

Impact assessment of a goal-based measure to reduce GHGs



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$$P(i|V) = \frac{\partial \ln G(eV)}{\partial V_i}$$

$\int_a^b \varepsilon \Theta$
 $\sqrt{17}$
 $\int \delta e^{i\pi} =$
 ∞
 χ^2
 $\Sigma!$
 $\{2.7182818284\}$

Overview

- Is an impact assessment of a goal-based measure possible?
- Approach
- Zoom in on the LDC/SIDS case study
- Conclusions & recommendations

“Initial IMO strategy”

CENTRAL AMBITION

- **Reduce annual GHG emissions by $\geq 50\%$ by 2050** (vs 2008 levels)
- **Reduce annual CO₂ emissions per transport work by $\geq 40\%$ by 2030**, pursuing efforts towards **70%** by 2050 (vs 2008 levels)



LONG LIST OF CANDIDATE MEASURES

- SHORT TERM (until 2023)

Prescriptive vs goal-based

- MEDIUM TERM (2023-2030)

MBMs (?)

- LONG TERM (2030-2050)

Alternative fuels

Prescriptive vs goal-based

- PRESCRIPTIVE

- GOAL-BASED

Set the goal ($\geq 40\%$ reduction of carbon intensity in 2030 vs 2008 level)

- Prescribes the means

- Speed limits (CSC)
- Power limits (Greece, Bimco)

- Freedom to choose the means

Goal-based approaches

- Japan and Norway
- Denmark et al (China, France, Germany, Spain)
- EEXI: Focus on technical measures
- Both for technical and for operational measures

Impact assessment study phases

Preliminary

- Already submitted by Denmark et al last fall
- Identified many positive impacts

Detailed

- To be submitted within 2 weeks
- Focuses on potential negative impacts, or disproportionately negative impacts

Positive impacts identified

- securing a level playing field and reducing emissions across the fleet by targeting the existing fleet and not just new ships;
- possibly lower transport cost;
- cost-effective energy efficiency gains;
- incentivizing development and integration of better ship designs, technological innovations, and efficient operation of ships
- incentivizing the shift towards sustainable alternative fuels
- climate action will reduce costs associated with climate change to many States and shipping

Taken into account

- geographic remoteness of and connectivity to main markets
- cargo value and type
- transport dependency
- transport costs
- food security
- disaster response
- cost-effectiveness
- socio-economic progress and development.

Impact assessment challenges (or, just how easy is it to do it?)

NOT VERY EASY BECAUSE OF:

- Randomness of many of the relevant variables
- Influence of factors not related to the goal-based measure per se
- Uncertainty of ship owners' response
- Lack of pertinent studies
- Lack of relevant data

Decision (x) vs exogenous (w) variables

- Any operational indicator associated with a goal-based measure is a function of:
 - **x**, the set of *decision variables* that the ship operator has at his disposal
 - **w**, the set of *exogenous variables* that are random and outside of the ship operator's control.

Decision (x) vs exogenous (w) variables

- x: under the control of the ship owner/operator

x	Operational variables	Technical variables
	Speed optimization Optimized routing Fleet management Capacity utilization Network design Virtual arrival/just-in-time ³	Buy a new ship/scrap or sell old one Ship retrofit (eg bulbous bows, propellers, etc) Engine retrofit/derating Energy saving devices (waste heat recovery, etc) Power limitation Electric/hybrid propulsion Alternative fuels Hull condition (coatings, cleaning, etc) Digitalization

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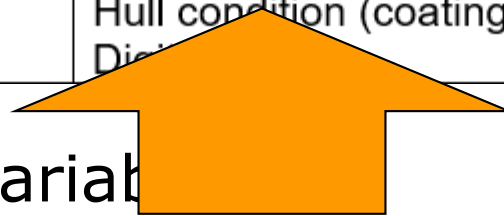
- w: exogenous variables

w	Weather variables	Other exogenous variables
	Waves- sea state Wind Currents Tides Ice	Cargo demand Cargo value Freight rates Fuel prices Port efficiency "Political" variables (port strikes, trade embargoes, civil unrest, etc)

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x's depend on w's

- w: exogenous variables

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Influence of factors not related to the goal-based measure per se

EXAMPLE:

