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Identifying and assessing the impact of Market Based Mechanisms on India's international sea trade

Submitted by:

Dr. Aditya Gupta	Mr. Prasanta Patri
Chief Operating Officer Supply Chain Management Centre Indian Institute of Management Bangalore Email: aditya.gupta@iimb.ac.in	Post- Doctoral Fellow (RA) Supply Chain Management Centre Indian Institute of Management Bangalore Email: prasanta.patri@iimb.ac.in prasanta.iim2018@gmail.com

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Mumbai - 400 042 (India)

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Impact Assessment of MBMs on Maritime Shipping Decarbonisation in India

1.1 Introduction

The climate policy of every country aims to reduce greenhouse gas (GHG) emissions in a way which is cost-effective and goal-oriented. To do the same, there are two alternative approaches. These approaches are (i) the command and control approach, and (ii) the Market-Based Measures (MBMs) approach. If we consider approach one, is about formulating deregulation by setting a benchmark to restrict and reduce GHG emissions. The set benchmarks are speed, power, and fuel consumption limit. But this approach has certain limitations as it restricts investments in technology because it gives no incentive to the shipping firm to innovate. By contrast, Market-Based Measures (MBMs) are considered as a more flexible method that use price and other economic variables to provide monetary incentives for polluters to reduce emission (Lagouvardou et. al., 2020). It applies a very effective principle called the "polluter pays principle." As per this principle, the polluter compensates for the cost by internalizing the negative externality of emission. Some examples of MBMs are carbon tax, emission Trading System (ETS) and Bunker levy.

The present study is to provide an assessment and overview of the most talked about and potential Market-Based Measures to reduce greenhouse gas (GHG) emissions from the marine industry in general and ships. It is to discuss India's stance on shipping decarbonisation and effective measures to reduce carbon emissions by following various strategies of the International Maritime Organization (IMO). IMO's Secretary General has appointed an expert group to evaluate 10 separate MBMs proposals to reduce Green House Gas (GHG) emissions by employing 'in-sector emission reduction' or 'out sector emission reduction' by collecting funds or climate finance that are to be used for mitigation activity.

The MBM discussion at IMO, 2013 was suspended because developing countries like China, Brazil, India, Saudi Arabia strongly opposed the Energy Efficiency Design Index (EEDI). This divisive discussion was the reason for the suspension of IMO, 2013. After five years, that is in 2018, the IMO has again focused on MBMs (IMO, 2018) with medium-term measures among the nations from 2023 to 2030. The IMO, 2018 focuses on "innovative mechanisms for reducing emissions, inclusions of MBMs, reduce GHG emissions through incentives".

Moreover, in this study, we need to discuss three aspects.

- **MBM Mechanism**: A detailed evaluation of the different MBM mechanisms on various parameters and our suggested mechanism, which is best suited for India, with our reasoning for the choice being made.
- **Impact Assessment**: An impact assessment of the suggested MBM mechanism.
- **Fund Sharing**: A suggested methodology for sharing the funds collected through the MBM by the IMO allowing India to gather a fair share.

For a better analysis, the present study can be divided into the following MBMs:

1. Bunker Levy/Carbon Levy
2. Emission Trading System (ETS)

The first part of the study is making a comparison among the various MBMs and to find out the best methodology for India with proper argument and reasoning.

1.2 Bunker levy

The Bunker levy or carbon levy is one of the important variants of MBMs. These include:

A. The GHG fund-the international fund for GHG emission from the shipping industry. This was first proposed by Denmark and submitted to IMO in the year 2010.
B. A simple tax on bunker fuel
C. A tax or levy on CO2 equivalent emission
D. Variants that include restrictions on which ships would be subject to the levy or differentiation of the levy according to some criteria.
E. To eliminate the tax-free status of marine fuels at a European level

The variant E is proposed to be investigated under European Green Deal (EU, 2019), it will be beneficial for all to adopt the variant E and GHG emission will be minimized. That is when Marine fuels will be taxed at a global level (Variant A to D), it will have impact on to lower the global GHG emission.

Table 1.1: Price level of Levy

Price Level of the Bunker levy	**Range (USD/tonne of CO2 e)**	**Range (USD/tonne of HFO/MGO/MDO)**	**Expected GHG reduction**
Low	0.5-5	1.5-15	None or negligible
Medium	5-75	15-225	Moderate
High	>75	>225	Significant

Source: Psaraftis and Lagouvardou (2019)

To impose bunker levy, it requires certain key elements these are explained below: (Psaraftis and Lagouvardou, 2019)

- Which ships will be liable for the levy?
- The levy varies depending on the type of fuel used.
- the level of the levy's price
- the levy's implementation
- Who will be in charge of collecting the levy?
- how and to whom the levy proceeds will be distributed

Table 1.2: Pros and Cons of Bunker Levy

Bunker Levy	
Pros	**Cons**
• In the short term, a bunker levy can reduce CO2 emissions from tankers by up to 43%. (Lagouvardou et. al., 2022)	• Bunker levy is good for deep sea shipping and not for short sea shipping where competition with other transport exists
• Considered as one of the simple taxes on bunker fuel	• Bunker may hinder the promotion and exploitation of short sea shipping (SSS)
• It can provide an additional source of government revenue, which can then be used to fund additional climate action.	• The challenges are rising transaction costs of levying and monitoring for both the participants and the regulator
• It can politically feasible	• The developing country will suffer more financial burden than developed countries
• Bunker levy generates data and facilitates information sharing	•

Source: Author's own compilation

2.1 Emission trading Systems (ETS)

ETSs are market-based measures that allow individual companies to trade emission allowances. Every individual company has a certain limit to emit the GHGs which is called emission allowances. If they emit less than their limit, they can sell their unused allowances to other companies who need them more. ETSs are also known as 'cap and trade system' as it caps the total GHGs emission and allows small emitters to sell their extra allowances to the large emitters. This method creates a supply-side and demand-side market for optimized GHG emissions.

Variants of ETSs

There is various emission trading system (ETS) to minimize maritime GHG emission. These are:

A. Global ETS: submitted in the year 2010 to the IMO by countries like Germany, UK, Norway, and France.

B. Regional ETS: It was submitted by European Union to align with European Green Deal (EU, 2019). The intent was to include the shipping industry in the EU, ETS.

Regarding category A of ETS, there has not been any updated submission of Global ETS proposals since 2013, as it was the year when the discussion on MBMs was not successful because of its suspension. Some of the examples of Global ETS are presented IN THE YEAR 2010. These countries are UK, Norway, France, and German. Though their ETS proposals were somewhat like each other but were not fully the same. All these countries had a global coverage basis for ETS.

If we investigate category B of ETS which is the regional ETS, the intention to include the shipping industry in European Union ETS, its action, legislation, and impact assessment front are not finalized. There is huge uncertainty about the strategies and ways to implement the regional ETS. It is a matter of discussion and time to bring it to success (Psaraftis & Lagouvardou, 2021).

Category B of the ETS i.e., EU ETS is expected to relate to the European Union regulation on Monitoring, Reporting and Verification (MRV) of CO2 emission (EU, 2015). The EMSA[1] published in 2020 the first account of CO2 emission that comes under MRV regulation. (EMSA, 2020). This report recorded a CO2 emission of 138 million tonnes from more than 11,000 ships.

