

**CONSTRUCTING A MARKET ACCESSIBILITY INDEX FOR SOUTH AFRICAN PRODUCTS
IN AFRICA**

BY

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Abstract

Public policy makers regard export development as an economic tool that enables a nation to increase employment, build overseas exchange reserves and ultimately create a higher standard of living. In order to realise these gains from increased exports, increased market access of a country's products into international markets is important. The need therefore arises to identify the constraints that prevent countries from exploiting their export potential. This study specifically focuses on measuring the market accessibility of South African products to African markets.

From the literature, the various constraints to market access into international markets are identified. These (quantifiable) constraints to market access are used in a principle components analysis to construct a market accessibility index (MAI) for South Africa. Three factors were identified which measure the market accessibility of a market. These include (i) an international factor (international shipping time and cost), (ii) a domestic factor (domestic time and cost, logistics performance index) and (iii) a barrier factor (*ad valorem* equivalent tariff and non-tariff barriers).

The most accessible African countries for South Africa are Swaziland, Lesotho, Malawi, Mauritius, Namibia and Botswana. The least accessible countries are Chad, Sudan, Equatorial Guinea, Sierra Leone, Algeria and Angola. For all the measures of market accessibility, except the international factor (time and cost of international shipment), the African countries on average perform worse than the world average. These observations underline the fact that one of the biggest impediments to trade in Africa is poor infrastructure and logistical problems.

Key words

Market access, tariffs, non-tariff barriers, trade logistics, South Africa, Africa.

1. Introduction

Increased market access is important for countries to realise the gains from increased exports, which include creating employment, building exchange reserves and ultimately creating a higher standard of living (Shankarmahesh, Olsen & Honeycutt, 2005:203; Edwards and Stern, 2007:1-22). Access to world markets allows firms to exploit scale economies, reduce unit costs and specialise (Reis & Farole, 2012).

According to the ITC (2011) a successful export effort requires an assessment of market access conditions when identifying market opportunities. The need therefore arises to measure the market accessibility¹ of different markets.

Furthermore, the importance of market openness for growth in Africa have been summarised by Azam, Fosu & Ndung'u (2002:190). The overall result of the more than 15 studies mentioned in Azam et al's study is that market openness has a positive effect on growth in African economies. Sachs & Warner (1997) also found that the lack of openness is the largest contributor to Sub-Saharan Africa's bad economic growth performance.

For the abovementioned reasons, this study specifically sets out to develop a market accessibility index (MAI) for South African products into the rest of the African continent.

In section 2 the literature overview identifies different constraints to market access and investigates the impact of these constraints on trade. These constraints to trade form the basis

¹ For the purposes of this article 'market accessibility' refers to tariffs and non-tariff barriers as well as trade time, trade cost and trade logistics.

of the MAI developed in this study, which is described in detail in section 3. In section 4 the main results of this study are provided.

2. Literature overview

A variety of constraints to market access exist and the impact of these constraints on trade has been widely researched. In Table 1, the studies from 2001 to 2011 on the different (quantifiable) trade constraints as well as the main findings in terms of the impact of these constraints on trade, are summarised.