- The implementation of the global 0.5% sulphur cap, as of 1.1.2020.
- Such a measure will have very important (albeit still not well understood) ramifications on fuel prices, freight rates and speeds, and, by extension, on the exports or imports of LDCs, SIDS, or other states.
- It will also impact the fleets and trade flows serving these countries in an unspecified way.
- **It will also impact CO2!!**

Uncertainty in ship owners' response

- One of the advantages of the goal-based approach of Denmark et al. is its **inherent flexibility**, leaving all of the pertinent choices to the ship owner.
- This flexibility maximizes the likelihood of the 2030 target being achieved.
- It also has a higher chance to help reach the 2050 target than other, more restrictive proposals (eg, EEXI, power or speed limits).
- At the same time, this flexibility renders the task of impact assessment more difficult.
- The possible impacts of the goal-based measure depend, inter alia, on the precise way the world's ship owners will choose to implement the measure.
- This depends on company strategy, preferences and other factors
- So the mix of actions to be undertaken by these owners is inherently unpredictable.

Lack of relevant studies or data

- Several studies
- None *directly* relevant
- Some *indirectly* relevant

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- None *directly* relevant
- Some *indirectly* relevant
- Dearth of relevant data (esp. re. LDCs/SIDS)



Can we model the process?

- YES, WHEN:
 - We have all the data
 - We know how the data influence all of the outputs

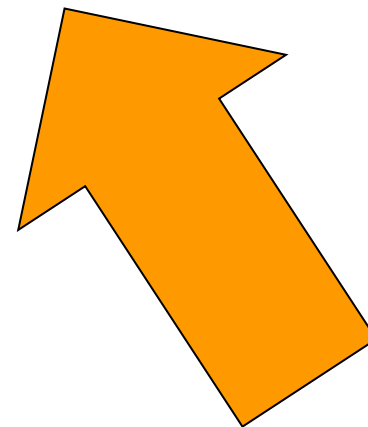
- Impossible within the timeline of the assignment

If data is elusive or not 100% reliable

- Do we quit?
- Or do we try to see if something can be said?

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Our approach

Approach

- STEP 1: Define list of potential negative impacts.
- STEP 2: Update existing literature.
- STEP 3: Discuss the role of connectivity as a determinant of freight rates.
- STEP 4: Focus on some specific case studies.
 - SOUTH AMERICA
 - Selected LDCs/SIDS
- STEP 5: Draw some conclusions & recommendations.

List of potential negative impacts

- Undesirable degradation in the quality of the cargo
- Increased cargo in-transit inventory costs
- Cargo shifts to faster modes of transport
- Higher freight rates
- Decrease of (export) FOB prices and/or increase of (import) CIF prices

List of potential negative impacts ii

- Loss of market share to competitors who are closer to target markets
- Change of stock levels
- Higher lifecycle GHG emissions
- Difficulty to finance retrofitting of old ships or investment in new ships

EXAMPLE: Chilean cherries to China

- Assuming a 14,000 USD/ton CIF price for Chilean cherries and a 3% interest rate, a reduction of sailing speed from 13 to 10 knots across the 12,000 nautical miles from Chile to China would increase the sailing time by 11.5 days and would amount to an **extra inventory cost of 13.3 USD/ton**, or less than 0.1% of the value of the cargo.

Table 2: Potential modal shifts

Scenario	Maritime				Air				Total Chain
	Market Share (%)	Days	Cost per FEU	CO ₂ per ton	Market Share (%)	Days	Cost per ton	CO ₂ per ton	CO ₂ (tons)
Baseline Sailing Speed 15.2 knots	84	28.2	5500	0.022	16	2.1	833	12	405197
New Sailing speed 14 knots	83.5	30.6	5500	0.019	16.5				416552
New Sailing speed 12.5 knots	82.8	34.4	5500	0.017	17.2				434393

LDCs/SIDS study scope

- Focus on states that are **both LDCs and SIDS**.
- SIDS that are not LDCs (for instance, Singapore) or LDCs that are not SIDS (for instance, Cambodia) are outside the scope of our analysis.
- For the former (SIDS that are not LDCs) we speculate that **many of the potential negative impacts are not relevant**.
- For the latter (LDCs that are not SIDS) we think that **many of the issues are very similar** (although perhaps not as pronounced) as with states that are both LDCs and SIDS.

Table 4: List of SIDS and their LSCIs. Source: UNCTADSTAT.