For instance, if we look in to the two processes, IMO and EU they are totally disconnected. Hence a complete EU-ETS proposal is not possible to do a better cost-benefit analysis on it (Psaraftis & Lagouvardou, 2021). But from an Indian perspective, there is some evaluation of ETS on various parameters.

India is getting ready to adopt carbon market efforts, such as ETS and crediting systems, in the upcoming years. The goals and preparations being made throughout the nation to achieve this are listed in the table below.

2.2 Pros and Cons of Emission Trading System (ETS)

There is no doubt that with the implementation of ETS, there will be a substantial reduction in CO2 emissions, but it is a difficult task to fix the target. It is equally difficult to fix a cap on carbon price through ETS, as the price may skyrocket when close to the cap (Psaraftis, 2012). The cost-effectiveness of ETS in the case of Indian maritime will be less, as it is associated with high administrative costs with an unpredictable carbon price. The scientific

[1] European Maritime Safety Agency (EMSA) published in May of 2020

community is interested in the effects of a worldwide global maritime emission trading system (METS). According to a study by (Gu et al., 2019), the METS will eventually encourage the sector to invest in carbon-neutral technology. The implementation of METS has various potential challenges (Balcombe et. Al., 2019). These challenges are rising transaction costs of trading and monitoring for both the participants and the regulator. The developing country will suffer more financial burden than developed countries (Balcombe et. Al., 2019). Credit borrowing must be regulated to reduce the risk of businesses just offsetting emissions without controlling them. Companies will be able to stockpile allowances when the price is lower and use them later when carbon prices rise again because of a METS's high price volatility. ETS can.

Table 1.3: Pros and Cons of ETS

ETS	
Pros	**Cons**
• ETS targets to reduce emissions by allowing highly efficient engines in the shipping industry	• The poor and developing countries may experience less economic activity because of ETS imposition in the shipping industry
• Delivers cost-effective abatements in the shipping	• To fix the ETS target is a difficult task
• ETS can provide an additional source of government revenue, which can then be used to fund additional climate action.	• Difficult to cap the carbon price through ETS in the shipping industry
• It can politically feasible	• The challenges are rising transaction costs of trading and monitoring for both the participants and the regulator
• Emissions trading generates data and facilitates information sharing.	• The developing country will suffer more financial burden than developed countries

Source: Author's own compilation

The IMO has developed nine criteria for assessing GHG reduction efforts. These are as follows: (IMO, 2010g)

1. Environmental efficiency
2. Cost-effectiveness, possible effects on trade, and long-term and sustainable development
3. incentives for innovation and technological change
4. Practical viability of MBM implementation
5. The requirement for technology transfer to and capacity building within developing countries, especially the LDCs and small island developing states (SIDS)

6. The relationship with other pertinent treaties (UNFCCC, Kyoto Protocol, and WTO) and conformity with customary international law
7. The added administrative cost that MBM implementation and enforcement may entail, as well as the legal implications for national administrations.
8. The implementation of MBM could have an added workload, financial burden, and operational impact on specific ships, the shipping industry, and the marine sector as a whole.
9. compliance with current enforcement and control provisions established by the IMO legislative framework.

The Danish Maritime Authority (DMA) commissioned the Technical University of Denmark (DTU) to conduct research on comparative evaluation of MBMs (Psaraftis et al., 2020) by using the following criteria:

- Effectiveness of the Green House Gas reduction
- Compatibility with the current legal framework
- Effective timeline for implementation of MBMs
- Potential impacts on states
- Administrative burden
- Practical feasibility
- Avoidance of conflict between ship owner and charter
- Commercial impacts

This study uses the evaluation criteria of the Danish Maritime Authority commissioned by DTU, Denmark. The evaluation of all the three MBMs is as follows:

GHG effectiveness

An interesting question arises if there will be the imposition of any MBMs on the ships, how much carbon emission can be reduced? To answer this question, the shipping association has fixed a USD 200 per tonne surcharge recommended to the IMO to establish an R & D fund to decarbonize shipping (ICS, 2019). This will induce them to technological advancement and logistical measures. The technology will be more energy efficient, economically viable and less dependent on fossil fuels. By considering the ETS, the clarity of understanding is that there will be a market to auction CO2 emission allowances or permits at a price decided by the market mechanism. If the ship owner does not have the allowances with them, they would not be able to emit the CO2. The cap would be adjusted downwards every year to achieve a 50 % reduction by 2050 at the 2008 base year level. By contrast, slow steaming in the short run will reduce CO2 emissions. If the bunker price will be doubled from 500 to 1000 USD per tonne, it will lead to a 50 % reduction in CO_2 emission (Psarftis, 2019). That indicates a substantial bunker levy will incentivize low or zero-carbon fuels and better energy efficient-cum-saving technologies.

Compliance with the existing legal framework

There is no doubt that a bunker levy and ETS are the most effective ways to reduce CO_2 emissions. Here the government needs to reform the tax system in the economy to levy the same. Whether the tax will be imposed on personal or corporate income is also a question. In the same fashion, the ETS also carries some legal obstacles. The major challenges for ETS are the rising transaction costs of trading and monitoring for both the participants and the regulator. It is important to note that no MBM proposals or GHG fund documents have used the word 'tax' or 'levy' rather the term 'mandatory contribution' for that purpose has been used to avoid legal obstruction to institute an international tax. The MBM expert group of IMO has established a "legal task group' to examine the legal issues. Their work is to highlight policy sensitivity while discussing the MBM proposals. The legal experts proposed that MBMs must consider the principle of CBDR-RC i.e., Common but Differentiated Responsibilities and Respective Capabilities. To develop a better MBM in the form bunker levy, an appropriate legal document should be drafted to avoid legal obstacles. But it can be considered that providing subsidies to the shipping industry to build carbon-efficient ships carries fewer legal obstacles as compared to other MBMs

Timeline for possible implementation

There is no clear timeline to impose any MBMs and all are at the beginning of their introduction. Hence there is no exact timeline to impose a levy. Even currently India has not any uniform system of carbon taxation. However Indian government is imposing Green Cess and Eco Tax on vehicles to reduce the negative externality. But if considering the international community, all the initial IMO strategies in the form of MBMs are expected to be implemented between 2023 and 2030. Here, the implementation is only a possibility. We can't say the MBMs will be agreed upon by all countries in the recent future to decarbonize the whole system. There is no doubt that the European Union is at the forefront to include the shipping industry in the EU ETS, but the MBMs currently almost do not take any shape or are invisible within the IMO agenda. This may take some time to have a clear draft of MBM implementation worldwide, but it is uncertain.