Table 1: Literature overview on the (quantifiable) constraints to market access

Barrier to trade	Examples of support from the literature	Impact on trade ²
International shipping time per country and Domestic time to import	Djankov, Freund & Pham (2006:1)	Trade is reduced by more than 1% for each additional day that a consignment is delayed.
	Hummels (2001:2,4,21)	Each additional day in transit (ocean transport) will decrease trade between countries by 1% for all types of products, and by 1.5% for manufacturing products. Furthermore, each day in transit is worth 0.8% of the value of manufactured products. Shipping time of 20 days is therefore equal to a 16% tariff.
	Martinez-Zarzoso & Nowak-Lehmann (2007:424)	Transit times, especially road transport time have a significant and negative impact on trade flows.
International shipping cost per country and Domestic cost to import	Anderson & Van Wincoop (2003:4)	The tariff equivalent for transportation costs in industrialised countries is 21% (12% freight cost plus 9% for the time value of goods in transit).
	Baier & Berstrand (2001:1,23)	8% of the average post World War II world trade growth rate can be attributed to decreases in transport cost.
	Egger (2005:599)	A 1% decrease in transportation costs would cause a 0.6% increase in trade openness. The effect of reductions in transport costs on trade openness has significantly increased in the three decades since 1970. The reduction of transport costs is therefore becoming more effective over time.
	Hoffmann (2002)	Transport costs have a similar impact on trade as tariffs have due to the fact that they can impact on the competitiveness of an exporter. Compared to tariffs, transport costs have risen in the relative importance in export competitiveness.
	Hoekman & Nicita (2008:17-18)	A 10% reduction in the World Bank Doing Business report's domestic cost to import (as used in this study, see section 3.4) would increase imports by 4.8%. Furthermore, if the Doing Business cost of trading of low income countries increases to the middle income average, imports of these countries will increase by 7.4%.
	Jansen van Rensburg (2000:177)	International transport costs pose a threat to South African export competitiveness. An increase in transport costs will have a significant impact on South Africa's exports.
	Limão & Venables (2001:453,471)	Trade volume will decrease by 20% if transport costs increase by 10%. Doubling transport cost will result in a 45% decline in trade volumes (imports and exports). Compared to coastal countries, landlocked countries have 50% higher transport costs and 60% lower trade volumes. However, if landlocked countries improve their infrastructure, the transport costs will be lower.
	Martinez-Zarzoso & Nowak-Lehmann (2007:424)	Transport costs have a significant negative effect on trade volumes.
	Martinez-Zarzoso & Nowak-Lehmann (2008:3145)	Higher transportation costs have a significant negative effect on trade, especially in high value-added sectors.

² These findings are based on data of different samples of countries. One should therefore take caution in interpreting these results. The detailed findings are not provided in Table 1, as the purpose of this table is only to illustrate the importance of including barriers to trade in a market accessibility index.

Table 1: Literature overview on the (quantifiable) constraints to market access (continues)

Barrier to trade	Examples of support from the literature	Impact on trade
Logistics Performance Index per country	Bougheas, Demetriades & Morgenroth (1999:169)	A positive relationship exists between the level of infrastructure and the volume of trade.
	Clark, Dollar & Micco (2004:417,434)	When port efficiency is improved from the 25 th to the 75 th percentile, maritime transport costs are reduced by around 12%.
	Hoekman & Nicita (2008:18)	A higher LPI score is strongly associated with increased bilateral trade. If the LPI of low income countries increases to the middle income average, imports of these countries will increase by 15.2%.
	Limão & Venables (2001:464)	Improvements in a landlocked country's infrastructure from the median to the 25 th percentile will increase trade volumes by 13%.
	Wilson, Mann & Otsuki (2004:12,17)	Improvements in port efficiency lead to an increase in trade flows in manufactured goods.
	ITC (2011:98)	Inefficient logistics can discourage exports. The cost of logistics is considered a major market access barrier for developing country exporters. In developed countries, average logistics costs are estimated at 3% of the export value in developed countries and 8% in developing countries. These values are estimated at 15% in African countries and to almost 30% in landlocked developing countries.
<i>Ad valorem</i> equivalent tariffs	Baier & Berstrand (2001:1,23)	25% of the average post World War II world trade growth rate can be attributed to tariff rate reductions.
	Haveman, Nair-Reichert & Thursby (2003:485)	Tariffs reduce trade flows by an average of 5.5% in the 15 countries included in the study.
	Hoekman & Nicita (2008:17-18)	If an exporter has a 1% tariff advantage over competitors, it will increase exports by 3.5%. Furthermore, if the average tariff trade restrictiveness index for low income countries decreases to 5%, imports of these countries will increase by 5.7%.
	Hummels (1999:21)	A 10% increase in tariffs will decrease trade by 56%.
	Wilson, Mann & Otsuki (2004:12)	Trade is significantly negatively affected by higher tariffs. A decrease of 1% in the world average <i>ad valorem</i> tariff (8.5% to 7.5%) will increase trade by 1.1%.
	Fugazza & Nicita (2011:21)	A 1% decline in the overall tariff faced by exporters will increase bilateral trade by almost 0.7% on average.
Ad valorem equivalent non-tariff barriers (NTBs)	Haveman, Nair-Reichert & Thursby (2003:485)	Non-tariff barriers can either increase or decrease trade, but the net effect was found to be a trade reduction of 0.4% (in the sample of 15 countries for which the analysis was done).
	Hoekman & Nicita (2008)	If the average overall trade restrictiveness index (including tariffs and non-tariff measures) for low income countries is reduced to 10%, imports in these countries will increase by 8.4%.
	Kee, Nicita & Olarreaga (2008:31)	Non-tariff barriers play a big role in the trade restrictiveness of countries. On average, non-tariff barriers add 87% extra restrictiveness to the tariffs already imposed. For almost half of the countries included in this analysis, the restrictiveness of non-tariff barriers was found to be larger than that of tariffs.
	Most of the studies included in the summary of Cipollina & Salvatici (2006:53-57) make use of some form of either tariff or non-tariff barriers.	

