation is different. The big mining companies have jointly invested in a transport system from the mines in South Africa to Richards Bay, thereby fully utilising economies of scale in rail transport, storage, transfer in port and access for large deep-sea vessels. Note that in 2006 Richards Bay handled 80 million tons of dry cargo of which coal has the major part. The ports of Maputo and Durban offer no alternative for this large scale type of operations.

There are, however, niches in the coal market where Maputo has carved out its position; such as the market of sized coal for household purposes. The strong growth of the world coal market leads to increases in South African exports which are congesting/straining the logistic export system via Richards Bay. The mine operators cannot increase the capacity of this system in the short term.

The coal shipped through Maputo and Durban is coming from a number of small coal mines around Middelburg in Mpumalanga, where traders organise export shipments of single ship loads of 40-45,000 tons. In this market Maputo and Durban are competing, where Maputo has the advantage of lower railway costs and Durban the advantage to

better receive coal carriers (in Maputo ships with the same maximum draft have to use high tide to leave the port) and have better handling and storage facilities. One interviewee stated that they transport 2/3 of their sized coal through Maputo, the rest being transported through Durban.

In interviews it was stated that Maputo has a small cost advantage compared to Durban of about USD 2 per ton. See table 4.9.

Table 4.9 Costs of coal routings in USD per ton

	Maputo	Durban	Additional cost Maputo
Rail transport	15.6	21.6	-6.0
Transfer in port	11.0	7.1	3.8
Maritime transport	42.0	42.0	0.0
Total	68.6	70.8	-2.2

Note: A negative figure indicates lower costs for Maputo routing

In the past the volume of coal shipments via Maputo has shown no increase due to capacity restrictions caused by ongoing improvement works on the Ressano Garcia Line. As CFM is finalising the present program of improvements, the railway capacity will increase and Maputo is expected to increase its market share. In its newest forecast MPDC expects an increase from the annual volume of 850,000 tons at present to 3 million tons for 2017.

For coal exports the scanning charge is USD 0.20 per ton, which is 9% of the cost advantage of coal.

## 4.5 Magnetite exports

### 4.5.1 Present situation

Magnetite is a low value iron ore, a by-product of copper ore milling. Until recently it had practically no market value, but this has changed recently because of the increase in world demand by countries such as China. The mines of Phalaborwa Mining Company (PMC) and Phoskor both located near Phalaborwa provide an important market for Maputo.

The low value makes only transport by rail economically viable. The RG line to Maputo takes 7 trains per week, but has shown no growth possibilities for years, while there was sufficient demand. Richards Bay takes 10 trains a week, which is up from a few trains per week few years ago because of the ongoing improvement works along the Phalaborwa-Nelspruit connection.

In the past there were periods that PMC exported all magnetite through Maputo. Since 1978 exports were shifted to Richards Bay for political reasons. Since 2003 exports



through Maputo restarted. PMC's export volume currently is about 1.5 million tons annually, divided about 50-50 over Maputo and Richards Bay.

The routing via Richards Bay goes through Komatipoort and Swaziland, resulting in a much longer distance than Phalaborwa-Komatipoort-Maputo. The difference is  $895-374 = 521$  km. This longer distance cannot be compensated by lower cost trains, so that the costs of the Richards Bay routing should be higher. PMC staff stated that the cost of rail transport via both routings is about the same, implying a high degree of subsidisation on the South African side. The cost comparison presented in Table 4.10, without subsidy of railway costs in South Africa, indicates that the Maputo routing is much cheaper.

In Maputo there is one loader and PMC has to compete for a single berth with the coal exports. The maximum consignment size is 60,000 tons using the high tide for outgoing vessels. Richards Bay has more berths, three loaders and better equipment and PMC has an own stockpile of 200,000 tons in this port. The consignment size in Richards Bay is 75,000 tons.

For magnetite the scanning charge is USD 0.20 per ton, which is with 1% a small part of the cost advantage.

Table 4.10 Costs of magnetite routings in USD per ton

	Maputo	Richards Bay	Add. Maputo
Rail transport	24,0	44,8	-20,7
Transfer in port	6,0	7,1	-1,2
Maritime transport	42,7	41,9	0,8
Total	72,7	93,8	-21,1

Note: A negative figure indicates lower costs for Maputo routing

#### 4.5.2 Future development

PMC has a stockpile of 240 million tons in Phalaborwa which can be sold on the world market and to China in particular. PMC has plans to sell this magnetite. Phoskor is in a similar position and has a stockpile of 43 million tons. Phoskor has put the stockpile on sale and is asking interested parties to invest in the required logistic system.

At present all magnetite is carried by rail, but price curves appear to indicate that the price will come down at some point, to a level where rail transport is no longer viable. Currently, 82% of the FOB price is rail transport. The current contract is with China National Minerals, China's base metals trader. It is in its second of three years. Short term plans are to increase the export volume to 3.5-4 million tons (by 2010), all on rail.

The rail infrastructure between Phalaborwa and Maputo needs some improvements, but no major capital investments. Main problem is the lack of efficiency, not the often mentioned lack of equipment. If wagons would be turned around quicker, there would not be a need for more rolling stock.

In the longer run, PMC has plans to construct a hydraulic pipeline to Maputo, allowing for an annual export of 10 million tons at a low operational cost through Matola. This is purely aimed at capitalising on the 240 million ton stockpile. Prefeasibility studies have already been done. The pipeline should be ready by 2013/2014, when the iron ore price is expected to drop below the level at which rail transport is no longer viable. The pipeline will follow the rail route more or less.

It can be stated that magnetite offers a great potential for the port of Maputo. MPDC foresees growth rates of about 12.5% from the present level of 0.7 million tons to some 2.5 million tons in 2017. If the expansion plans of the port will materialise the ships involved could be Panamax or even larger.

