Bottom-up analysis of projected impacts on imports arising from a maritime MBM[1] for Bangladesh and South Africa

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INTRODUCTION

This paper provides results from a bottom-up analysis of projected impacts on imports arising from a maritime MBM for two countries, Bangladesh, a Least Developing Country (LDC), and South Africa, a more economically advanced developing country.

The analysis is based on the impact of the increased price of bunker fuel equivalent to the additional costs from a maritime MBM, such as a levy on fuel or an emission trading system (ETS) examples of price and quantity type mechanisms respectively.[3]

The paper is structured as follows. Following this introduction, Section 1 outlines the projected, maximum impacts on imports from a maritime MBM for Bangladesh and South Africa. Section 2 discusses the inclusion of impacts on exporters in the estimates. Section 4 concludes. The annex describes the methodology used to calculate the impacts.

1. PROJECTED IMPACTS

The maximum projected or potential impacts on imports is calculated assuming that the entire freight cost increase arsing from the application of a maritime MBM is passed on to end consumers (importers), and using the methodology described in the Annex. The calculations are made for trade patterns for 2007, and assuming an anticipated increase in ship operational costs due to the MBM, equivalent to a 10% increase in the price of bunker fuels. [4]

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[1] A maritime MBM means a global Market-Based Mechanism or Measure for greenhouse gas (GHG) emissions from international maritime transport, such as a levy on shipping fuel or an Emission Trading System (ETS).

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[3] There are two proposals for a maritime MBM that are efficiency-based, namely the Ship Efficiency and Credit Trading (SECT) and the Efficiency Incentive Scheme (EIS) (see IMO documents: MEPC 61/INF.2 and MEPC 62/5/1). Their impact on ship's operational and total costs has not been quantified. Furthermore, the distribution of costs would be less uniform than that of a levy or ETS across different types, sizes and age of ships. The regions the most impacted ships would operate are also not known. Thus a quantitative impact analysis of the efficiency-based MBMs on specific countries is not possible at this stage. The presented analysis and results therefore does not apply to the efficiency-based proposals.

[4] According to the various scenarios for carbon and bunker prices investigated in the MBM-EG report (MEPC 61/INF.2), the MBM costs as percentage of fuel cost (P) ranged from 3% to circa 10%. Thus P=10% is used this analysis.

The estimated impact on imports, expressed as the increase in value of total imports for Bangladesh and South Africa, are calculated to be less than 0.2%, as shown in Table 1.

Table 1 Estimated Impact on Imports from an MBM equivalent to 10% of fuel price

Bangladesh	South Africa
0.19%	0.14%

Given that every country both imports and exports various goods, and the entire freight increase has been accounted for, the above results also provide the estimated impact on the economy of these countries.

The estimated impact on Bangladesh is larger than that on South Africa, which is mostly attributable to the structural differences of their seaborne imports. Bangladesh imports relatively more food and minerals than South Africa, and unit transport costs in these sectors are higher than in the other ones.

Figures 2 and 3 illustrate the estimated share of value of total seaborne trade for four sectors, food, fuel, minerals and manufactures, for Bangladesh and South Africa, respectively.[5]