Caribbean	LSCI	Pacific	LSCI	AIMS	LSCI
Anguilla	4.39	American Samoa	7.47	Bahrain	25.71
Antigua and Barbuda	5.32	Cook Islands	2.68	Cape Verde	6.49
Aruba	9.51	Federated States of Micronesia	4.47	Comoros	6.72
Bahamas	31.36	Fiji	11.2	Guinea Bissau	4.55
Barbados	7.44	French Polynesia	10.79	Maldives	7.42
Belize	11.49	Guam	8.3	Mauritius	28.01
British Virgin Islands	5.5	Kiribati	2.01	Sao Tome and Principe	6.32
Cuba	9.61	Marshall Islands	4.92	Seychelles	9.11
Dominica	6.21	Nauru	2.2	Singapore	108.08
Dominican Republic	38.78	New Caledonia	11.02		
Grenada	6.08	Niue	NA		
Guyana	9.23	Northern Mariana Islands	5.12		
Haiti	11.12	Palau	3.4		
Jamaica	33.19	Papua New Guinea	12.63		
Montserrat	4.39	Samoa	8.07		
Netherlands Antilles	NA	Solomon Islands	10.66		
Puerto Rico	NA	Timor-Lest	2.91		
St. Kitts and Nevis	6.64	Tonga	7.59		
St. Lucia	6.67	Tuvalu	2.01	LEGEND	
St. Vincent	6.97	Vanuatu	7.91		In UNCTAD list
Suriname	9.06				Member at AOSIS
Trinidad and Tobago	15.43				
US Virgin Islands	NA				Observer at AOSIS

The importance of connectivity for LDCs/SIDS

- Liner Shipping Connectivity Index (LSCI)
- A high LSCI implies a reduced risk of monopolistic-oligopolistic schemes and hence it implies reduced freight rates, vis-à-vis situations of a low LSCI, which imply the opposite.
- Wilsmeier & Hoffmann (2008) suggest that one transshipment has the equivalent impact on freight rates as an increase in distance between two countries of 2612 km.

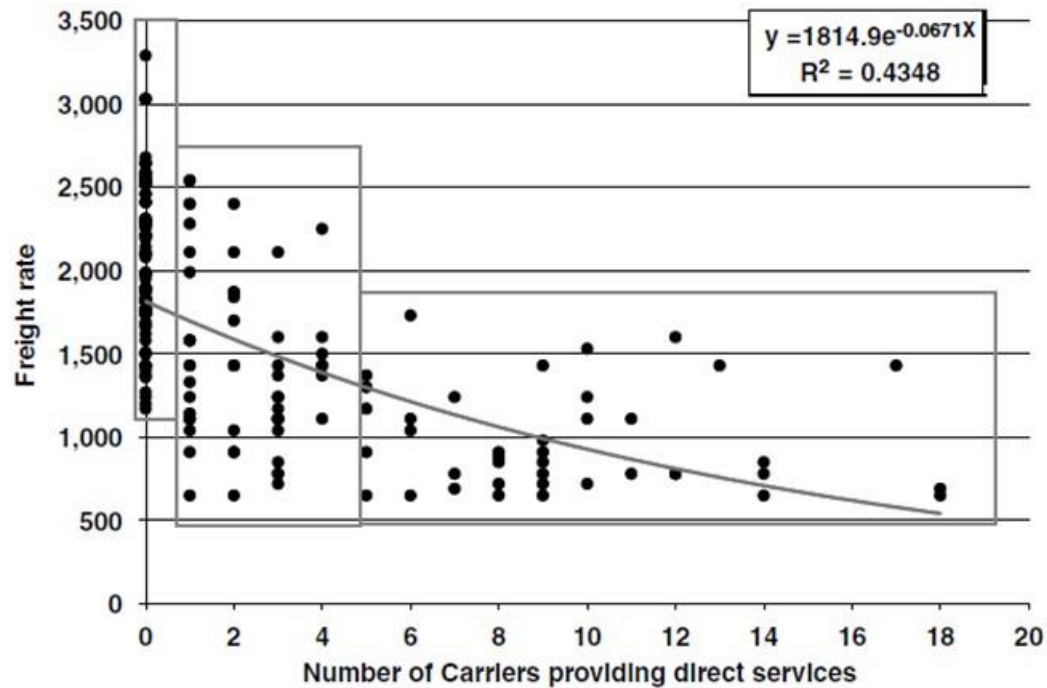
CONNECTIVITY II

Source: Wilmsmeier and Hoffmann (2008).