## 4.6 Citrus exports

Citrus is a high value product coming mainly from Mpumalanga. Transport costs are not that important, but rather the regularity of the entire transport chain. Throughput volumes have decreased the last few years from 106,000 tons in 2004 to 65,000 tons in 2006, but are expected to increase again with 8.7% annually to 2017. Expansion plans exist, as the current capacity is limited. The ships exporting to the Far East are 6,000-12,000 dwt reefer ships with reefer chambers.

Annually some 800,000 pallets are exported from Mpumalanga. One pallet equals one ton. The season runs from April to September. There is a growth of about 10% per year. One third of the trade goes to Japan and given the phyto-sanitary requirements of this trade, this cannot go through Maputo. On land all is transported ambient and cooled in the port for transport by sea. Therefore feeding via Maputo is not possible. The potential for Maputo is 400-500,000 pallets.

The exports are by container and break-bulk ships. Only 100,000 pallets, i.e. 12.5% of the Mpumalanga production, is shipped through Maputo. The reasons of this low share are:

- Not enough break-bulk ships
- Not sufficient container capacity
- Feeder shipping not acceptable, not because of costs but because of the time involved.

Facilities in Maputo need to be upgraded: in Matola and Maputo (FPT). At present 20% goes by rail which concerns the citrus from Letsitele in the Phalaborwa region. The remainder in South Africa goes by road.

In general Transnet used to concentrate on big volumes thereby overlooking products such as citrus. Now it is also looking to more at attracting high value trades such as citrus.

An example presented by MCLI compares the cost of the Maputo and Durban routing for citrus exports in a slightly different form. See table 4.11. The Maputo routing is cheaper for the road routing and the Durban option for the rail routing. The lower railway rate for Durban most likely relates to the pricing practices of Transnet favouring the use of the port of Durban. See also with magnetite exports.

Table 4.11 Costs of citrus routings in USD per pallet

	Maputo	Durban	Additional cost Maputo
road transport	43.8	61.3	-17.5
rail transport	53.9	40.4	13.5
cargo dues	0.0	10.5	-10.5
container scanning	0.8	0.0	0.8
freight surcharge	8.8	0.0	8.8
total road	53.3	71.8	-18.5
total rail	63.4	50.9	12.5

Note: A negative figure indicates lower costs for Maputo routing

Source: MCLI Presentation of May 6, 2008

## 4.7 Steel products

In 2004 some 49,000 tons of steel products were handled in Maputo, which increased to 88,000 tons in 2006. Most of it is produced by factories around Witbank in Mpumalanga, but the trade also includes also some steel products from KweKwe in Zimbabwe. For steel products, Maputo is in competition with Durban and Richards Bay. MPDC forecasts an annual increase of 10% to 2017, due to improvements in the railway connections. The products are carried by multi-purpose ships of 18,000 to 30,000 dwt such as those of Messina Lines.

In the near future there will also be Mozambican imports and exports from a new steel plant in the Free Zone of Maputo, which is planned for by Capital Star from a South African-Chinese consortium.

Columbus Stainless (CS) in Middelburg produces stainless steel in coils, sheets/plates and slabs, all with a high value of USD 4300 per ton. Maputo, Durban and Richards Bay are all used for their exports in containers or as break-bulk. Their monthly export volume is about 55,000 tons.

CS exports to all part of the world and their strategy is to be flexible in their choices. They have developed an information system supported by a vast database on logistics costs in order the quickly decide to ship in break-bulk or in containers, to use Durban, Maputo or Richards Bay, to transport to port by rail or road and to load containers at factory or in port.

They state that the problem with Maputo is the lack of shipping connections. For containers to the Far East MOL is only one with direct calls and for break-bulk to Italy Messina is the only one with one call per month.

In October 2003, CS made their first shipments through Maputo, but there was no real growth since then. Their aim is 10,000 ton per month, but currently it is around 3,000 tons. They expect improvements as a result of the impact of the Maputo Corridor Logistic Initiative leading to lower hinterland transport costs. Durban profits from imports for

Columbus of about 250-300 boxes per month. These are used to send products back along the same corridor. Maputo lacks imports to South Africa and therefore always has an empty return leg when exporting through this port.

Containers are mostly 20 ft and sometimes 40 ft as they come in on imports. Columbus Stainless operates own warehouse in Durban. Annual growth in demand for stainless steel varies worldwide from 6 to 9%; Columbus Stainless experience a growth of 6%. For steel products the scanning charge is USD 0.60 per ton. As stainless steel is carried by container the same conclusions apply as for containers. See table 4.6 and 4.7. The present low volume of 3,000 tons per month in Maputo on a total export volume of 55,000 tons is very low, but it is surprising given the costs of the Maputo and Durban routings.

## 4.8 Ferro chrome and chrome ore exports

Ferro chrome is used for the production of stainless steel. Large deposits of chrome ore are found in South Africa (Mpumalanga, Witbank, Nelspruit and Middelburg) and Zimbabwe (around Harare). From Zimbabwe it is all shipped through Mozambique and mainly by rail via the Limpopo Line. Dredging problems in Beira have decreased its share, limiting it to only a small share which is transported to the port by road. From South Africa the major share is shipped through Richards Bay and smaller volumes go in containers via Durban. MPDC forecasts a 12% growth rate for the period until 2017, resulting from a combination of an increase of the market volume and of the market share of Maputo.

The chrome ore is carried in bulk carriers of 25-40,000 tons to the Far East. The comparison of chrome ore exports from the Nelspruit region to the Far East is given in table 4.12 and shows that the Maputo routing is clearly cheaper than the Durban routing, only the costs of maritime transport are higher because of the longer time spent in port. Two parties involved in ferrochrome exports stated shares in the Nelspruit region generated ferrochrome for Maputo of 33% and 50%, respectively. The share of Maputo for ferrochrome generated in the Rustenburg area is negligible to small (10%).