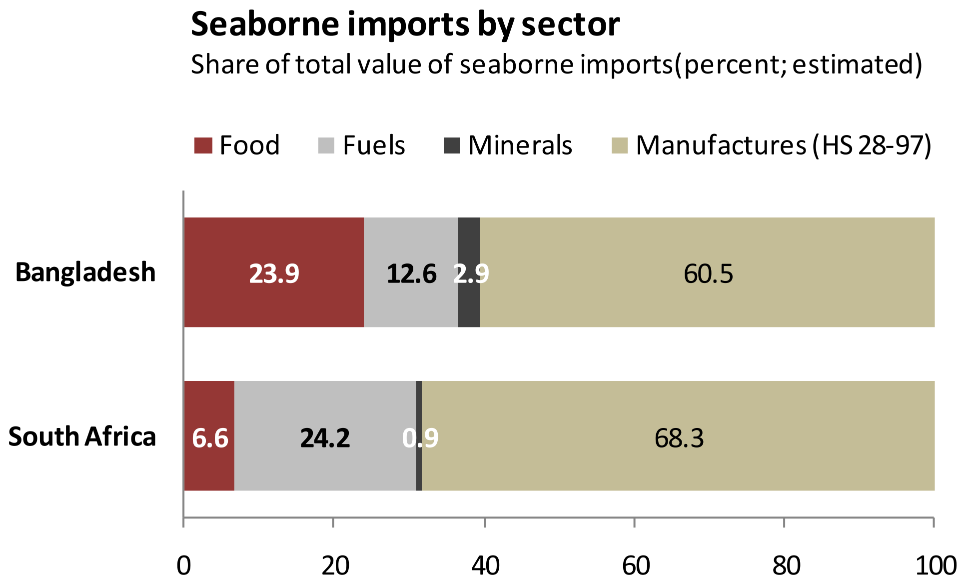

Figure 1 Structure of seaborne imports in 2007 *(author's analysis)*

The costs of transporting food and minerals are significantly higher than transporting fuels and manufactures for each of the two countries, and this is reflected in the percentage of impact on imports in these sectors obtained through the analysis, as illustrated in Figure 2. As an example, for Bangladesh the projected impact on the food sector is 0.30% of imports value, compared with 0.11% for fuels.

[5] The four sectors are defined in this analysis by the Harmonized System or HS codes, and may differ from categorisation used in other studies (for instance manufactures may be defined less widely). Food is defined by HS chapters 1-24, fuels: chapter 27, minerals: 25-26, and manufactures: 28-97.

Bangladesh	Imports	Impact	
Sector	$mln	$mln	%
Food	3,133	9	0.30
Fuels	1,655	2	0.11
Minerals	386	3	0.71
Manufactures	7,934	11	0.14
TOTAL	13,107	25	**0.19**

South Africa	Imports	Impact	
Sector	$mln	$mln	%
Food	3,984	12	0.30
Fuels	14,576	16	0.11
Minerals	512	4	0.87
Manufactures	41,077	51	0.12
TOTAL	60,148	84	**0.14**

Figure 2 Estimated maximum impact per sector, imports by sea *(author's analysis)*

These two effects, namely different import structures between sectors and different impacts within sectors, are the reasons for the difference in the estimated total impact on the countries (0.19% and 0.14% for Bangladesh and South Africa, respectively).

As shown in Figure 2 the impacts within the same sector of different countries, for instance Manufactures, may also differ given that each sector represents many products itself (see Annex for details).

2. Inclusion of Impacts on Exporters

Under a global, universal application of an MBM, any additional costs would generally be passed on to the end consumers (importers), although for certain products/markets some of the costs may be borne by producers (exporters) in the form of reduced margins.

Exporters are more likely to share some of the costs of the maritime MBM for the destinations where their exports experience significant domestic competition.[6] The modelling of impact on exporters would require knowledge of all destination markets, and the level of domestic competition as they typically differ, making such modelling rather difficult for the all exports of a given country.

Thus three illustrative options are defined in which the freight cost increase is split between exporters and importers, according to average cost pass-on rates, as shown in Table 2.[7]

Table 2: Illustrative options with cost-pass through rates to exporters and importers

Option Name	**Cost pass-on rates to:**	
	Exporters	**Importers**
Exp 5%	0.05	0.95
Exp 10%	0.10	0.90
Exp 20%	0.20	0.80

[6] This implicitly assumes that these destinations would not experience additional carbon costs on domestic transport when maritime MBM is implemented. This may be not true. When carbon regulation is implemented for domestic transport/fuel than the exporters using international shipping may be able to pass the entire costs of a maritime MBM to the importers.

[7] Given that only share of exports may be impacted per each product category, due to a significant domestic competition in some destination markets only, the overall cost pass-on to exporters is likely to be low. Thus, illustrative values of 5%, 10% and 20% are used.

As an example, in option named Exp 5%, on average 5% of increased freight cost is absorbed by exporters (producers) and 95% of increased freight costs is passed on to importers (end-consumers). A base option (not shown) is equivalent to calculations in the previous section, which assumed 100% cost pass-on to importers.

The impact on importers for a given option is a relevant share of impact from Table 1 (for instance 95% share for the option Exp 5%). The impact on exporters for a given option is a share of a hypothetical impact on exporters (not shown), which assumes 100% cost pass-on to exporters[8] (for instance 5% share for the option Exp 5%). The total impact, is the sum of impact on importers and exporters, and is calculated in relation to country imports for comparative reasons with the base option.[9] The estimated impacts for the different options are shown in Figure 3, for Bangladesh and South Africa.