State-specific potential impacts

Yet there is no study available by the IMO on the potential impact assessment of MBMs on states. The consortium of the shipping association (ICS, 2019) has faced serious objections from many IMO member states, especially from developing countries to do an impact assessment of the two dollars per tonne surcharge on bunker fuel. This assessment has not been done yet because of concerns shown by the developing world. This discussion may reopen at the IMO in the future. The potential impact of bunker levy can't be ignored if we look at the Least developing countries and Small Island Developing States (Halim et. AL., 2019). Many states think that they may suffer due to the negative impact of freight rate increases due to carbon levies. By contrast, the bunker levy generates revenues that can be used to compensate for the negative impact of carbon emissions. All MBMs have their state-specific potential impacts, but it is a matter of further study in the due course of time after the implementation of MBMs in the maritime industry worldwide

Administrative burden to impose the MBMs

There is an administrative cost to measure the level of pollution and the imposition of a carbon tax on shipping. But in the case of ETS, the major challenges are rising transaction costs of trading and monitoring for both the participants and the regulator. To impose the bunker levy, the executing country will face some kind of administrative difficulties and burdens. This is because the levy is collected from the bunker supplier level and at sea level. So, it has huge administrative efforts required. Some policymakers assume that it is not possible to impose bunker levy directly but rather to collect the tax from the measurement of CO2 or GHG emission through a suitable ultra-sound device within a ship's stack (Devanney, 2011).

Practical Feasibility

The practical feasibility to impose the bunker levy is not clear as it creates a burden on the consumer indirectly and is regressive in nature. But the ETS enforcement will be considered on the high side. In the case of ETS, the practical difficulties will be faced by the maritime industry will it be imposed on a global scale or regional scale. To implement a levy there must not be any practical or administrative difficulties. With easy implementation, the levy works as an 'invisible hand' that affects user behaviour in reducing GHG emissions at a global level. The feasibility of providing subsidies for low-carbon technology is high if we consider it at a regional scale such as the Indian maritime industry.

Avoidance of split incentives between ship-owner and charterer

There is a serious split incentive between ship owners and charterers under the ETS system (Psarftis, 2012). It is a difficult task to link the price of a permit purchased and the speed decision of the charterer at a different time. As far as a bunker levy is considered, If the ship owner and time charter have different incentives to adopt energy saving, a split incentive situation comes into existence. In reality, the shipowners do not have any serious incentive to invest in energy-saving technologies. This is so allegedly because fuel is being paid for by the charterer and not by the ship owner. Hence the split incentive creates a 'market barrier' or 'market imperfection' and it also prohibits technology or alternative fuel.

Commercial Impacts

The commercial impact of the bunker levy will be high as it will raise the cost of production and the price of goods and services will be higher and it will be borne by the ultimate consumer. In the case of ETS, its commercial impacts are potentially very significant and may be manifested in a variety of high administrative burdens and lower practical feasibility of an ETS. Due to the imposition of bunker levy, the transportation cost will rise in the form of rising costs or sailing time. It will reduce the income of shipping companies. Business enterprises such as fossil fuel producers and vendors must sell energy-efficient technologies, otherwise, there will be a commercial disadvantage. The commercial impacts would include the entire chain of stakeholders. The government subsidies strategy to reduce carbon emissions will drive the low-carbon maritime companies to further reduce the same. These companies will use the subsidy to develop low-carbon and efficient ships. As a result, the social cost of environmental degradation due to CO2 emission will be reduced. In environmental economics terms, the negative externality due to pollution and emission will be minimized.

Table 1.4: A summary of levy-based and ETS-based MBMs for India

MBMs Criteria	Bunker Levy-based	ETS-based
GHG effectiveness	It depends on the level of levy imposed on the ships. Good for India	Good for global ETS and questionable for India and EU ETS
Compliance with the existing legal framework	There may be some legal obstacles	There may be some legal obstacles
Timeline for possible implementation	There is no clear timeline at the global level at IMO	There is no clear timeline at the global level
State-specific potential impacts	potentially significant	potentially significant
Administrative burden	Low	Considerable
Practical Feasibility	High	Considerable

Avoidance of conflict between ship owner and charter	No serious split incentives	Serious split incentives
Commercial Impacts	Considerable in many sectors	Potentially very significant but uncertain due to unexpected carbon price

Source: Author's own compilation

Conclusions

The present study focuses on the comparative evaluation of maritime MBMs. We have discussed two measures of MBMs. These MBMs are bunker levy and emission trading systems (ETS). The ETS help individual marine companies to trade emission allowances. Every shipping company will have a certain limit to emit the GHGs by using their emission allowances. If they want to emit more than their emission allowance, they must purchase the same from a different shipping company that has some surplus allowances. That the big shipping companies are supposed to purchase the extra emission allowances from the small emitters. These supply-side and demand-side strategies will play a vital role to minimize GHG emissions and will lead to shipping industry decarbonization in India.

If we consider the bunker levy, it is considered as good for deep-sea transportation and not suitable for short-sea shipping. Every measure has its own benefits and limitation. Based on the evaluation study, the imposition of a bunker levy in India is considered the best option as compared to the ETS. At the strategic level, the bunker levy would incentivize the development of alternatives such as low-carbon fuels or zero-carbon fuels by employing energy-saving technologies. A bunker levy is considered as a simple levy to implement and it will affect the user behaviour towards reducing GHG emissions both in the short run and long run. The bunker levy has certain positive commercial impacts. In long run the bunker levy will favour companies that have the financial resources to invest in energy efficient technology and alternative fuels. As the price level of the levy is significant, in the long run it will boost the business prospects of a wide variety of companies such as alternative or zero carbon technology developers, manufacturers of engines that can use green energy and equipment such as wind sails, air bubbles, specialised propellers, etc. Bunker levy is considered a good measure for deep sea transportation as compared to ETS because ETS imposition needs a lot of legal-cum-administrative difficulties to monitor. There are no serious split incentives between ship owners and charter in case of bunker levy. But the scenario is different for ETS as there exist serious spilt incentives. The imposition of ETS in Indian marine is potentially uncertain due to unexpected carbon prices.

Impact Assessment: An impact assessment of the suggested MBM mechanism

1.1 Introduction

Marine transport creates anthropogenic climate change because of the substantial emission of carbon dioxide (CO2) and other polluting gases such as nitrogen oxide (NOX), Sulphur dioxide (SOX), and hydrogen oxide (H2O). SOX and NOX are not greenhouse gases but cause acid rain and other undesirable effects (Psarftis, 2012). The present study concerns greenhouse gas emissions in the maritime industry and the International Maritime Organization's consideration of a global shipping carbon tax. To assess the potential impact of the carbon tax on maritime trades, a trade-volume-based model of shipping carbon emissions was developed, and the model was applied to analyse the dry bulk trade in China. The results show that the introduction of the carbon tax could have significant impacts on freight rates and commodity prices, with shipping freight rates increasing by 10-30%. Additionally, the shipping carbon tax may significantly change the dry bulk trade patterns, resulting in China's increasing reliance on nearby countries for the import of key commodities. These findings can help shipping companies and sectors make better carbon reduction responses.