Table 4.12 Costs of chrome ore routings in USD per ton

	Maputo	Durban	Add. Maputo
Road transport	30.5	40.4	-9.9
Transfer in port	17.9	22.0	-4.1
Maritime transport	85.9	84.2	1.7
Total	134.3	146.6	-12.3

Note: A negative figure indicates lower costs for Maputo routing

For chrome ore and ferrochrome exports the scanning charge is USD 0.75 per ton, which is a small part of the cost advantage. This applies to all locations in the east of Mpumalanga. For the locations in the Rustenburg area the situation is different; here the Maputo routing is not competitive. This, however, can change, if the railway connections improve. The same mechanism applies as discussed with respect to the block trains between City Deep and Maputo.

## 4.9 Imports of cereals

### 4.9.1 Wheat and maize in bulk

The majority of wheat and maize is imported from the US and Canada at the specialised berth and silos of STEMA, for domestic needs and the needs of Zimbabwe and Malawi. MPDC expect the volume to increase from 70,000 tons in 2006 to 194,000 tons in 2017, i.e. a growth rate of about 10% per year.

The imports are in consignments of 7,500 – 20,000 tons in bulk carriers of 25,000-50,000 tons. Competition from Beira applies for Zimbabwe. Given the draft limitations in the port of Beira at present, Maputo is in an advantageous position. For grain in bulk the scanning charge is USD 0.75 per ton.

### 4.9.2 Wheat and maize in bags

This concerns food aid of about 10,000 tons and handled via the STEMA terminal. These shipments have an irregular character.

### 4.9.3 Rice in bags

The imports from the Far East are Mozambican imports. Typical consignments aboard vessels are 18,000 tons, of which 10,000 tons are discharged in Maputo and 8,000 in Beira. MPDC expects no increase of the present volume in Maputo of about 250,000 tons per year. It is carried in general cargo ships of 12-18,000 dwt.

## 4.10 Timber products

### 4.10.1 Woodchips exports

Woodchips are made of timber from South Africa. A new plant will start production in 2009. MPDC foresees a strong increase from the present low level of about 10,000 tons to 150,000 in 2008, thereafter gradually increasing to a level of 350,000 tons in 2012 and onward.

South Africa exports timber and wood pulp via Durban from areas significantly nearer to Maputo such as Nelspruit and other locations in the Limpopo province. Future volumes depend on:

- South African export market growth
- Improvement of land transport to Maputo
- Construction of a woodchip plant in Maputo.

At present, the wood pulp exported via Durban is mainly in containers, whereas the Maputo share is in bulk with bulk carriers of 42-48,000 tons.

#### 4.10.2 Timber bundles

MPDC foresees a market of transit imports of timber for construction in South Africa. Starting in 2008 from nil it is expected to gradually increase to 107,000 tons in 2017. Timber bundles are carried by bulk carriers of 18-25,000 dwt.

Transit imports and export of wood products in the form of woodchips, timber bundles and logs are an important market for the port of Maputo. The market share can increase for the same reasons as discussed above for other products such as magnetite and citrus.

### 4.11 Dry bulk

#### 4.11.1 Clinker imports

Cement is produced by Cimentos de Mozambique with factories in Matola, Dondo and Nacala. The factories are struggling to meet demand. Clinker is imported from India. MPDC expects no increase of the present volume of about 95,000 tons per year by small bulkers of 35,000 dwt. The throughput of clinker is a captive market for Maputo.

#### 4.11.2 Other dry bulk

This concerns transit import/export such as gypsum, sulphur, bulk fertiliser, phosphates and metallurgical coke. They showed strong fluctuations from 2004 to 2006. MPDC expects an increase from 41-280,000 tons at present with annual modest growth rate from the trend level of 100,000 tons increase to 196,000 tons in 2017.

### 4.12 Break bulk

#### 4.12.1 Aluminium billet exports

MPDC expects to get a new trade with level of 150,000 tons from 2012 onward, if phase 3 at Mozal will start, which is speculative. The billets are transported on pallets of 1.5 tons. The trade concerns the overflows of the Mozal terminal.

The alumina factory is established in Maputo mainly because of the availability of cheap hydro-electric energy of the Cabora Basa dam and the recent availability of natural gas. Incoming cargoes are one million ton of alumina from Australia, petcoke from Japan and chemicals from all over the world. Outgoing cargoes include 700,000 ton of billets.

MPDC expects a constant flow of goods, as the capacity of the terminal and production plant are fixed. The imports of alumina are in Panamax ships in consignments of 55,000 tons. Coke and chemicals are imported from all over the world in smaller consignments. About 700,000 tons of billets are shipped by liner vessels of 18-30,000 tons by Gearbulk and MACS. The port throughput generated by the Mozal plant is a captive market for Maputo.

#### 4.12.2 Granite exports

Granite exports concern transit exports from Zimbabwe and South Africa. They are taken by ships of 15-25,000 tons, predominantly as ballast cargo.

#### 4.12.3 Car terminal

The car trade concerns about 50/50 imports to South Africa and export from car factories in the Johannesburg area. Furthermore some small volumes of (mainly second hand) cars are imported for Mozambique.

The car terminal has potential for South African transit imports and exports, but currently these are hampered by the bonds that are required to transport cars through Mozambique. According to interviewees, Customs require bonds of 80% of the value for transit vehicles, and it is difficult to get these bonds acquitted. If this issue could be solved, the estimated potential volume of cars would be around 30,000 units per annum.

#### 4.12.4 Other dry break-bulk cargo

This concerns transit imports of construction materials, cement, steel, bricks, chemicals and project cargoes. MPDC expects a strong increase from the current annual 50,000-100,000 tons at present to 667,000 tons in 2017. This means an annual increase of 20%. The goods are carried by general cargo ships of in between 18,000 and 40,000 dwt.