Bangladesh	Impact, %			Total /
Scenario	Imports	Exports	**Total**	T. Base
Base	0.19	-	**0.19**	1.00
Exp 5%	0.18	0.01	**0.19**	0.98
Exp 10%	0.17	0.01	**0.19**	0.96
Exp 20%	0.15	0.03	**0.18**	0.93

South Africa	Impact, %			Total /
Scenario	Imports	Exports	**Total**	T. Base
Base	0.14	-	**0.14**	1.00
Exp 5%	0.13	0.01	**0.14**	1.01
Exp 10%	0.13	0.02	**0.14**	1.02
Exp 20%	0.11	0.04	**0.15**	1.04

Figure 3 Estimated impacts for different options, trade by sea *(author's analysis)*

The results show that the total impact changes a little between the different options, particularly for South Africa.

The trend of change is opposite for the two countries analyzed, as illustrated in the last column of the two tables in Figure 3 (entitled Total / T. Base). With increased inclusion of exports in the calculations of total impact, the estimate of total impact goes down for Bangladesh and goes up for South Africa. Thus for Bangladesh (an LDC) the most beneficial way to calculate the impact from a maritime MBM is based on the base option, i.e. on imports alone (from the point of view of potential compensation to Bangladesh).

Given that the above trend is driven by the amount of imports versus exports and the structure of trade, similar results are anticipated for all LDCs, and similar countries, as they import more than they export, and often import a significant amount of low value goods, for which costs of transport are high. Thus from the point of equity, as well as relatively low impact of inclusion of exports for South Africa (and similar countries), it can be argued that the approach based on imports alone should be used to calculate the impact of a maritime MBM. Such an approach is also simpler as only import data is needed, rather that import and export data. Furthermore, data on imports is more reliable and more widely available, given that import data is widely collected by national authorities for tax purposes (which is not the case for data on exports).

3. CONCLUSIONS

The projected impacts on imports arising from a maritime MBM for Bangladesh and South Africa are estimated to be under 0.2% increase in import prices (0.19% and 0.14%, respectively).

[8] These calculations use methodology described in Annex but using export rather than import data

[9] According to a formula: impact on exports x (exports/imports) + impact on imports

Given that all costs from the potential freight increases are assumed to be passed on to importers, these estimates are the maximum potential impacts, and were derived for a relatively high cost case when the MBM costs would be equivalent to a 10% increase in fuel prices. No benefits are included in the estimates. Thus the real impacts may be significantly smaller, and may even be positive due to reduced costs of transport influenced and enabled by the MBM.

The economic impact on the country is estimated through the same measure and implicitly includes impact on the country's exports

The analysis demonstrated that splitting the impacts between importers and exporters does not change the estimates significantly. Using the simple estimate based on the assumption that 100% of the MBM cost is passed on to end consumers is thus sufficient. Such an approach is simple given that only data on country imports is required, and it is more robust given that data on imports is more reliable than data on exports.

Furthermore, the approach based on imports alone is more beneficial in assessing impacts on the poorest countries, such as the LDCs, including Bangladesh, as it provides a higher estimate of impacts when compared with any calculations based on splitting the impacts during the estimation between importers and exporters. This is justified by the fact that poor countries generally import more than they export, and import a significant amount of low value products characterized by higher unit transport costs.

Bibliography

MEPC 61/INF.2, 'Full report of the work undertaken by the Expert Group on Feasibility Study and Impact Assessment of possible Market-based Measures', Note by the Secretariat, Marine Environment Protection Committee, MEPC 61/INF.2, MEPC 61/INF.2/Corr.1, MEPC 61/INF.2/Corr.2, 61st Session, International Maritime Organization, 13 August 2010. Available at: http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Documents/INF-2.pdf; http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Documents/INF-2%20Corr-1.pdf; http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Documents/INF-2-Corr-2.pdf

GHG-WG 3/3/11, 'Towards an optimal rebate key for a global maritime MBM', Submitted by the World Wide Fund for Nature (WWF), Intersessional Meeting of the Working Group on GHG Emissions from Ships, 3rd session, International Maritime Organization, 25 February 2011. Available at: http://imers.org/docs/ghg_wg_3-3-11_wwf.pdf

MEPC 62/5/1, "Report of the third Intersessional Meeting of the working group on greenhouse gas emissions from ships", International Maritime Organization, 8 April 2011