The marginal abatement cost (MAC) curves for illustrating greenhouse gas (GHG) emission reductions from design standards, retrofit technologies, and operational measures that improve ship energy efficiency. The first generation of MAC curves for marine GHG reductions lacked detail and was not tailored to specific ship types. To improve the precision of marine MAC values and support policies in development at the International Maritime Organization (IMO), the ICCT and its partners worked with the Society of Naval Architects and Marine Engineers (SNAME) to identify 50 potential ship efficiency measures. The study examined these measures against 53 ship types and sizes over 30 years, and the results showed that by 2020, the industry's growing fleet could reduce annual CO2 emissions by 436 million metric tons, or 33% of the projected annual total, with 340 MMT (26% of the total) achievable for a net negative cost after fuel and other savings are accounted for. This work was originally submitted to the IMO in a detailed technical report.

A comparative evaluation of market-based measures for shipping decarbonization is required for the present scenario. It is also high time to discuss the potential Market-Based Measures (MBMs) for reducing greenhouse gas (GHG) emissions from ships, in line with the Initial IMO Strategy. The paper also considers the potential inclusion of shipping into the EU Emissions Trading System. Maritime MBMs use various criteria, including GHG reduction effectiveness, compatibility with legal frameworks, implementation timeline, impacts on States, administrative burden, feasibility, avoidance of split incentives, and commercial impacts. The paper categorizes potential MBMs into bunker levy/carbon levy MBMs, ETS MBMs (global and/or EU), and other MBM proposals.

1.2 An impact assessment of the suggested MBM mechanism

The impact assessment of MBMs can be broadly categorised as follows:

1. Environmental impact assessment
2. Social impact assessment
3. Business impact assessment
4. Economic impact assessment
5. Human impact assessment
6. CSR impact assessment

Moreover, the present study is focusing on three important impact assessments for the time being as follows:

Figure. 1: Impact Assessment

Source: Author's own compilation

Environmental impact are comprises of co2 emission, disaster response and food security. In the same line for assessing the business impact of MBMs we need to focus on the following aspects

MBMs and their various impact on the Indian Marine

1. Increase in freight cost.
2. Increase in cost of imported / exported goods.
3. Impacts of the measure(s) on final consumer prices, following assessment of the ability of the firms to pass through costs.
4. The loss of competitiveness of States in their main exports, as well as the consequent substitution of imports in their main destination markets;
5. The possibility of transport modal shift + change in trade pattern with changes in maritime logistics costs.

Table 1: Impact assessment after imposition of MBMs in India

Sl. no	Environmental Impact Assessment	Business Impact Assessment	Economic Impact Assessment
1.	GHGs emission reduction (Wu et al., 2022; IMO, 2010, Long-term simulation model)	Transport dependency	Impact on trade: change in trade pattern with changes in maritime logistics costs
2.	Cost of reduction of CO2 emission (USD per ton CO2 abated)	Transportation cost	Impact on GDP: Based on growth rate (IMO, 2010: Long-term simulation model)
3.	Disaster response	Impact on ship owners' operation (Wu et al., 2022)	
4.	Food security	Impact on shipping companies	
5.		Cargo value and type	
6.		Impact on investment and purchase of ships (IMO, 2010: Long-term simulation model)	

7.	Freight model shift (Wu et al., 2022)	

Source: Author's compilation

To assess the impact of the IMO short-term measures on States, the first steps are:

1. Changes in ship costs and speed, as estimated by DNV, must be converted into changes in maritime logistics costs, i.e., costs to shippers and cargo interests.
2. The second step is to evaluate how the computed changes in maritime logistics costs will impact trade flows (Imports and Exports) and GDP at both the aggregate and country-specific levels, as well as across the three GHG reduction scenarios (EEXI-Only, HIGH-GHG reduction scenario, and LOW-GHG reduction scenario), in comparison to the 2030 baseline Current Regulations scenario.
3. The impact on supply chain costs, ship journeys, and routing patterns was also investigated across the country-trade sector, as well as ship types and routes.
4. With global AIS-based ship traffic data, it was possible to identify the ship types and categories expected to be affected by the IMO short-term measure.
5. Small-sized vessels travelling short-sea shipping routes have been found to be more negatively affected than larger ships travelling longer distances in terms of shipping costs.
6. Some ship size substitution may also occur when a deep-sea liner is required to travel faster, potentially skipping a port and resulting in more transhipment, increasing the use of smaller ships and thus increasing costs.
7. Some ship size substitution may also occur when a deep-sea liner is required to travel at a slower speed, potentially skipping a port and resulting in more transhipment, increasing the use of smaller ships and thus increasing costs.
8. To summarise, the IMO short-term measure affects not only ship costs but also ship travel distance, fleet distribution, routing patterns, as well as market and regional connectivity levels.
9. The impact of reduced sailing speeds and the potential for service reconfiguration is more visible in Pacific and Caribbean SIDS where short-sea shipping and the use of general cargo ships are more prevalent.
10. A network analysis of regional shipping services within Pacific and Caribbean SIDS confirms that smaller economies in these two regions are heavily challenged by

shipping (dis)connectivity and service (in)frequency, and thus may be more negatively impacted by the IMO short-term measure.

GHG emission reduction in India

Considering the environmental impact assessment, we need to focus on GHG emission reduction by the imposition of any MBMs in India. However, India has not employed any measures yet for the maritime industry, but IMO has introduced certain regulations to reduce the GHGs emission from ships on a global scale. The IMO has certain targets to achieve regarding reducing the carbon emission from international shipping by at least 50 per cent by the year 2050 by comparing the base year 2008 level. India also focused to reduce the GHG from the shipping industries by launching a Green Port Initiative in the year 2017 with the objective to make Indian ports greener, and cleaner through renewable energy and efficient technologies. Furthermore, the Indian Register of Shipping (IRS) has developed a voluntary Green Passport certification scheme for Indian-flagged ships aiming to provide sustainable shipping practices by providing environmental performance ratings of ships.

Impacts of MBMs on the Indian marine industry

The impact of MBMs on the marine industry in India would depend on the extent to which the industry contributes to greenhouse gas emissions. But the marine industry is not a major contributor to greenhouse gas emissions in India, it is still likely to be affected by the ETS and bunker levy. If we consider ETS in India, shipping companies will emit greenhouse gases more than their permits, they need to buy permits or allowances from those companies who have surplus permits with them. It will reduce the GHG emission as this measure given an economic incentive to those companies who emits less. Indian marine industry needs to shift to a cleaner fuels or technologies to reduce emission. If and only the shipping companies can switch to best and efficient engines with lower sulphur fuels including wind assisted propulsion or hybrid power type of engines, it could lead to emission reduction. The impact of ETS ON Indian marine industry also depends on how efficiently the allocation of permits or allowances done by a centralised system. If

Impact on States: Trade and Income/Economic Output (GDP)

The impact of EEXI-Only is larger for developing countries than for developed countries. By considering the Low-GHG and High-GHG reduction scenario, the distribution is shifted downward for developing countries as compared to developed countries. That means the developing country will suffer more as there is a larger fall in their export flow. With the imposition of any MBMs measure, the countries which are importing agricultural products are the worst suffers. Even the net food-importing countries experience a negative impact. The countries that are exporting manufacturing products and mining commodities may also have negative impacts. For SIDS and LDC countries, there is a fall in exports of around 2 % as compared to the 2030 baseline current regulation scenario (UNCTAD, 2021). The worldwide GDP drop will be between -0.01%, -0.04%, and -0.02% under the EEXI-Only scenario, the HIGH-GHG reduction scenario, and the LOW-GHG reduction scenario, respectively. Global trade (imports plus exports) reductions will range between -0.10%, -0.49%, and -0.21% under the EEXI-Only scenario, the HIGH-GHG reduction scenario, and the LOW-GHG reduction scenario, respectively. Countries with lower GDP and lower trade are more likely affected as compared to countries with higher GDP and trade levels.