### 4.13 Petroleum products and other liquid bulk

There is no refinery in Mozambique and therefore all products such as petrol, diesel and jet fuel have to be imported. The vessels used are around 32,000 dwt.

#### 4.13.1 Petrol pipeline project

##### *The project*

Plans exist to construct a pipeline to South Africa with a capacity of 3.5 million m<sup>3</sup> of petrol and diesel per year, the Petrol pipeline project. It would include a 150,000-200,000 tonne storage depot in Matola. The pipeline is to link to receiving stations in Nelspruit and Kendal, linking to the existing South African network at the latter. A new pipeline is also

being constructed from Durban, due to be available in 2012. South Africa prefers to have two import pipelines, for strategical reasons.

The project's first phase of 3.5 billion m<sup>3</sup> capacity is to be online by 2010. Further upgrades to 5 million m<sup>3</sup> are optional in the future, but these would require an extra berth at Matola. The Government of Botswana has already indicated its interest in transporting 1 million m<sup>3</sup> per annum. Most products are expected to come from the Middle east and Singapore.

The liquid bulk berth at Matola is being upgraded to receive

#### *Impacts on transport and logistics*

Initially, the products are to be received in 30,000-35,000 vessels, that need a draft of 11.5m. 100 vessels a year are expected, compared to the current Maputo total of 750, of which 25 tankers. The berth at Matola is being upgraded (to be ready by mid 2009), as it now has limitation of receiving 30-35,000 vessels only at high tide. Later on, a expansion to 13.5 or 14m is foreseen, to allow for Panamax vessels. This however, depends on the amount of capital and maintenance dredging needed. Dredging inside the port is the responsibility of MPDC, the approach channel is the responsibility of CFM. The Polana channel (the approach) now is 100m wide, but this should become 150m to allow for two lane traffic. Also, the turning circle near Matola may be too small for larger vessels.

The cost difference with competing port of Durban is not large. Durban calls currently result in an average demurrage of 4 days, at about 32,000 usd/day. Maputo has no congestion problems in the near future. The oil product berths in Durban are 11.5 to 13m, again not that different from Maputo.

#### 4.13.2 Bulk liquids

A new tank farm has been constructed near MIPS for exports and imports and transit of vegetable oils, chemicals, molasses, palm oil (from Malaysia), soya (from Argentina). It is carried by tankers of 35-40,000 dwt with parcels of 5000 tons.

### 4.14 Competitive position with respect to Zambian foreign trades

Insight in the role of transit of Zambia can be obtained from World Bank sponsored research<sup>9</sup>. The foreign trade of Zambia amounts to 2.3 million tons of imports and 1.6 million tons of exports. Of this 64% is with other African countries and with South Africa (45%) in particular.

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<sup>9</sup> 'The Impact of Regional Liberalization and harmonization in Road Transport Services: A Focus on Zambia and lessons for Landlocked Countries', Policy Research Working Paper 4482, Gael Raballand e.a., The World Bank, Washington DC, January 2008.



At present there are routings of foreign trade via Dar es Salaam, Durban and Beira and some negligible volumes via DR Congo. When looking at distances Beira offers the shortest distance and Durban the longest. As far as costs are concerned, the Dar es Salaam routing is the cheapest for both containerised and non-containerised cargoes. The Durban routing is the most expensive one. See table 4.13.

The unit costs differ strongly per routing indicating that the distance advantage of Beira is lost against a high unit cost. For the other routings Durban has lower unit costs for containers, but a higher one for non-containerised cargoes. The picture is not complete as maritime costs and transfer in port are not included. The low share of Beira reflects the high maritime costs in terms for both containerised and non-containerised cargoes. Beira's position with respect to shipping lines is weaker than Maputo's, as it has less direct lines calling. Given the limited draft its position with respect to bulk ships calling is also weaker. The small market share is not surprising. Durban has the highest costs with respect to land transport, but the best position with respect to maritime costs: good liner connections with Europe and the Far East better than for Daressalaam.

The port of Maputo plays no role for Zambian trade. The port does not have the same distance advantage as Beira has, while the slight advantage it has for liner shipping is by far not sufficient to attract some cargo via the Limpopo Line connection.

Table 4.13 Land transport costs and market share for Zambian foreign trades

Routing	Distance km	tariff non-container USD/ton	tariff container USD/TEU	tariff non-container USD/tkm	tariff container USD/TEUkm	Market share in total
Dar es Salaam	1970	65	1600	0.033	0.812	45.5%
Durban	3000	120	2040	0.040	0.680	47.8%
Beira	1400	100	1700	0.071	1.214	6.7%

Source: World Bank Policy Research Working Paper 4482

Note that tariff concerns the average of rail and road transport

## 4.15 Competitive position with respect to Swaziland foreign trades

Maputo is well located for Swaziland. The distance from Matsapha to Maputo by road is 200 km and to Durban 540 km. By rail the distances are practically the same. According to CFM statistics in 2006 there were 17,700 tons carried via Maputo and in 2007 nothing. For liner shipping the reason for the low share are the absence of direct liner shipping connections in Maputo. For export of sugar and wood products, which are carried by bulk ships, this is different and has Maputo a market share. The low figures for 2007 suggest that this role is weak. Most likely some exports are taken under Mozambican exports for statistical reasons.

In a study on the role of seaports for Swaziland it is stated that the weak role of Maputo for liner shipping will change if Maputo will get better liner connections<sup>10</sup>.

<sup>10</sup> Improving Transportation Logistics for Competitiveness of Swaziland, Stallard Mpata e.a., USAID, 2004

## 5 Overview competitive position

### 5.1 Cost difference and market share of Maputo routings

The cost of the various competing routings through the ports of Maputo, Durban and Richards Bay are given per port sector in Chapter 3. These costs concern maritime transport, cargo transfer in port and inland transport for the cargoes in the potential hinterland of Maputo. The costs concern the out-of-pocket costs of transport as mentioned in the previous section and do not include the storage carrying costs the cargo owner incurs with respect to transit time, service frequency and other quality of service elements. Generally, the latter costs are high for high value goods and low for low value ones.