United Nations Conference on Trade and Development (UNCTAD) (2010), "Oil Prices and Maritime Freight Rates: An Empirical Investigation", UNCTAD/DTL/TLB/2009/2, April 1, 2010; http://www.unctad.org/en/docs/dtltlb20092_en.pdf

Vivid Economics, "The impact on trade of market-based mechanisms for greenhouse gas emissions from international shipping", Prepared for the Expert Group on Market-based Measures, International Maritime Organization, Final Report, August 2010; http://www.imo.org/OurWork/Environment/PollutionPrevention/AirPollution/Documents/VividEconomicsIMOFinalReport.pdf

ANNEX

1. METHODOLOGY

The impact of a maritime MBM is analyzed through the impact of increased price of bunker fuel at the level equivalent to the costs of a maritime MBM, such as a levy on fuel or an emission trading scheme. The impact is assessed for each product type defined in the commodity Harmonized System level 2, and aggregated across all the products.[10]

The extent to which an MBM affects end consumers is related to:

1. MBM costs, equivalent to an increase in bunker fuel prices (P),
2. Elasticity (E) of freight rate to P,
3. Ad valorem transport cost (A), for a given product,
4. Rate (R) of cost pass-on to end-consumers of increased freight costs

The formula, for the price increase of a given product/commodity, is C = P x E x AV x R.

This formula excludes any positive impacts of the MBM, such as reduced cost of transport and ignores the benefits of revenue raised, and thus should be seen as maximum potential impact from the MBM on a given product.

The projected maximum impact on a country's imports is defined as an average price increase across all products. It is calculated as a volume-weighted average of the individual product price increases, C (for all products in HS 2).

1.1 Fuel price increase, P

P depends on the costs arising from the MBM and the prevailing level of fuel prices. For instance for a fuel levy, P would equal the levy divided by the fuel price. For nearly all potential scenarios analyzed by the Expert Group on MBM established by the International Maritime Organization, P was less than 10% (see document IMO MEPC 62/INF.2). Thus to estimate maximum potential impact from a maritime MBM, P = 10% is assumed in this analysis.

1.2 Elasticity of freight rates to bunker fuel price increase, E

In this analysis, shipping is divided into four key segments: Clean Bulk, Dirty Bulk, Tanker, and Container. They are characterized as follows:

- clean or dry bulk carriers generally transport grains, oilseeds, and sugar;

[10] The Harmonized Commodity Description and Coding Systems – also referred to as the Harmonized System or HS code – is an international product nomenclature developed by the World Custom Organization (WCO), and used globally. It comprises 5 000 commodity groups, each identified by a six-digit code, arranged in a legal and logical structure and supported by well-defined rules to achieve global uniform classification. The products are organized into 99 chapters: chapters 1-24 cover agricultural products (food), 25-27 mineral products (25, and 28-98 manufactured products (widely understood). For instance, chapter 25 is for salt; sulfur; earth & stone; lime & cement plaster; chapter 26: for ores, slag and ash; or iron ore; chapter 27 for mineral fuel, oil etc.; bitumin subst; mineral wax.

- dirty or industrial goods bulk: bulk carriers transport of "dirty bulk" goods, like iron ore, coal, bauxite and other industrial raw materials;
- tankers: which typically transport petroleum, petroleum products and some liquid chemicals, and
- containers: used to transport most of the manufactured goods and an increasing amount of agricultural products.

The elasticity of freight rates to bunker fuel price increase (E) can be calculated by econometric analysis for each of the shipping segments. Table A-1 includes the elasticity values used in this analysis for the four shipping segments.

Table A-1: Elasticity (E) estimates of freight rate to bunker price increase used

Clean Bulk	Dirty Bulk	Tanker	Container
0.25	0.25	0.28	0.29

Data sources: Clean bulk – Vivid Economics 2010; Tanker and Container – UNCTAD 2010; Dirty bulk – assumed equal to clean bulk[11]

1.2 Ad valorem transport cost, AV

The ad valorem transport cost (i.e. transport costs divided by the total import value; AV) varies per commodity, and type of ship. It can also vary by source and destination of transport. Typically, the lower value goods, such as cereals and iron ore, have larger AV than high value goods. For this analysis, average AV values for the nearly 100 HS-2 product chapters are used and were calculated from the Maritime Transport Costs database created by OECD.[12]

1.2 Cost pass-on rates, R

Under a global, universal application of a MBM, any additional costs would generally be passed on to the end consumers (importers), although for certain products/markets some of the costs may be borne by producers (exporters) in the form of reduced margin.