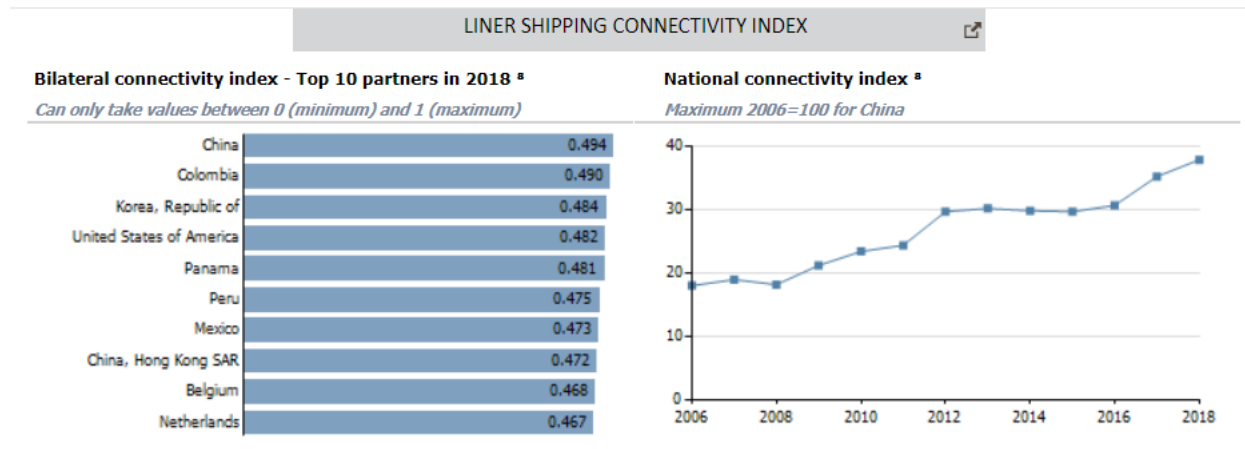
G Wilmsmeier & J Hoffmann
Liner Shipping Connectivity and Port Infrastructure

140



Connectivity: good or bad

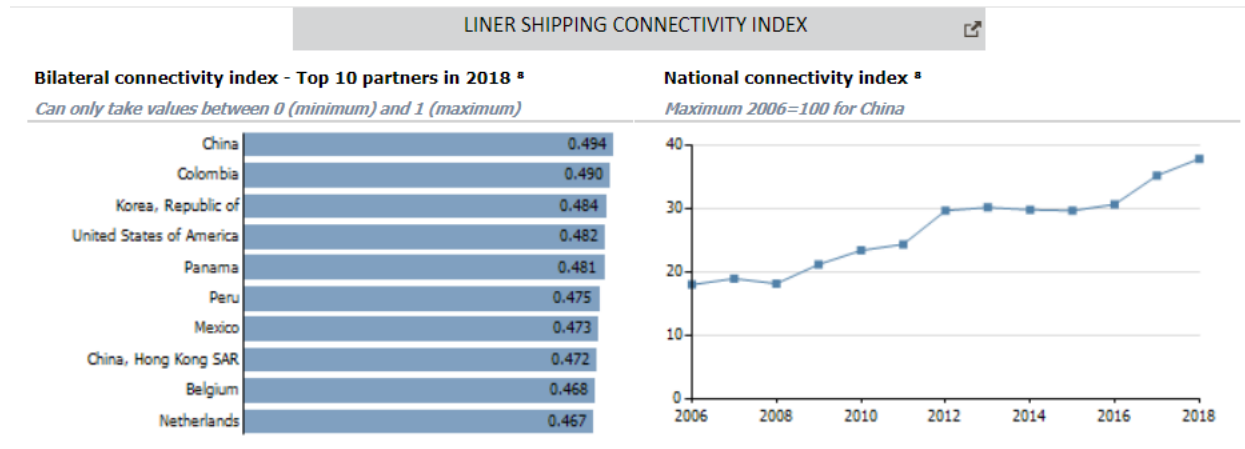
- Brazil



Source: UNCTADstat (<http://unctadstat.unctad.org>)