The costs presented are rough indications of the real value and include error terms will be discussed later on. This means that cost differences are also subject to errors and, being differences, are even more sensitive. This requires a probabilistic approach implying that, if the cost of routing A is slightly more than the cost of routing B, routing A may still being selected in some cases. This effect resembles the observed practice that in most cases both competing routings are chosen.

From an analysis of seven exemplary transit cargoes it appears that the market share of transit cargoes ranges from negligible for cargoes such as containerised cargoes, to substantial for chrome ore from the Nelspruit area, sized coal from the Witbank area and magnetite from Palabora to 100% for sugar from eastern Mpumalanga.

As noted all data have inaccuracies: the cost data are quotations obtained from interviews and therefore may be biased; the data on market shares are inaccurate, as the size of the sector in South Africa may in some cases not fully be known. Per port sector the following observations can be made:

1. For **containerised cargoes** there is a strong variation in the quoted rates. The Maputo routings are more expensive than the Durban routings, with the exception of areas such as around Polokwane. The variation in railway charges is great, as it depends on the outcome of negotiations with TRANSNET and the road haulage industry. The variation in the sea freight is big, as it concerns the willingness of shipping companies to absorb feeder costs in the ocean freight for nearby ports<sup>11</sup>. The additional seafreight of Maputo compared to Durban is stated to be about

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<sup>11</sup> This in fact indicates the extent at which the cost of direct shipments cross-subsidise indirect shipments. For coast lines where the size of ports do not differ too much, there is a tendency to equalise the rates between ports of call and absorb feeder costs equally for all trades concerned.

USD 400 per 20 ft container, which difference resembles the additional feeder line costs and costs of double handling. In a recent presentation MCLI gave a somewhat lower of USD 285. If the latter figure would be applied the additional costs of the Maputo routing comes at close to zero for the major centres in Mpumalanga.

It can be concluded that under present circumstances the container routings via Maputo are generally more expensive and only in a few occasions cheaper. The latter explains why the share of the Maputo routing is small. For the assessment of the probability to select the Maputo routing later on it is assumed that the Maputo routing under present circumstances has the same price as the Durban routing for a 20 ft container. The market share of the Maputo routing is about 1%, being the share of 12,000 TEU in 2007 in a total of 1.2 million TEU<sup>12</sup> generated by Gauteng, Mpumalanga and Limpopo.

2. For the volumes of sugar exported from the factories east of Nelspruit the Maputo routing about USD 28-40 per ton cheaper . The market share of the Maputo routing is 100%, which seems quite logic.
3. For sized coal exports of the Middelburg area the Maputo routing is USD 2.2 per ton cheaper than the Durban routing. This difference includes losses of value related to the bad moisture conditions in Maputo. The resulting market share is 66%.
4. The Maputo routing is up to USD 21 per ton cheaper for magnetite exports of the Phalaborwa area. Maputo's market share is 50% and could be higher, if railway capacity would be sufficient. It was stated that TRANSNET is willing to set the tariff for Richards Bay equal to the tariff to Matola, despite the considerably longer distance via Komati Poort and Swaziland to Richards Bay.
5. Citrus exports from the Mpumalanga area are about USD 18.5 cheaper for the Maputo routing. The market share, however, is with 12.5% very. The scarce availability of shipping capacity is given as a reason. Note that for sanitary reasons citrus cannot be transhipped, limiting the availability of shipping services.
6. Columbus Stainless (CS) exports from Middelburg to all over the world in containerised and in break-bulk form. As for containers the prices vary strongly. CS also exports to regions such as the Mediterranean, where no feeder transport is needed which positively influences costs. CS states that it wants to keep the Maputo routing open and aims at a monthly export level of 10,000 tons from a present low level of 3000 tons on a total of 55,000 tons.
7. Ferry alloys and chrome ore in bulk from the Nelspruit area can be shipped USD 12.3 cheaper via the Maputo routing. The Maputo routing has a strong market share of 33%.

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<sup>12</sup> Based on the reasonable assumption that the northern area generates about half of the Durban's container throughput of 2.3 million TEU in 2006

Table 5.1 Land transport costs and market share for Zambian foreign trades

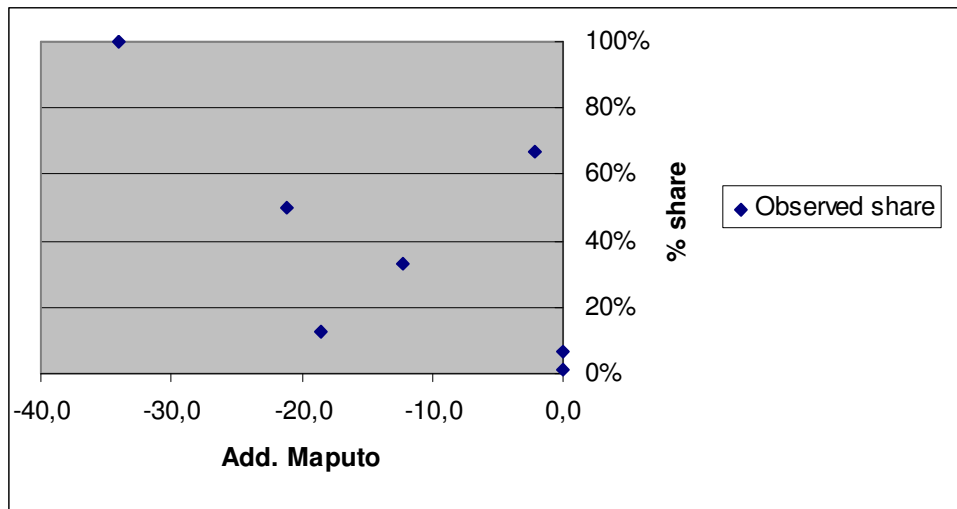
Port sector	Additional Maputo routing USD per ton	Volume Maputo 2006	Estimated market share	Comments
1 Containerized cargo Mpumalanga/ Gauteng	0	12,000	0.1%	Assuming lower MCLI rates
2 Sugar Komati Poort-Malelane	-28 to -40	-	100%	Absolute volume not known
3 Sized coal Middelburg area	-2.2	600,000	66%	As stated by one company
4 Magnetite Phalaborwa	0.0 -21.1	700,000	50%	TRANSNET appears to play with the rates
5 Citrus Mpumalanga	-18.5	68,000	12.5%	Low availability of shipping services
6 Columbus Stainless Steel	0	36,000	5%	According CS could be 20%
7 Ferro alloys and chrome Nelspruit area	-12.3	505,000	33%	