Impact on Maritime Logistics Costs

The UNCTAD report shows that there is an increase in maritime logistic costs if any MBMs are imposed to reduce GHG emissions. These stand at 1.6%, 3.1% and 7.6% for the EEXI-Only scenario, the LOW-GHG reduction scenario and the HIGH-GHG reduction scenario, respectively. However, wide variations prevail across the three GHG reduction scenarios, particularly the HIGH-GHG reduction scenario. These variations imply that some countries and trade pairs would be more impacted than the global average. Conversely, moving from an EEXI-Only scenario[2] to a LOW-GHG reduction scenario generates the smallest maritime logistics cost increases as compared to a shift from a LOW-GHG reduction scenario to a HIGH-GHG reduction scenario. This suggests that much of the cost burden will take place at a later or more advanced stage of the implementation process where operational carbon intensity reduction requirements become more stringent.

Global Model Assessment

Impact by ship type and distance travelled

[2] The International Maritime Organization (IMO) aims to reduce greenhouse gas emissions by 40 per cent by 2030 and another 50 per cent by 2050. The "Energy Efficiency Existing Ship Index" was created to help attain these goals. (EEXI)

The data received from DNV in connection with the 2030 HIGH-GHG reduction scenario, shows that ships which operate in shortsea shipping are affected the most. Under the HIGH-GHG reduction scenario, total cost intensity rises by 41.1% and 37.6% for containers and tankers deployed in short-sea shipping, respectively. This rises by 9.3% and 10.3% for deep-sea bulkers and gas carriers, respectively.

Impact by Journeys and Region

The 2019 laden and partially laden travels undertaken by containerships and tankers involved in regional shortsea shipping, with the Pacific SIDS and African coastal regions having a significantly lower concentration. The majority of very big bulk carriers (>200,000 dwt) are used on export routes from Brazil or Australia to East Asia. Capsize bulk carriers (100,000-200,000 dwt) are proven to trade on more routes across shorter distances, such as those connecting North America to Europe and East Asia.

Impact on iron ore trade

Iron Ore Exports India to Japan

The present impact assessment is a detailed analysis of the impact of a range of levy contribution on iron ore trades from India to Japan.

This includes an analysis of the impacts on States whose iron ore production industries are more geographically remote from their key markets than their competitors, comparing the impacts on the iron ore trades between India and Japan (voyage length about 6374 NM).

To conduct this analysis, the present study used its standard ship and voyage assumptions for a cargo carrier of iron ore, carrying 187500 MT of iron ore from India to Japan from the origin Mumbai port, India to Tokyo port Japan.

Based on the FOB price of iron ore delivered in Japan and total freight cost in USD, with respect to the India-Japan route, the study calculates the impact assessment on bunker price, freight cost, increase in final landed price of iron ore and its final impact on the price of steel as follows:

Iron Ore Exports from India to Japan						**Scenario**					
						1	**2**	**3**	**4**	**5**	**MBM**
Sr. No	**Discussion**	**Source**		**As Is**		**25**	**50**	**100**	**200**	**400**	**Levy in USD per ton on Co2**
						79	**157**	**314**	**628**	**1256**	**Equivalent levy in USD per ton on Fuel Oil**
	Cargo Details										
1	Quantity to be carried in MT (Capesize vessel with capacity of 100,000 DWT)		A	187500		187500	187500	187500	187500	187500	
2	Vessel Size in DWT	Assumption A Below	B	1000000		1000000	1000000	1000000	1000000	1000000	
3	FOB Price of Commodity in USD per MT	https://markets.businessinsider.com/commodities/iron-ore-price	C	126		126	126	126	126	126	1.875
	Origin-Destination- Distance										
1	Origin Port			Mumbai		Mumbai	Mumbai	Mumbai	Mumbai	Mumbai	
2	Destination Port			Tokyo		Tokyo	Tokyo	Tokyo	Tokyo	Tokyo	
3	Distance in NM	Ports.com	D	6374		6374	6374	6374	6374	6374	
	Bunker Details - VLSFO										
3	Bunker Efficiency - NM/MT	Assumption B Below	E	10		10	10	10	10	10	
4	Quantity of bunker used in MT		F = D/E	637.40		637.40	637.40	637.40	637.40	637.40	

5	Price of Bunker in USD/MT	https://shipandbunker.com/prices	G	565		644	722	879	1193	1821
	Freight and Product Cost									
1	Total Bunker Cost In USD		H = F*G	360131		410485.6	460202.8	560274.6	760418.2	1160705
2	Total Freight Cost In USD	Assumption C Below	I = H/0.4	900327.5		950682.1	1000399	1100471	1300615	1700902
3	FOB Price of the Product		J = A*C	23625000		23625000	23625000	23625000	23625000	23625000
4	Freight as % of Price		K = I/J	4%		4%	4%	5%	6%	7%
5	Total CIF Tokyo Price in USD / MT (FOB plus Freight)		L = (J+I)/A	130.80		131.07	131.34	131.87	132.94	135.07
	Impact Asessment									
1	Increase in Bunker Price					13.98%	27.79%	55.58%	111.15%	222.30%
2	Increase in Freight Cost					5.59%	11.12%	22.23%	44.46%	88.92%
3	Increase in Final Landed Price for Iron Ore					0.21%	0.41%	0.82%	1.63%	3.26%
4	Iron Ore required to make one MT of Steel			1.6						
5	FOB Price of Steel in USD per MT	https://www.lme.com/en/metals/ferrous/lme-steel-hrc-fob-china-argus#Trading+day+summary		640						
6	Share of Iron Ore in Price of Steel			33%		33%	33%	33%	33%	33%
7	Impact on the price of Steel					0.1%	0.1%	0.3%	0.5%	1.1%

Source: Author's Compilation

Assumption

A. Assuming a density of around 2.5 metric tons per cubic meter (t/m^3) for iron ore, a 2,000 DWT ship with a hold capacity of 1,500 cubic meters (m^3) could carry approximately 3,750 metric tons (MT) of iron ore.
B. As a rough estimate, the average VLSFO consumption for a cargo ship is around 0.1 to 0.3 metric tons per hour per 1,000 deadweight tons (DWT) of the vessel, depending on the factors mentioned above. This translates to approximately 0.05 to 0.15 metric tons of VLSFO consumption per nautical mile for a typical cargo ship.
C. As a general guideline, a 2000 DWT cargo ship can travel at an average speed of around 10 to 12 knots (18.5 to 22.2 kilometers per hour or 11.5 to 13.8 miles per hour). This speed is considered moderate and suitable for transporting cargo efficiently while maintaining fuel efficiency.