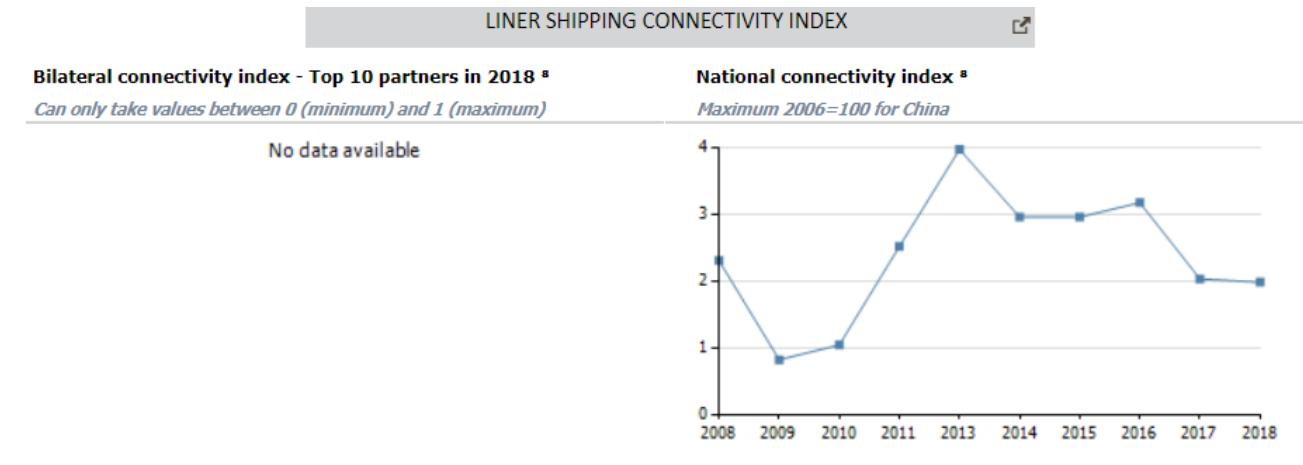
Connectivity: good or bad ii

- Brazil



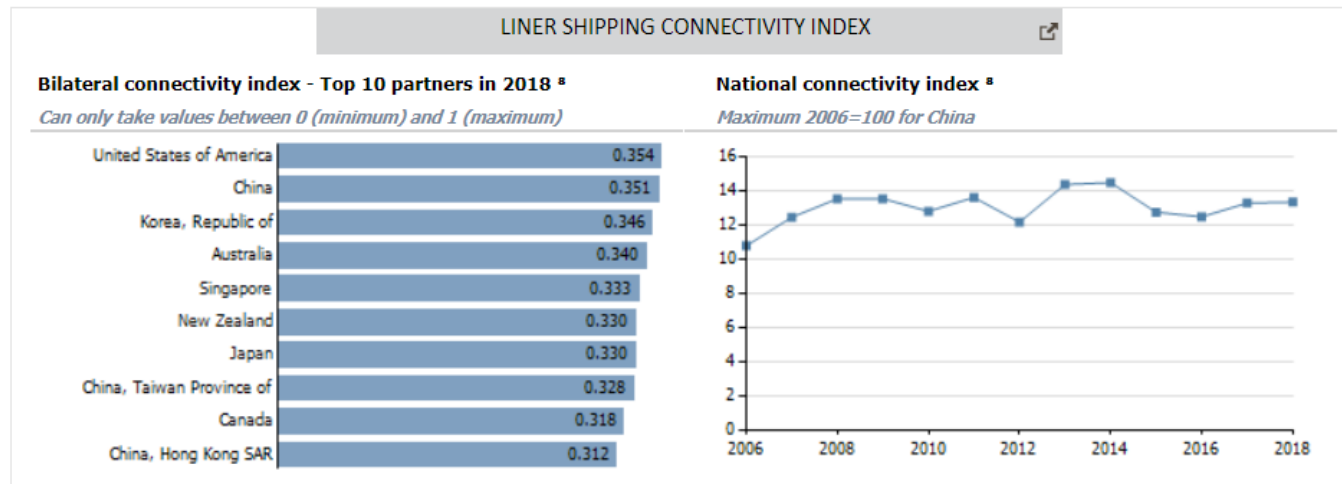
Source: UNCTADstat (<http://unctadstat.unctad.org>)