The importance of each of the (quantifiable) constraints to market access is evident from Table 1. These constraints form the basis of the market accessibility index developed in this study.

In section 3, the method used to develop a market accessibility index will be discussed.

3. Research method

In this section a description and source of each constraint to trade included in the market accessibility index is firstly provided (see sections 3.1 to 3.7). Secondly, since these constraints to trade are all measured in different units (e.g. days, USD, percentage of trade and a score out of 5), an index was constructed to incorporate these barriers into one measure (see section 3.8).

3.1 International shipping time per country

Information on international shipping time was gathered from www.linescape.com. Information regarding routes and schedules from 125 container lines, 8 million voyages through 3000 ports is available on this website. If no direct route is available between two countries, transshipment information was used. The international shipping time from Durban, South Africa, to the port that was used by the World Bank in their Doing Business report (Djonkov, Freund & Pham, 2006³) for each country was used.

³ A word of gratitude is expressed to the authors of the article *Trading on Time* for providing information on the ports in each country that was used in their analysis.

3.2 Domestic time to import per country

The World Bank's Doing Business report includes a section on *Trading Across Borders* called *time to import* in which the time required for obtaining all necessary documents, inland transport and handling, customs clearance and inspections and port and terminal handling is measured for most world-wide countries (The World Bank, 2009:92)⁴. This information was gathered from freight forwarders, shipping lines, customs brokers, port officials and banks⁵.

3.3 International shipping cost per country

Quotes for the shipment of a 20-foot container from Durban harbour to the nearest or most likely port in 66 coastal countries were obtained from three main shipping lines⁶. Based on these quotes, the average shipping cost for each country was calculated. In the case of landlocked countries or coastal countries for which a quote could not be obtained, the cost of shipment to the nearest or most likely port, for which a quote is available, was used.

Distance was not used as one of the variables to measure market accessibility in this study for two main reasons. Firstly, shipping time and cost are considered to encapsulate distance and are considered better measures due to the fact that it takes routing (eg. lower transport cost and times associated with main routes, Hoffmann, 2002), transshipment, dwell costs (eg. time and cost of loading, unloading, waiting in the port, Coughlin, 2004:2) as well as time and costs associated with distance into account. Secondly, domestic time and cost incurred by the exporter in the importing country are also considered in this study which, as opposed to

⁴ The World Bank adopted the methodology of Djankov, Freund & Pham (2006) to calculate the domestic time to import per country.

⁵ For more detail on the method, see Djankov, Freund & Pham (2006:4-6).

⁶ A word of gratitude to Dr. S Grater who supplied this information.

distance, takes the time and cost of poor infrastructure, documentation, inland transport and handling, customs clearance and inspections as well as port and terminal handling into consideration.

3.4 Domestic cost to import per country

The World Bank's Doing Business report was also used for this variable. *Cost to import* information in the *Trading Across Borders* section of the report for all the countries under investigation was used (The World Bank, 2009:92).

The cost to import for each country includes the cost associated with all documentation, inland transport and handling, customs clearance and inspections, port and terminal handling and official costs (The World Bank, 2009:92). In calculating the cost to import for each country, the fees levied on a 20-foot container in US dollars were used. The cost does not include tariffs or costs related to ocean transport.