In figure 5.1 the market share of the Maputo routing within the sum of the Maputo and the Durban routing is set against the cost differences. From the graph it appears that the cheaper the Maputo routing, the higher is its market share.

Very roughly speaking, the points are located along a curve with the exception of the point of sized coal which shows, with a small cost advantage of USD 2.2 per ton, a high market share of 66%. This is in contrast with magnetite, where the market share is 50% with a cost advantage of USD 28 per ton. An explanation could be that the actual price of rail transport offered by TRANSNET is lower, shifting the point to the right. Another explanation is that a market share being closer to 100% cannot be accommodated as the capacity of the RG Line is limited. The market share of the Maputo routing is also low for citrus exports. In this case the explanation given is the scarce availability of adequate shipping capacity.

It can be concluded that apart from cost considerations the availability of rail and shipping services is an important element of port choice.

Figure 5.1. Market shares and routing cost advantages in USD per ton



## 5.2 Impact of costs on market share

To assess the impact of costs and quality of service aspects on market shares, it is needed to know the relationship between both. There are no studies available which have assessed such a relationship in the case of the southern African ports. The statistical basis of our observations on both is too weak to draw conclusion other than very rough indications.

On the basis of the observations a mathematical relationship is established between both by measuring the parameters of a simple Logit Model. This is done in Annex 3. The results show that a decrease in costs of the Maputo routings of one USD per ton will lead on average to an increase of on average of 2.6% of the Maputo routings.

## 5.3 Importance and impact of the scanning charge

The level and impact of the level of the scanning charge is studied at three level: its share in total port related costs, its share in the difference of port related costs between Maputo and its major competitor the port of Durban and its impact on the market share of Maputo.

### *The share in port related costs*

The share of the scanning charge in the total of all port related costs appears to vary from 1.2% for forestry products to 8.8% for citrus and grain and to be 8.6% for containers. See table 3.10. If the charges for empty containers, which are borne by the shipping companies, are distributed over loaded containers and added, the share would be the highest for containerised cargoes. It is assumed that the scanning charge applies for all cargoes, i.e. also cargoes carried by rail which are exempt till the end of 2008.

#### *The share in the difference of port related charges for Maputo and Durban*

For the assessment of the competitive position it is important to compare the charge with the difference between all port related charges in Maputo and Durban. As stated, port charges in Maputo are lower. The scanning charge appears to absorb a considerable part of this difference, varying from 4% for forestry products to 65% for grain and 61% for containers.

#### *The impact of the scanning charge on port choice*

The outcome of the statistical analysis in Annex C shows that a decrease in costs of the Maputo routings of one USD per ton will lead on average to an increase of on average of 2.6% of the Maputo routings. For transit cargoes the scanning charge is about USD 0.75 per ton. If the charge would be lifted, this would lead to an increase in the market share of 1.9%. In terms of the present throughput level of transit cargoes of 2.7 million tons this would lead to an increase of about 50,000 tons. It can be stated that this is not very great impact. It should be stated that the impact of the scanning charge on imports and exports of Mozambique, 60% of the total, is negligible.

## Annex A - List of references

- *A regional institution to focus on the optimisation of infrastructure investment to support regional cooperation & integration*, Maputo Corridor Logistics Initiative, presentation by Brenda Horne, 2008.
- *Case study: Success of the Maputo Corridor – a true transportation corridor creating an enabling environment for further investment and growth*, presentation by Brenda Horne, 2<sup>nd</sup> annual freight and logistics conference.
- *Developing the Maputo Corridor business potential – from a cluster perspective*, dissertation by Emmy Bosten, November 2005.
- *Financial report 2007*, CFM.
- *Maputo Corridor Summary Report*, Nathan Associates, March 2008.
- *Port Maputo – Yearbook & Directory 2008*, Maputo Port Development Company, 2008.
- *Port tariffs*, National Port Authority of South Africa, 4<sup>th</sup> edition, 1 April 2004.
- *Republic of Mozambique: Railways and Ports Restructuring Project – Transport Costs Study*, Jacobs Consultancy, December 2005
- *Scanning the plan*, African Business, August 1, 2006.
- *Study of Transport Costs and Prices in Sub-Saharan Africa – the South African Case*, presentation by Gaël Raballand and Patricia Macchi, Worldbank March 2008.
- *Tariff book of harbour dues and charges*, Tanzania Harbours Authority, 1<sup>st</sup> August 1999.
- *The economic impact of the high-level constraints on the Maputo corridor*, presentation by Brenda Horne and Dick Moore.
- *Throughput statistics containers 2001-2008*, MIPS.