- Tuvalu



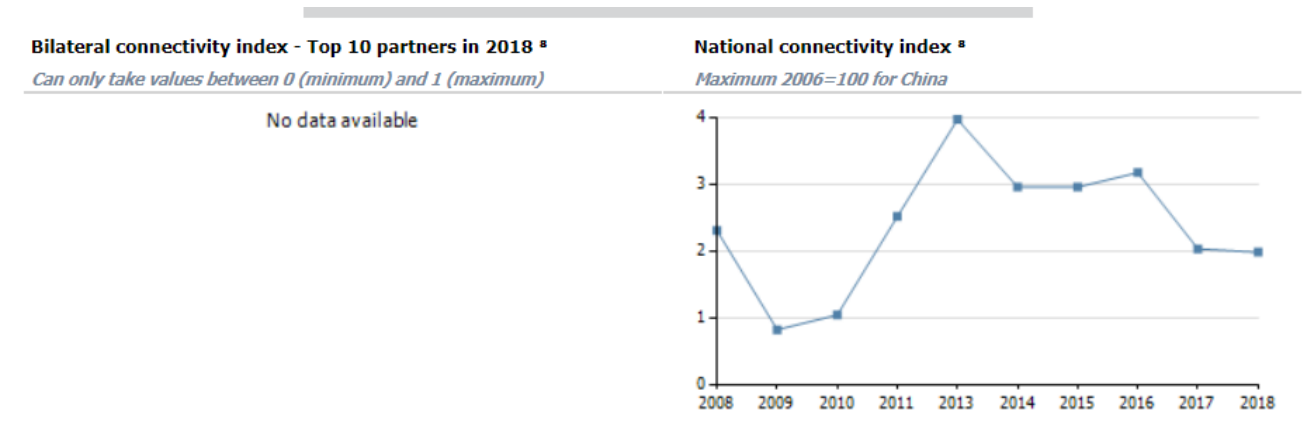
Connectivity: good or bad iii

- Fiji

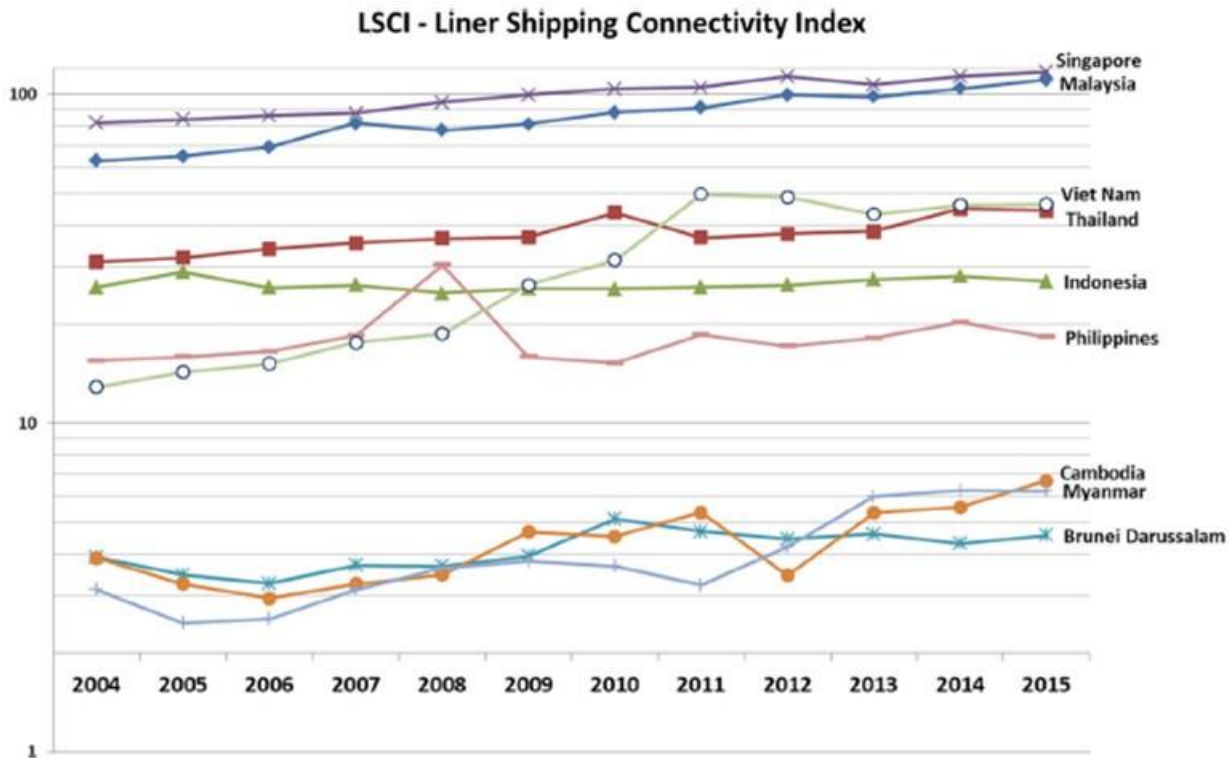


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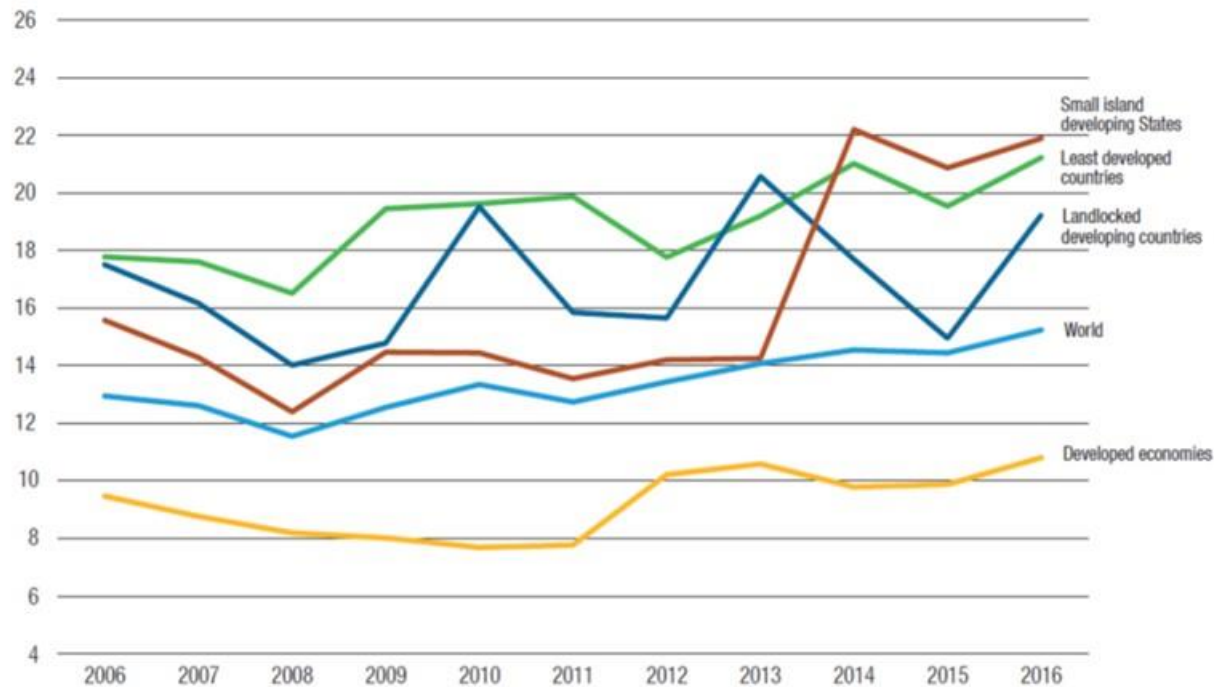
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LSCI for ASEAN SIDS/LDCs



Transport and insurance costs as a percentage of value of imports. Source: UNCTAD (2017).



Source: UNCTAD secretariat calculations.

Note: All modes of transport; the least developed countries grouping includes 48 countries for all periods up to 2016.

FLEETS

- The majority of the SIDS have a very small number of vessels that are “beneficially owned”.
- This means that for most of these SIDS the responsibility to achieve appropriate GHG emissions reductions will fall onto owners **from other countries** serving these SIDS.

FLEETS ii

- Risk of trade disruption in case the owners of these fleets decide
 - either not to serve these SIDS in the future because of commercial or other considerations, or
 - charge disproportionately high freight rates to serve these SIDS.
- Whether such a risk will increase in case the goal-based measure is adopted is a hypothesis that we found no evidence or other data to consider as likely
 - particularly given that under the goal-based measure ship owners would have more flexibility to respond than under other GHG reduction measures (eg, speed or power limits).