3.5 Logistics Performance Index (LPI) per country

The World Bank issued a report compiled by Arvis, Mustra, Ojala, Shepherd & Saslavsky (2010) in which a Logistics Performance Index (LPI) was constructed for 155 countries around the world. The LPI measures the performance of these countries in six important aspects of the current logistics environment. These are the efficiency of the customs clearance process, quality of trade and transport-related infrastructure, ease of arranging competitively priced shipments, competence and quality of logistics services, ability to track and trace consignments, and the frequency with which shipments reach the consignee within the scheduled or expected

time. Online questionnaires were used to survey nearly 1,000 logistics professionals from international logistics companies in 130 countries (Arvis et al. 2010:4).

According to Arvis et al. (2010:46), the LPI is specifically focused on the “friendliness” of countries’ trade and transport facilitation and is considered the first international benchmarking tool that specifically measures the critical factors of trade logistics performance.

3.6 *Ad valorem* equivalent tariffs per product

The International Trade Centre’s *MacMap* was used to gather information on the tariffs applied to South Africa for all the product-country combinations under consideration on HS 6-digit product level (ITC, 2010a). *Ad valorem* equivalent tariffs were used due to the difficulty of comparing specific duties (eg, two Euros per kilogram of sugar) with *ad valorem* tariffs (eg, 5% of the total value of the imports) across countries. An *ad valorem* equivalent tariff is defined as a tariff presented as a percentage of the value of goods cleared through customs. It is the equivalent of a corresponding specific tariff measure based on unit quantities such as weight, number or volume (ITC, 2010b).

3.7 *Ad valorem* equivalent non-tariff barriers (NTBs) per product

Kee, Nicita & Olarreaga (2008:18) estimate *ad valorem* equivalents for non-tariff barriers per product-country combination on a HS 6-digit level, based on the UNCTAD TRAINS database.

They include *core non-tariff barriers*, namely price control measures, quantity restrictions, monopolistic measures and technical requirements as well as *agricultural domestic support*

measured in US dollars. 4,575 non-linear regressions (one for each HS 6-digit category for which at least one country imposes non-tariff barriers) were run to estimate the impact of the above-mentioned non-tariff barriers on imports. Country and product-specific import demand elasticities were estimated and used to transform the above-mentioned non-tariff barrier impact estimates into price equivalents of non-tariff barriers (see Kee, Nicita & Olarreaga, 2008:6-17 for more detail on the method).

For clarity, it is important to note that Kee et al. (2008) constructed different trade restrictiveness indices. One only accounted for tariff barriers, called tariff trade restrictiveness index (TTRI), and another one adding tariff and non-tariff barriers, called the overall trade restrictiveness index OTRI. The TTRI was not used in this study due to the fact that it is not measured from a South Africa point of view, and the *MacMap* database provides more recent *ad valorem* equivalent tariffs applied by different importing countries on products originating from South Africa (see section 3.6). The OTRI (sum of tariff and non-tariff barriers) was not used either, as it would double count for tariff barriers if used together with the *MacMap* tariff data. Therefore, only the sum of Kee et al's. (2008) estimated *ad valorem* equivalent core non-tariff barriers and the *ad valorem* equivalent of domestic support were used in this study to measure non-tariff barriers on a HS 6-digit level per product-country combination.

3.8 The construction of a market accessibility index (MAI)

The data for the seven variables described in sections 3.1 to 3.7 was gathered for all product-country combinations under consideration. No clear guidelines on weighing the different variables relative to one another could be found in the literature. A principle components analysis was therefore used due to the fact that different variables, in different units, can be reduced/condensed to measure a single construct (market accessibility in this case).

Although it was determined from the literature (see Table 1) that the seven variables discussed in sections 3.1 to 3.7 all impact market accessibility, the first step was to statistically determine whether the variables are indeed measuring the same construct (market accessibility). To determine this, a correlation matrix (R-matrix) was used. The analysis requires that variables correlate well, but not perfectly ($R > 0.9$) (Field, 2005). The variables included in the measurement of market accessibility in this study were found to be appropriately correlated and therefore all variables were found to be suitable to measure market accessibility.