## Annex B - List of interviews and meetings

### First mission – April 14-25, 2008

Date	Location	Organisation	Representatives
Tue 15 April	Maputo	Ministry of Transport	Mr. Sergio Cassamo, project manager
		CFM	Mr. Arun Pai, advisor to the board
		CFM	Mr. Adelino Mesquita, executive director
Wed 16 April	Maputo	CFM	Mr. Mads Tiemroth, financial consultant to CFM
		CFM	Mr. Osório Lucas, executive board director
			Mr. Adelino Mesquita, executive director
			Mr. Arun Pai, advisor to the board
		MoCargo	Mr. Manuel Amaral, managing director
			Mr. João Chiboleca, business development manager
Thu 17 April	Maputo	MPDC	Mr. Dick Moore, commercial director
		MIPS	Mr. Jorge Ferraz, managing director
			Mr. Pedro Pena, director of operations
Fri 18 April	Maputo	Maersk	Mr. Christopher Crookall, managing director
Sun 20 April	Maputo	MIPS	Mr. Jan Bekker, business development manager
Mon 21 April	Maputo	Manica	Mr. Ahmad Chothia, managing director
		Manica	Mr. Fernando Couto, operations manager
		CDN	Mr. Fernando Couto, Nacala manager CFM
Tue 22 April	Maputo	MIPS	Mr. Ricardo Roberts, commercial manager
Wed 23 April	Maputo	MPDC	Mr. Dick Moore, commercial director
			Mr. Ron Herman
Thu 24 April	Maputo	MCLI	Mrs. Brenda Horne



## Second mission – May 18-29, 2008

Date	Location	Organisation	Representatives
Mon 19 May	Johannesburg	Nomad Freight Transnet Freight	Mr. Simon Avis Mr. Herman Fourie, senior manager African trade
Tue 20 May	Rustenburg	Chrome Traders Xstrata	Mr. Marius Roothman, logistics director Mr. Sean Edwards, general manager marketing Mr. Gerrie de Jonge, logistics manager
	Pretoria	Petroline	Mr. Ian Barnard, senior project manager Mr. Russel Adams
Wed 21 May	Johannesburg	Coal Procurement	Mrs. Christina Schaeffner, financial manager
	Middelburg	Columbus Steel	Mr. Dirk Nell, senior logistics manager
Thu 22 May	Nelspruit	MCLI	Mrs. Brenda Horne
	Phalaborwa	Palabora Mining Corp	Mr. Brandon Swanepoel, manager concentrator prod. Mr. Basil Schaeffler, logistics manager
	Malelane	Citrus Growing Assoc TSB Sugar	Mr. Hoppie Nell Mr. Eben Maree
Fri 23 May	Komatipoort	Lebombo Dry Port Delta Clearing Röhlig-Grindrod	Mr. Piet van Dyk, manager Mr. Eddie Ferreira, marketing manager Mr. Rodney Cresswell, branch manager
Mon 26 May	Maputo	Ministry of Transport CFM South Kudumba Investment	Mr. Sergio Cassamo, project manager Mr. Joaquin Zucule, executive director Mr. Ghassan Ahmad, chief executive officer Mr. Gary Mitchell, training and airport dev. Manager Mr. Anastácio Banze, administration manager
		Autoridades Tributárias	Mr. Banze
		MPDC	Mr. Dick Moore, commercial director
		MIPS	Mr. Jan Bekker, business development manager
Tue 27 May	Maputo	Alfandegas MoCargo CFM	Mr. Gonçalves Mavanda, head of south region Mr. João Chiboleca, business development manager Mr. David Gomes, commercial director Mr. Fernando Mause, operations and comm. Advisor
		Kudumba scanning site	Mr. Stănică Enache, operations director (Kudumba) Mr. Anastasio Buque, head of customs port section

## Annex C Routing choice model

### *Routing choice determining factors*

The importers and exporter of the transit countries have a choice between the various routings offered to have their cargoes shipped. This choice of routing also involves a choice of port of transfer. An important element concerns the costs of the alternatives. Also important are quality of service aspects such as transit time, frequency of service and other elements. The transit time and service frequency applies to container services in particular: the need of transshipment in combination with service frequency quickly leads to an extra week for the Maputo routings. In Durban there is some port congestion leading to losses of time. These disadvantages are not discussed so far. This time element is in particular of importance for high value exports such as ferrochrome, stainless steel and some metals and imports of consumables such as electronics and capital goods. It practically is negligible for low value goods such as magnetite. Other elements influencing choice concern loss of value due to time such as occurs with sized coal exports through Maputo (5% of the value of coal due to specific situation) and sanitary conditions with some products such as citrus. All these aspects can be brought on a common denominator to be referred to as generalised costs.

### *Adoption of all choice determining factors under generalised costs*

The general costs could look like:

$$GC = C + a_1T + a_2 IAT + a_3OST + a_4LOSS$$

where:

GC: generalised costs

C: out-of-pocket door-to-door costs

T: door-to-door transit time

IAT: time between two consecutive departures

OST: average amount of time a shipment is off-schedule, i.e. too early or too late.