1. **For a levy of $25 per tonne of CO2** (equivalent to $79 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 13.98% and thereby increasing the freight cost by 5.59% and increase in final landed price by 0.21% for iron ore that affects the final steel price with 0.1% increase in the Japanese market.
2. **For a levy of $50 per tonne of CO2** (equivalent to $157 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 27.79% and thereby increasing the freight cost by 11.12% and increase in final landed price by 0.41% for iron ore that affects the final steel price with 0.1% increase in the price of iron ore delivered to Japan when shipped from India.
3. **For a levy of $100 per tonne of CO2** (equivalent to $314 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 55.58% and thereby increasing the freight cost by 22.23% and increase in final landed price by 0.82% for iron ore that affects the final steel price with 0.3% increase in the price of iron ore delivered to Japan when shipped from India.
4. **For a levy of $200 per tonne of CO2** (equivalent to $628 per tonne of fuel oil) there is an additional cost in the form of an increase in bunker price to 111.15% and thereby increasing the freight cost by 44.46% and increase in final landed price by 1.63% for iron ore that affects the final steel price with 0.5% increase in the Japanese market.
5. **For a levy of $400 per tonne of CO2** (equivalent to $1,256 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 222.30% and thereby increasing the freight cost by 88.92% and increase in final landed price by 3.26% for iron ore that affects the final steel price with 1.1% increase in the price of iron ore delivered to Japan when shipped from India.

Iron Ore Exports from India to Bangladesh

The impact assessment of MBMs with special consideration with bunker levy is detailed in the following table (Table 3) with a range of levy contribution on iron ore trades from India to Bangladesh.

This includes an analysis of the impacts on States whose iron ore production industries are more geographically remote from their key markets than their competitors, comparing the impacts on the iron ore trades between India and Bangladesh (voyage length about 394 NM).

To conduct this analysis, the present study used its standard ship and voyage assumptions for a cargo carrier of iron ore, carrying 3750 MT of iron ore from India to Japan from the origine Paradip port, India to Chittagong port Bangladesh.

Based on the FOB price of iron ore delivered in Bangladesh and total freight cost in USD, with respect to the India-Bangladesh route, the study calculates the impact assessment on bunker price, freight cost, increase in final landed price of iron ore and its final impact on the price of steel as follows:

The below table shows a detailed analysis of the impact of a range of levy contributions on iron ore trades from India to Bangaldesh. There is a levy imposed in USD per ton on CO2 emission and an equivalent levy in USD per ton on Fuel Oil.

There are five scenarios for imposing the bunker levy on fuel oil. These Scenarios are from 1 to 5. As we move from scenario 1 to 5 the levy on fuel oil is more.

Due to the imposition of the levy, there is an increase in freight cost, FOB price of the product, increase in bunker price and increase in final landed price for iron ore.

Based on the five scenarios of levy imposed per ton on fuel oil on the iron ore exports from India to Japan the additional cost in the form of the levy would be as follows:

Table 3: Iron Ore Exports from India to Bangladesh						Scenario					
						1	2	3	4	5	MBM
Sr. No	Discussion	Source		As Is		25	50	100	200	400	Levy in $ per ton on Co2
						79	157	314	628	1256	levy in $ per ton on Fuel Oil
	Cargo Details										
1	Quantity to be carried in MT		A	3750		3750	3750	3750	3750	3750	
2	Vessel Size in DWT	Assumption A Below	B	2000		2000	2000	2000	2000	2000	
3	FOB Price of Commodity in USD per MT	https://markets.businessinsider.com/commodities/iron-ore-price	C	126		126	126	126	126	126	
	Origin-Destination-Distance										
1	Origin Port			Paradip		Paradip	Paradip	Paradip	Paradip	Paradip	
2	Destination Port			Chittagong		Chittagong	Chittagong	Chittagong	Chittagong	Chittagong	
3	Distance in NM	Ports.com	D	394		394	394	394	394	394	
	Bunker Details - VLSFO										
1	Vessel efficiency Bunker Fuel in MT/hour	Assumption B Below	E	0.4		0.4	0.4	0.4	0.4	0.4	
2	Average speed of vessel in NM /Hour		F	12		12	12	12	12	12	
3	Bunker Efficiency - NM/MT		G = F/E	30		30	30	30	30	30	
4	Quantity of bunker used in MT		H = D/G	13.13		13.13	13.13	13.13	13.13	13.13	
5	Price of Bunker in USD/MT	https://shipandbunker.com/prices	I	565		644	722	879	1193	1821	
	Freight and Product Cost										

1	Total Bunker Cost In USD		J = H*I	7,420.3		8,457.9	9,482.3	11,544.2	15,668.1	23,915.8
2	Total Freight Cost In USD	Assumption C Below	K = J/0.6	12,367.2		13,404.8	14,429.2	16,491.1	20,615.0	28,862.7
2	FOB Price of the Product		L = A*C	472500		472500	472500	472500	472500	472500
3	Freight as % of Price		M = J/K	3%		3%	3%	3%	4%	6%
4	Total CIF Bangladesh Price in USD / MT (FOB plus Freight)		N = (J+K)/A	129.30		129.57	129.85	130.40	131.50	133.70
	Impact Asessment									
1	Increase in Bunker Price					13.98%	27.79%	55.58%	111.15%	222.30%
2	Increase in Freight Cost					8.39%	16.67%	33.35%	66.69%	133.38%
3	Increase in Final Landed Price for Iron Ore					0.21%	0.43%	0.85%	1.70%	3.40%
4	Iron Ore required to make one MT of Steel			1.6						
5	FOB Price of Steel in USD per MT	https://www.lme.com/en/metals/ferrous/lme-steel-hrc-fob-china-argus#Trading+day+summary		640						
6	Share of Iron Ore in Price of Steel			32%		32%	32%	32%	32%	32%
7	Impact on the price of Steel					0.1%	0.1%	0.3%	0.5%	1.1%

Source: Author's Compilation

Assumption

A. Assuming a density of around 2.5 metric tons per cubic meter (t/m³) for iron ore, a 2,000 DWT ship with a hold capacity of 1,500 cubic meters (m³) could carry approximately 3,750 metric tons (MT) of iron ore

B. As a general guideline, a 2000 DWT cargo ship can travel at an average speed of around 10 to 12 knots (18.5 to 22.2 kilometers per hour or 11.5 to 13.8 miles per hour). This speed is considered moderate and suitable for transporting cargo efficiently while maintaining fuel efficiency. bunker cost can range from 50% to 70% of the total freight cost for a small 2000 DWT vessel.

C. Bunker cost can range from 50% to 70% of the total freight cost for a 2000 DWT vessel. As we raise Bunker levy, the cost of bunker will go up, but rest of the costs will remain the same.