Henceforth it needed to be determined whether a principle components analysis was suitable for the data. The Kaiser-Meyer-Olkin measure and Bartlett's test were used to measure this. The Kaiser-Meyer-Olkin measure for sampling adequacy ranges between zero and one, with values closer to zero indicating that unreliable factors were extracted from the data, and values closer to one indicating reliable and distinctive factors. Table 2 presents the statistics for the Kaiser-Meyer-Olkin measure and Bartlett's test for this analysis.

Table 2: Kaiser-Meyer-Olkin measure and Bartlett's test

Measure	Value
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.527
Bartlett's Test of Sphericity	
Approximate Chi-Square	1031731.935
Degrees of freedom	21
Significance	0.000

From Table 2 it is clear that the Kaiser-Meyer-Olkin value for this analysis is 0.527. Although values above 0.7 are more desirable, a value between 0.5 and 0.7 is acceptable (Field, 2005). Bartlett's test measures whether there are suitable relationships between the variables included

in the analysis. This test was highly significant in this analysis (significance < 0.05). Based on the results of these tests, it can be concluded that a principle components analysis was appropriate.

Three factors (components) that measures the market accessibility of a market were extracted in the principle components analysis (see Table 3). These factors are: (i) an *international factor* that includes international shipping time and cost, (ii) a *domestic factor* that incorporates domestic time to import, domestic cost to import and the LPI, and (iii) a *barrier factor* that includes *ad valorem* equivalent tariff- and non-tariff barriers.

Table 3: Component matrix

	Component		
	Factor 1 (International factor)	Factor 2 (Domestic factor)	Factor 3 (Barrier factor)
International shipment time		0.875	
International shipment cost		0.863	
Domestic time to import	0.882		
Domestic cost to import	0.829		
LPI	-0.753		
<i>Ad valorem</i> equivalent tariffs			0.614
<i>Ad valorem</i> equivalent non-tariff barriers			0.802

The combination of the three factors explained 69.64% of the variance of the relevant construct, namely market accessibility. The amount of variance retained in the three factors for each variable was around 80% for international time and cost, 87% and 73% for domestic time and cost respectively, 57% for the logistic performance indicator, 44% for tariffs and 65% for non-tariff barriers.

The three factor scores were added⁷ to calculate a market accessibility index for each product-country combination⁸.

The MAI developed in this study provides a score for each product-country combination relative to all other product-country combinations included in the analysis. Each index value is therefore not very meaningful on its own. It places each product-country combination in position relative to all other product-country combinations.

4. Results: South Africa's market accessibility in other African countries

In tables 4 and 5, the results of the study are summarised by providing the 20 most and least accessible African countries from a South African point of view. The market accessibility indicators in tables 4 and 5 are average values per country. Within a country there can still be products that are highly protected or restricted, even though the country as a whole is in the top 20 most accessible world-wide countries for South Africa.

⁷ As longer times to import, higher cost to import, higher tariffs and non-tariff barriers affect market accessibility negatively, while a higher logistics performance index affects market accessibility positively; the signs of these variables were taken into consideration in the summation of the factor scores.

⁸ A word of thanks is expressed to Prof W.F. Krugell who provided valuable help and inputs in constructing this index.