LOSS: loss of value

### *Deterministic versus probabilistic approach*

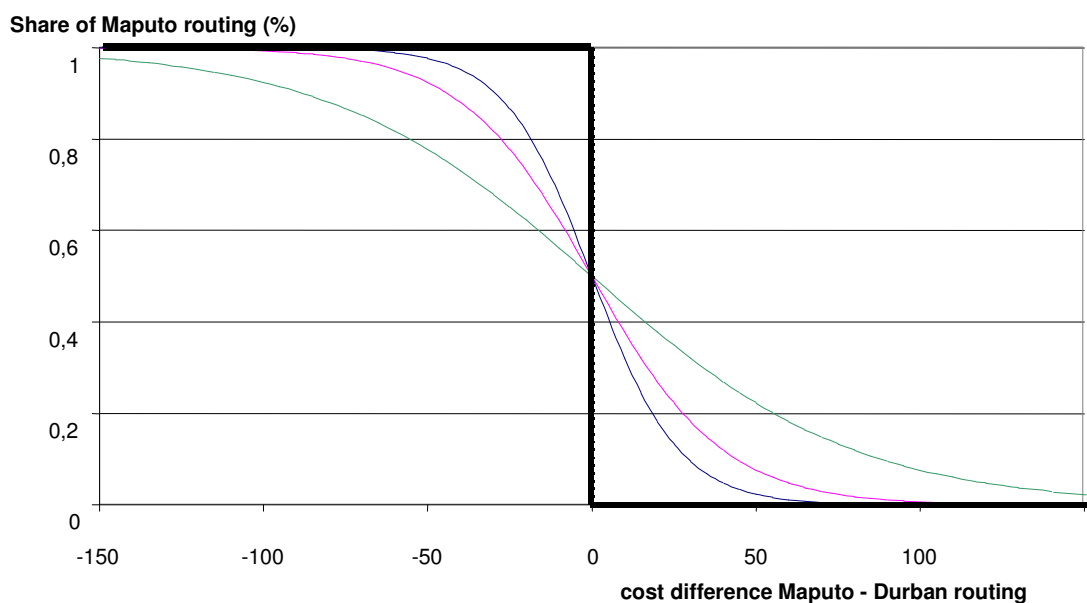
If a shipper is choosing between two alternatives, he can choose the cheapest alternative, i.e. the alternative with the least generalised cost. In a deterministic approach this is a choice of either alternative A or alternative B. If the generalised costs of alternative 'a' ( $GC_a$ ) are greater than the generalised costs of alternative 'b' ( $GC_b$ ), then alternative b is chosen; otherwise, alternative a is chosen. The choice is all-or nothing: either 'a' or 'b'. This is represented by the bold line in Figure A.1.

In the theory on transport choice behaviour there is a preference for a probabilistic approach, where the choice of an alternative is a function of the relation between the values of the generalised costs of alternative 'a' ( $GC_a$ ) versus alternative 'b' ( $GC_b$ ).

With this approach it is assumed that the values of generalised costs are measured on the basis of the observed set of values, which are an approximation of the real set of values. The shipper or receiver, whoever makes the choice, chooses from two alternatives 'a' and 'b' option 'a', if as mentioned above  $GC_a < GC_b$ .

The observed part of the generalised costs or utilities is a function of the attributes as given in the above equations and an error term  $\varepsilon_a$  and  $\varepsilon_b$ . If  $GC_a + \varepsilon_a < GC_b + \varepsilon_b$ , then the probability that 'a' is chosen  $P(a)$  is bigger than the probability that 'b' is chosen  $P(b)$ . The larger the difference, the larger the probability that alternative 'a' is chosen. See S-shaped lines in figure A.1.

Figure A.1 Market share of Maputo routing as a function of the generalised cost difference with competing routings



### The Logit Model

If it is assumed that the error term  $\varepsilon_a$  follows a so-called Gumbel<sup>13</sup> distribution and if this distribution is identical for all considered alternatives and that these distributions are mutually independent, then the probability that an individual decision-maker chooses option 'a' can be formulated as a Logit Model. The resulting S-shaped market shares curve of the Logit Model constrains the predicted market share between zero and one, is intuitively attractive and realistically describes the routing-switching behaviour of decision-makers. For an assessment of the advantages and disadvantages of the various types of demand choice models such as Logit and Probit see Oum<sup>14</sup>.

In chapter 5 an analysis is given of the relation between market shares and market share determining factors such as generalised costs and choice limiting conditions such as railway and terminal capacities. The resulting observations on market share and routing cost differences are given dotted point in figure 5.2. Given these points it is possible to

<sup>13</sup> Handbook of transport modelling, Edited by Hensher, D. and Button J., Volume 1, Pergamon, 2000, Both, C.R., Chapter 5, Flexible model structures for discrete choice analysis, p. 79

<sup>14</sup> Tae Hoon Oum, *Alternative demand models and their elasticity estimates*, Journal of transport economy and policy, May 1989

estimate the parameters of a simple Logit Model, only including the costs in given in the equation of generalised costs. This results in:

$$R = \exp(a + b.\Delta C)$$

Where:

R = ratio of probability of choosing Maputo routing versus other routings

a = constant indicating a preference for Maputo

b = coefficient of costs

$\Delta C$  = additional costs of Maputo routing in (lower costs for Maputo result in negative values)

Note that for the regression analysis we only used the costs and not the other elements of the generalised costs function. The coefficients a and b are assessed with regression analysis resulting in the following equation.

$$R = \exp(-3.91 - 0.21\Delta C)$$

The observed values of the port choice and the values calculated on the basis of the model are given in Figure A.2. The observed values are in blue and the calculated ones in red. The calculated values are based on the outcome of 6 observations only, so that the basis for conclusions is very narrow.

If the value of the constant would be zero, there would be no preference for Maputo and the ration would be one, which corresponds with a market share of 50%. Instead the negative value of -3.91 means, that the market share would be 2% instead, which indicates a strong preference for South African ports. Note that qualitative aspects such as transit time and service frequency are not yet included, which work in all cases to the disadvantage of Maputo and explain the low market share. Despite the inaccuracy of the figures they still show that the market share is very low on the basis of cost considerations only.

In Figure A.1 a number of curves are given showing different degrees of steepness: a steep curve corresponds with a high absolute value of the coefficient b and a flat one with a low value. The estimated value is -0.21. The resulting curve and the related points of observation are given in Figure A.2.

A decrease in the costs of the Maputo routings will lead to an increase in its market share. By decreasing the costs of Maputo routings with USD one per ton, the average market share of the six routings used in the statistical analysis will an increase with on average 2.6%. The greatest changes apply for the routings having a market share close to 50%, the steep part of the curve (magnetite) and the smallest change with the routings with for either a very high (sugar) or a very low market share (containers).

Figure A.2. Observed and calculated market shares of Maputo routing