Rate madness

Table 8: Illustrative freight rates (USD/TEU). Source: World Freight Rates.

	Export Freight Rate		Import Freight Rate	
Anguilla	USA (Miami) 1050	France 1700	USA (Miami) 1020	France 650
Comoros	India 2300	France 2750	Tanzania 3500	China 850
Cook Islands	Japan (reefer) 2900	China (Shanghai) 2850	New Zealand 1300	Fiji 1000
Fiji	USA (LA) 2750	Australia 680	Singapore 2050	New Zealand 1400
Tuvalu	Japan (reefer) 2700	France 2400	China 2450	Fiji 1000
Vanuatu	Mauritania 3350	Japan 2700	China 2350	Australia 1050

Rate madness ii

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Vanuatu	Mauritania 3350	Japan 2700	China 2350	Australia 1050

Summary

Table 9: Potential negative impacts on LDCs/SIDS

Potential negative impact	Likelihood
Undesirable degradation in the quality of the cargo	2
Increased cargo in-transit inventory costs	1
Cargo shifts to faster modes of transport	1
Higher freight rates	2
Decrease of product FOB prices and/or increase of product CIF prices	2
Loss of market share to competitors who are closer to target markets	1
Change of stock levels	2
Higher lifecycle GHG emissions	1
Difficulty to finance retrofitting of old ships or investment in new ships	3

- 0: almost impossible or very unlikely
- 1: unlikely
- 2: likely
- 3: very likely or almost certain
- 4: high risk of disproportionately negative impact

Note that:

- For LDCs/SIDS such an assessment is by necessity **qualitative and subject to review** once additional information or other data that may alleviate these uncertainties becomes available.
- Further analysis, supported by appropriate and reliable data, may be necessary so as to obtain a more accurate assessment of the potential negative impacts.

What is the share?

- The degree of share (or responsibility) **of the goal-based measure**, vis-à-vis the share of the many other factors that may contribute to these impacts, **cannot be precisely ascertained**.
- In fact, and on the basis of all information at our disposal, **our conjecture is that such share is low**.
- Any hypothesis that LDCs or SIDS would face disproportionately negative consequences *from the goal-based measure* is **NOT** supported by evidence or other information at our disposal.

Exemptions?

CSC proposal on speed limits (prescriptive)

- A bad idea to start with
- Also, embeds exemptions for:
 - LDCs/SIDS if negative impacts can be documented
 - Perishable products in export seasons
 - Selected ship types (eg reefer ships)

Exemptions? ii

- Exemptions would be a big mess to administer, will lead to carbon leakage, will not reduce CO2
- Exemptions would violate the principle of non-favorable treatment
- Exemptions would condemn LDCs/SIDS to being served by ships that will eventually become technologically obsolete

Mitigation measures

- Potential **mitigation measures** can be considered in terms of capacity building, technical assistance, R&D support and financial assistance to LDCs/SIDS.
- As these cannot happen in the context of the goal-based measure per se, a relevant forum in which this discussion can take place **at the IMO** is the impending discussion on Market Based Measures (MBMs).

LDCs/SIDS for MBMs

- ISWG-GHG 4/2/3 (Action Plan for implementing the IMO GHG Strategy and candidate measures)
- Submitted by **Antigua and Barbuda, Kenya, Marshall Islands, Palau, Solomon Islands, Tonga, and Tuvalu** to the 4th Intersessional WG on GHGs, the one that preceded MEPC 73.
- Argues that the preparatory work in agreeing MBMs should be an **immediate and high priority**, and specifically suggest an easily implementable and transparent **carbon tax or levy on bunkers**.

MBMs

- The sponsors suggested that the initial revenue generated could be targeted primarily at research and development for the industry and compensation for the impact on SIDS and LDCs from measures adopted.
- Even though the doc does not explicitly mention the goal-based measure, in principle the statement that SIDS/LDCs should be compensated for potential negative impacts is a fair one.

Last but not least

- Mitigation measures can also be considered outside the IMO
- Relevant bodies: UNFCCC, UNCTAD, OECD, WTO, or others.

THANK YOU VERY MUCH

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