Table 4: The 20 most accessible African countries to South Africa⁹

Country	Inter-national shipment time (days)	Domestic Time to import (days)	Inter-national shipment cost (US\$ per 20-ft container)	Domestic shipment costs (US\$ per 20 ft container)	LPI ¹⁰	Average <i>ad valorem</i> Tariff %	Average NTB %	Average Market accessibility index
Swaziland	0	33	0	2249	3.46	0.00%	0.00%	2.922080
Lesotho	0	49	0	1715	3.46	0.00%	0.00%	2.747620
Malawi	0	51	0	2570	3.46	9.35%	2.02%	2.119778
Mauritius	11	14	510	689	2.72	0.53%	6.56%	1.810274
Namibia	1	24	0	1813	2.02	0.00%	0.00%	1.716950
Botswana	0	41	0	3264	2.32	0.00%	0.00%	1.352980
Madagascar	14	26	681	1660	2.66	2.22%	0.41%	1.045239
Kenya	4	25	660	2190	2.59	11.16%	0.82%	0.905657
Uganda	4	34	660	3390	2.82	11.16%	0.31%	0.667586
Mozambique	1	30	927	1475	2.29	0.84%	13.76%	0.555034
Zimbabwe	0	73	0	5101	3.46	17.47%	13.76%	0.500900
Comoros	28	21	685	1057	2.45	10.91%	0.46%	0.294108
Benin	16	32	1235	1400	2.79	10.53%	0.00%	0.137210
Seychelles	12	19	1210	1839	2.6	7.93%	13.76%	0.037125
United Rep of Tanzania	4	31	685	1475	2.6	11.17%	44.81%	-0.023142
Togo	9	29	1323	963	2.6	10.53%	17.66%	-0.138062
Zambia	4	64	685	3335	2.28	1.48%	1.65%	-0.170099
Ghana	9	29	1453	1203	2.47	12.53%	3.28%	-0.231615
Tunisia	20	21	1385	858	2.84	25.95%	11.51%	-0.562316
Burundi	4	71	685	4285	2.6	12.26%	0.46%	-0.574392
AFRICA AVERAGE	15.7	36.8	\$1,221.63	\$2,212.17	2.52	11.30%	11.21%	-0.687150
WORLD AVERAGE	26	20	\$1,259.90	\$1,292.11	3.11	6.32%	9.92%	0

Sources: linescape.com, The World Bank (2009), Arvis et al. (2010), ITC (year), Kee, Nicita & Olareaga (2008).

As expected, some of the Southern African Customs Union (SACU) countries (namely Botswana, Lesotho, Namibia and Swaziland) are the most accessible to South Africa probably due to their proximity and the SACU free trade agreement between South Africa and these countries.

⁹ Since the results of this study are so vast in number, it is impossible to report on the accessibility for all the different products within the African countries. The detail on the accessibility of specific products within each of the countries mentioned can be obtained from the authors: Ermie.Steenkamp@nwu.ac.za.

¹⁰ Note that the LPI has an opposite effect on market accessibility than the other variables. The higher the LPI, the more accessible the market.

It is however interesting that Malawi and Mauritius are ranked above Namibia and Botswana. This is due to the relatively high cost and time of domestic transportation and other logistical procedures in Namibia and Botswana. Zimbabwe is another neighbouring country that is not in the top 10 most accessible countries due to Zimbabwe's domestic logistical constraints.

Most Southern African Development Community (SADC) countries are also included in the 20 most accessible countries for South Africa in the rest of the African continent, except for Angola and the Democratic Republic of the Congo. Angola and the Democratic Republic of the Congo are both included in the 20 least accessible African countries for South Africa (see table 5), due to the very high time and cost of domestic logistics in these countries.

Other non-SACU and non-SADC countries included in the 20 most accessible countries for South Africa include Kenya, Uganda, Comoros and Burundi (Eastern Africa); Benin, Togo and Ghana (Western Africa) and Tunisia (Northern Africa).

In table 5, the 20 least accessible African countries, from a South African point of view, are provided.

Table 5: The 20 least accessible African countries for South Africa

Country	Inter-national shipment time (days)	Domestic Time to import (days)	Inter-national shipment cost (US\$ per 20-ft container)	Domestic shipment costs (US\$ per 20 ft container)	LPI	Average <i>Ad valorem</i> Tariff %	Average NTB %	Average Market accessibility index
Chad	12	100	1560	6150	2.49	15.69%	0.73%	-3.138076
Sudan	36	46	1310	2900	2.21	17.75%	41.87%	-3.060984
Equatorial Guinea	16	49	3010	1411	2.55	15.69%	0.73%	-2.667906
Sierra Leone	23	31	2110	1639	1.97	12.91%	17.66%	-2.460713
Algeria	44	23	1385	1428	2.36	16.44%	38.35%	-2.323053
Angola	25	59	1518	3240	2.25	6.38%	13.76%	-2.202123
Eritrea	35	60	1310	1581	1.7	7.40%	0.46%	-2.198298
Central African Rep	12	62	1560	5554	2.55	15.69%	0.73%	-2.185769
Sao Tome and Principe	15	29	3010	577	2.55	15.93%	0.73%	-2.056855
Mauritania	37	42	1810	1523	2.86	11.11%	17.66%	-1.816380
Ethiopia	32	45	1333	2993	2.41	15.36%	0.27%	-1.744820
Dem Rep of the Congo	12	63	1810	2483	2.68	11.58%	13.76%	-1.722709
Niger	16	64	1235	3545	2.54	10.53%	17.66%	-1.679019
Congo	5	62	1810	2959	2.48	15.69%	0.73%	-1.640404
Guinea-Bissau	26	22	1485	2349	2.1	10.53%	17.66%	-1.634217
Nigeria	9	41	1845	1440	2.59	9.85%	39.37%	-1.564351
Mali	22	37	1545	2955	2.27	10.53%	2.85%	-1.512061
Burkina Faso	16	49	1257	3830	2.23	10.53%	0.87%	-1.426474
Libya	30	15	1385	823	2.33	18.59%	27.78%	-1.401934
Liberia	15	15	2110	1212	2.38	11.16%	17.66%	-1.289136
AFRICA AVERAGE	15.7	36.8	\$1,221.63	\$2,212.17	2.52	11.30%	11.21%	-0.687150
WORLD AVERAGE	26	20	\$1,259.90	\$1,292.11	3.11	6.32%	9.92%	0