Therefore two cost pass-on rates can be defined Ri for importers (end consumers), and Re for exporters (producers). These rates relate to the ability of ship operators to pass the increased freight rate to importers and exporters, with the distribution of costs depending on the elasticity of demand and supply of exporters, importers and freight service providers for the

[11] The elasticity E for dirty bulk was assumed to be equal to the elasticity of clean bulk segment given the same price structure of operating bulk ships transporting clean and dirty cargo. As reported by UNCTAD, the high level of elasticity calculated in their work may have been related to certain reasons, including market speculation. Elasticity of circa 0.25 is warranted also based on analysis of the bulk segment cost structure. In this sector fuel costs comprise circa 40% of all ship costs. However, these costs need to be discounted further for the costs of infrastructure (i.e. ports), that contribute significantly to costs of transport. Thus the elasticity of 0.25 used seems plausible also on this ground.

[12] The OECD MTC database is currently the most comprehensive databases of maritime transport costs. For details and certain caveats about the data and its use see: Korinek, Jane (2011), “Clarifying Trade Costs in Maritime Transport”, TAD/TC/WP(2008)10/FINAL, OECD, Paris.

different products, and destination markets. Such detailed data is not available, and is unlikely to ever be, given the complexity of global trade. Thus this analysis uses the rates of 100% for Ri to estimate maximum projected impacts on end consumers (equivalent to the entire cost increase being borne by the end consumers). The impact of splitting the freight increase between importers and exporters can be analyzed by splitting the impacts, between importers and exporters uniformly for all countries, for instance as: Ri=95%, Re=5%.

1. 5 Calculating maritime trade value

Detailed trade data by mode of transport is not available for the majority of developing countries, and is also not easily available for many developed countries. Thus the following approach is adopted.

Import and export data for 2007 is obtained from the UN Commodity Trade Statistics Database (UN Comtrade) at the HS 2 level for the two selected countries, Bangladesh and South Africa. To exclude data relating to trade by land and some short sea voyages, all data for countries adjacent to the analyzed one is excluded, following the approach proposed by the author (see IMO GHG WG/3/3/11). For Bangladesh trade data with India and Mayanmar was excluded. For South Africa, trade data with the following countries was excluded: Botswana, Lesotho, Mozambique, Namibia, Swaziland, and Zimbabwe. The resulting data relates to trade with non-adjacent partners (NAPS), and thus proxies well each country's trade by sea and air.

A decision whether to use sea or air transport often primarily depends on the value to weight ratio of cargo, and required speed of delivery. Thus the modal split between air and sea transport for the same product category for two countries at similar stage of development, particularly trading over similar distances is expected to be roughly similar.

Both Bangladesh and South Africa belong to countries that trade over long distances, on average, as illustrated in Fig. A-1 that shows trade weighted distances for various countries. Their trade weighted distances are similar to Chile. As noted in the report of the MBM-EG expert group (MEPC 62/INF.2), the trading distances only give some indication on which countries would be most affected by the implementation of an MBM that increases the cost of bunker fuels. Even though fuel costs are directly determined by distance, there is not a linear relationship between the two. This is because there are many factors that affect shipping costs, including: value-to-weight ratio of the cargo; time spent at sea (correlated with the distance from the market); type of ship; trade volumes (economies of scale); trade imbalances (especially for container traffic); price of fuel oil; level of port infrastructure and efficiency[13]; competition; and regulatory requirements.[14]

Thus in this analysis the methodology based on trade costs and statistics is used rather than distances. The modal split between sea and air transport is calculated for each HS 2 product category based on detailed trade data for Chile.[15] The calculated modal split, per product category, is applied to proxy the maritime share to transport per product category for South Africa and Bangladesh, given the various similarities.

[13] See, for example, Gordon Wilmsmeier and Jan Hoffman (2008). "Liner Shipping Connectivity and Port Infrastructure as Determinants of Freight Rates in the Caribbean", *Maritime Economics & Logistics*, vol, 10, pp. 130-151.

[14] OECD (2009), "Determinants of Maritime Transport Costs", Working Part of the Trade Committee, TAD/TC/WP(2009) 4, Feb. 27, 2009.