1. **For a levy of \$25 per tonne of CO2** (equivalent to \$79 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 13.98% and thereby increasing the freight cost by 8.39% and increase in final landed price by 0.21% for iron ore that affects the final steel price with 0.1% increase in the Bangladesh market.
2. **For a levy of \$50 per tonne of CO2** (equivalent to \$157 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 27.79% and thereby increasing the freight cost by 16.67% and increase in final landed price by 0.43% for iron ore that affects the final steel price with 0.1% increase in the price of iron ore delivered to Bangladesh when shipped from India.
3. **For a levy of \$100 per tonne of CO2** (equivalent to \$314 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 55.58% and thereby increasing the freight cost by 33.35% and increase in final landed price by 0.85% for iron ore that affects the final steel price with 0.3% increase in the price of iron ore delivered to Bangladesh when shipped from India.
4. **For a levy of \$200 per tonne of CO2** (equivalent to \$628 per tonne of fuel oil) there is an additional cost in the form of an increase in bunker price to 111.15% and thereby increasing the freight cost by 66.69% and increase in final landed price by 1.70% for iron ore that affects the final steel price with 0.5% increase in the Bangladesh market.
5. **For a levy of \$400 per tonne of CO2** (equivalent to \$1,256 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 222.30% and thereby increasing the freight cost by 133.38% and increase in final landed price by 3.26% for iron ore that affects the final steel price with 1.1% increase in the price of iron ore delivered to Bangladesh when shipped from India.

Crude Oil Import from Iraq to India

According to the United Nations COMTRADE database on international trade, India imported \$25.05 billion in crude oil from Iraq in 2021. India Imports of Crude Oil from Iraq - data, historical trend, and statistics - were last updated on March 2023. Iraq's Basrah crude oil export grades are appealing to modernised Indian refineries. They are also quite useful for manufacturing things like diesel. During the first eight months of current fiscal year, from April to November, Iraq remained the leading oil exporter to India, followed by Saudi Arabia and Russia, which has pushed the UAE to fourth place. Russia now accounts for 25% of all oil imported by India, having surpassed traditional suppliers Iraq and Saudi Arabia for the first time in October 2022. Keeping the above scenario in mind , we need to look at how the imposition of bunker levy affecting the crude oil import from Iraq to Japan. Especially India imports crude oil from the Basra port to Paradip port of Odisha, India.

Table 4: Crude Oil Imports from Iraq to India						Scenario					
						1	2	3	4	5	MBM
Sr. No	**Discussion**	**Source**		**As Is**		**25**	**50**	**100**	**200**	**400**	**Levy in USD per ton on Co2**
						79	**157**	**314**	**628**	**1256**	**Equivalent levy in USD per ton on Fuel Oil**
	Cargo Details										
1	Quantity carried in MT (VLCC Carrier - Capacity 2 million barrels)	Assumption A Below	A	272000		272000	272000	272000	272000	272000	
2	Vessel Size in DWT	Assumption B Below	B	311200		311200	311200	311200	311200	311200	
3	Average FOB Price of Crude Oil in USD per Barrel in 2022-23	https://ppac.gov.in/uploads/importantnews/1679458257_Croud_Eng.pdf	C	93.52		93.52	93.52	93.52	93.52	93.52	
3	Average FOB Price of Crude Oil in USD per MT in 2022-23		D	687.65		687.65	687.65	687.65	687.65	687.65	
	Origin-Destination-Distance										
1	Origin Port			Basra		Basra	Basra	Basra	Basra	Basra	
2	Destination Port			Paradip		Paradip	Paradip	Paradip	Paradip	Paradip	
3	Distance in NM	Ports.com	E	3717		3717	3717	3717	3717	3717	
	Bunker Details - VLSFO										
3	Bunker Efficiency - NM/MT	Assumption C Below	F	2.86		2.86	2.86	2.86	2.86	2.86	
4	Quantity of bunker used in MT		G = E/F	1,300.95		1,300.95	1,300.95	1,300.95	1,300.95	1,300.95	
5	Price of Bunker in USD/MT	https://shipandbunker.com/prices	H	565		644	722	879	1193	1821	
	Freight and Product Cost										

1	Total Bunker Cost In USD		I = F*G	735036.75		837811.8	939285.9	1143535.05	1552033.35	2369029.95
2	Total Freight Cost In USD	Assumption D Below	J = H/0.3	2450122.5		2552897.6	2654371.65	2858620.8	3267119.1	4084115.7
3	FOB Price of the Product		K = A*D	187040000		187040000	187040000	187040000	187040000	187040000
4	Freight as % of Price		L = J/k	1.3%		1.4%	1.4%	1.5%	1.7%	2.2%
5	Total CIF India Price in USD / MT (FOB plus Freight)		M = (J+I)/A	696.65		697.03	697.41	698.16	699.66	702.66
	Impact Asessment									
1	Increase in Bunker Price					13.98%	27.79%	55.58%	111.15%	222.30%
2	Increase in Freight Cost					4.19%	8.34%	16.67%	33.35%	66.69%
3	Increase in Final Landed Price					0.05%	0.11%	0.22%	0.43%	0.86%
6	Share of Crude Oil in Ex-Factory Price of Diesel	Assumption E Below		65%		65%	65%	65%	65%	65%
7	Impact on the price of Diesel					0.0%	0.1%	0.1%	0.3%	0.6%

Sources: Author's own compilation

Assumptions

A VLCC can carry around 2 million barrels of crude oil. 1 barrel of crude oil = 0.136 metric tons

B Assuming a density of 0.85 metric tons per cubic meter for crude oil, the total volume of 272,000 metric tons of crude oil would be. 272,000 metric tons ÷ 0.85 metric tons/cubic meter = 320,000 cubic meters. The carrying capacity of a VLCC is measured in DWT, which is the total weight of cargo, fuel, and supplies that the ship can carry. Assuming a cargo capacity utilization of around 95%, the DWT capacity of the VLCC required to carry 2 million barrels of crude oil would be: 320,000 cubic meters x 0.95 (utilization factor) x 1.025 (assumed density factor) = approximately 311,200 DWT.

C Assuming an average speed of 14 knots and a fuel consumption rate of 175 metric tons per day, a VLCC can travel approximately 500 nautical miles (nm) per day. This estimate assumes that the ship is traveling at a steady speed and does not encounter significant adverse weather or sea conditions that could slow down the vessel.

D Bunker cost can range from 20% to 40% of the total freight cost for a VLCC. As we raise Bunker levy, the cost of bunker will go up, but rest of the costs will remain the same.

E As a rough estimate, the cost of crude oil typically accounts for around 60-70% of the ex-factory price of diesel in India.

There are five scenarios for imposing the bunker levy on crude oil imports. These Scenarios are from 1 to 5. As we move from scenario 1 to 5 the levy on crude oil is more.

Due to the imposition of the levy, there is an increase in freight cost, bunker price, and the final landed price for crude ore.