In Chad, Sudan, Angola, Central African Republic, Ethiopia, the Democratic Republic of the Congo, Niger, Congo and Burkina Faso, the time and costs associated with documentation, inland transportation, customs and handling are more than double the world average. The logistics performance indices for Eritrea and Sierra Leone are exceptionally low. Chad, Sudan, Equatorial Guinea, Sierra Leone, Algeria, Central African Republic, Sao Tome and Principe, Ethiopia, Congo and Libya also impose, on average, tariffs that are more than double the world average on South African products. Average non-tariff barriers in Sudan, Algeria, Nigeria and Libya are also exceptionally high (more than double the world average).

From table 5 it is also clear that it takes, on average, 16.8 days longer than the world average for domestic shipment in African countries. The average domestic cost to import to Africa is almost double the world average. The average African logistics performance index is also lower than the world average and the average *ad valorem* equivalent tariff in Africa is much higher than the world average. African countries therefore perform worse than the world average for all the measures of market accessibility except for the time and cost of international shipment.

The abovementioned observations underline the fact that one of the biggest impediments to trade in Africa is poor infrastructure and other logistical problems.

5. Discussion

A successful export effort requires an assessment of market access conditions when identifying market opportunities. Furthermore, market openness has a positive effect on growth in African economies and the lack of openness was found to be the largest contributor to Sub-Saharan Africa's bad economic growth performance. This study therefore set out to develop a market accessibility index for South African products into the rest of the African continent.

The market accessibility index developed for this study takes the international shipping time and cost per country, domestic time and cost to import per country, logistics performance per country and *ad valorem* equivalent tariffs and non-tariff barriers per product-country combination into account. Support from the literature for using these variables to measure market accessibility has been provided in Table 1.

These (quantifiable) constraints to market access have been used in a principle components analysis to construct a market accessibility index for South Africa into other African countries. Three factors were found that measure the market accessibility of a market, which include (i) an

international factor (international shipping time and cost), (ii) a domestic factor (domestic time and cost, logistics performance index) and (iii) a barrier factor (*ad valorem* equivalent tariff and non-tariff barriers).

Results show that the most accessible African countries for South African export products are Swaziland, Lesotho, Malawi, Mauritius, Namibia and Botswana. The least accessible countries are Chad, Sudan, Equatorial Guinea, Sierra Leone, Algeria and Angola. On average, it takes 16.8 days longer than the world average for the domestic shipment of goods in African countries. The average domestic cost to import to Africa is almost double the world average. The average African logistics performance index is also lower than the world average and the average *ad valorem* equivalent tariff in Africa is much higher than the world average. African countries therefore perform worse than the world average in all the measures of market accessibility except for the time and cost of international shipment. The abovementioned observations underline the fact that the largest impediments to trade in Africa are poor infrastructure and other logistical problems.

Future studies could include surveying South African exporters on the barriers to trade they face in different markets and how they overcome some of these barriers. A panel of experts could also be consulted to verify the weighting of the different constraints to trade relative to one another.

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