[15] Data on Chile trade has been kindly provided by the Chilean Customs Agency (Servicio Nacional de Aduanas).

The calculations confirmed that, for low value commodities, such as cereals and iron ore (HS 10 and 26), are typically transported in bulk, and practically never transported by air. High value products, such as pharmaceuticals, precious stones, and optic instruments (HS 30, 71, and 90, respectively), are primarily transported by air.

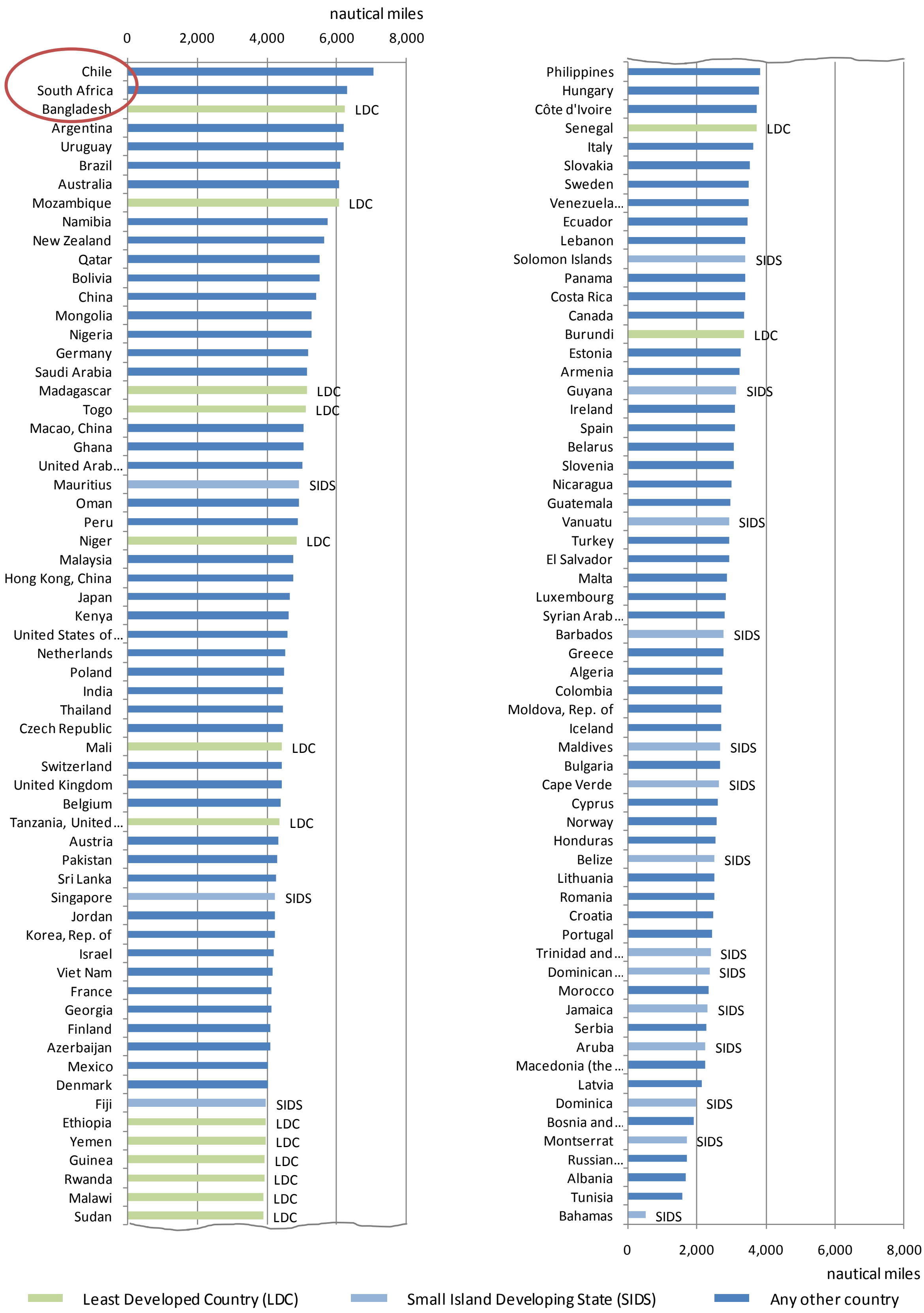

Figure A-1: *Trade-weighted distances, international transport (TWD) (author's analysis)*