Based on the five scenarios of levy imposed per ton on crude oil imports from Iraq to India the additional cost in the form of the levy would be as follows:

6. **For a levy of $25 per tonne of CO2** (equivalent to $79 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 13.98% and thereby increasing the freight cost by 4.19% and increase in final landed price by 0.05% for crude oil that affects the final diesel price with 0.0% increase in the Indian market.
7. **For a levy of $50 per tonne of CO2** (equivalent to $157 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 27.79% and thereby increasing the freight cost by 8.34% and increase in final landed price by 0.11% for iron ore that affects the final diesel price with 0.1% increase in the price of diesel delivered to India when shipped from Iraq.
8. **For a levy of $100 per tonne of CO2** (equivalent to $314 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 55.58% and thereby increasing the freight cost by 16.67% and increase in final landed price by 0.22% for iron ore that affects the final diesel price with 0.1% increase in the price of diesel delivered to India when shipped from Iraq.
9. **For a levy of $200 per tonne of CO2** (equivalent to $628 per tonne of fuel oil) there is an additional cost in the form of an increase in bunker price to 111.15% and thereby increasing the freight cost by 33.35% and increase in final landed price by 0.43% for crude oil that affects the final diesel price with 0.3% increase in the Indian market.
10. **For a levy of $400 per tonne of CO2** (equivalent to $1,256 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 222.30% and thereby increasing the freight cost by 66.69% and increase in final landed price by 0.0.86% for diesel that affects the final diesel price with 0.6% increase in the price of diesel delivered to India when shipped from Iraq.

Palm Oil Imports from Indonesia to India

According to a Reuters survey, India's palm oil imports in 2022/23 could increase by 9% from the previous year due to increased local consumption and competitive prices that allow the tropical oil to reclaim its share of the world's largest market. The increased buying might aid leading producer Indonesia in reducing rising inventories, as well as bolster benchmark Malaysian palm oil prices, which have virtually halved from record highs earlier this year. After imposition of the Bunker levy there is a sharp rise in freight cost and thereby rise in price of edible oil in India. The following table (Table 5) will give a better projection of imposition of bunker levy and its impact in a broder term.

There are five scenarios for imposing the bunker levy on palm oil imports. These Scenarios are from 1 to 5.

This includes an analysis of the impacts on States whose palm oil production industries are more geographically remote from their key markets than their competitors, comparing the impacts on the iron ore trades between Indonesia and India (voyage length about 2718 NM).

To conduct this analysis, the present study used its standard ship and voyage assumptions for a cargo carrier of iron ore, carrying 25000 MT of palm oil from Indonesia to India from the origin Belawan port, Indonesia to Kandla port India.

Due to the imposition of the levy, there is an increase in freight cost, bunker price, and the final landed price for palm oil.

Table 5: Palm Oil Imports from Indonesia to India						Scenario					
						1	2	3	4	5	MBM
Sr. No	Discussion	Source		As Is		25	50	100	200	400	Levy in USD per ton on Co2
						79	157	314	628	1256	Equivalent levy in USD per ton on Fuel Oil
	Cargo Details										
1	Quantity carried in MT (Handysize tanker capacity 25,000 MT)		A	25000		25000	25000	25000	25000	25000	
3	Average FOB Price of Crude Oil in USD per MT in 2022-23	https://www.commodity3.com/chain/CPO0ID/palm-oil-crude-indonesia	B	900.00		900.00	900.00	900.00	900.00	900.00	
	Origin-Destination- Distance										
1	Origin Port			Belawan		Belawan	Belawan	Belawan	Belawan	Belawan	
2	Destination Port			Kandla		Kandla	Kandla	Kandla	Kandla	Kandla	
3	Distance in NM	Ports.com	C	2718		2718	2718	2718	2718	2718	
	Bunker Details - VLSFO										
3	Bunker Efficiency - NM/MT	Assumption A Below	D	10.00		10.00	10.00	10.00	10.00	10.00	
4	Quantity of bunker used in MT		E = C/ D	271.80		271.80	271.80	271.80	271.80	271.80	
5	Price of Bunker in USD/MT	https://shipandbunker.com/prices	F	565		644	722	879	1193	1821	
	Freight and Product Cost										

1	Total Bunker Cost In USD		G = E*f	153567		175039.2	196239.6	238912.2	324257.4	494947.8
2	Total Freight Cost In USD	Assumption B Below	H/0.6	255945		277417.2	298617.6	341290.2	426635.4	597325.8
3	FOB Price of the Product		I = A*B	22500000		22500000	22500000	22500000	22500000	22500000
4	Freight as % of Price		J = H/I	1.1%		1.23%	1.33%	1.52%	1.90%	2.65%
5	Total CIF India Price in USD / MT (FOB plus Freight)		K = (J+H)/A	910.24		911.10	911.94	913.65	917.07	923.89
	Impact Asessment									
1	Increase in Bunker Price					13.98%	27.79%	55.58%	111.15%	222.30%
2	Increase in Freight Cost					8.39%	16.67%	33.35%	66.69%	133.38%
3	Increase in Final Landed Price					0.09%	0.19%	0.38%	0.75%	1.50%
6	Share of Palm Oil cost in the Retail price od Edible oil in India	Assumption D Below		65%		65%	65%	65%	65%	65%
7	Impact on the price of Edible Oil					0.1%	0.1%	0.2%	0.5%	1.0%

Source: Author's Compilation

Assumptions

A. On average, a Handysize tanker can travel between 250 and 300 nautical miles per day, assuming a speed of around 12 knots. The average fuel consumption of a Handysize tanker is around 25 to 30 metric tons per day when traveling at a speed of 12 knots.
B. The bunker cost accounst for about 60% of the total freight cost. As we raise Bunker levy, the cost of bunker will go up, but rest of the costs will remain the same.
C. As a rough estimate, the cost of crude oil typically accounts for around 60-70% of the ex-factory price of diesel in India.

Based on the five scenarios of levy imposed per ton on palm oil imports from Iraq to India the additional cost in the form of the levy would be as follows:

1. **For a levy of $25 per tonne of CO2** (equivalent to $79 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 13.98% and thereby increasing the freight cost by 8.39% and increase in final landed price by 0.09% for palm oil that affects the final edible oil price with 0.1% increase in the Indian market.
2. **For a levy of $50 per tonne of CO2** (equivalent to $157 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 27.79% and thereby increasing the freight cost by 16.67% and increase in final landed price by 0.19% for palm oil that affects the final edible oil with 0.1% increase in the price of palm oil delivered to India when shipped from Indonesia.
3. **For a levy of $100 per tonne of CO2** (equivalent to $314 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 55.58% and thereby increasing the freight cost by 33.35% and increase in final landed price by 0.38% for palm that affects the final edible oil price with 0.2% increase in the price of palm oil delivered to India when shipped from Indonesia.
4. **For a levy of $200 per tonne of CO2** (equivalent to $628 per tonne of fuel oil) there is an additional cost in the form of an increase in bunker price to 111.15% and thereby increasing the freight cost by 66.69% and increase in final landed price by 0.75% for palm oil that affects the final edible oil price with 0.5% increase in the Indian market.
5. **For a levy of $400 per tonne of CO2** (equivalent to $1,256 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 222.30% and thereby increasing the freight cost by 133.38% and increase in final landed price by 1.50% for palm oil that affects the final edible oil price with 0.1% increase in the price of palm oil delivered to India when shipped from Indonesia.

Conclusion

The present analysis suggests that there is a direct impact of MBMs on the price of steel, crude oil and palm oil. That is due to the imposition of the Bunker levy on CO2 emissions, there is a rise in price for the final product. But it plays a significant role in reducing the carbon emission from the marine industry but ultimately the consumer is bearing the burden of the rising of steel, crude oil and edible oil price. Moreover, for better clarity, it needs a comprehensive impact assessment which has been discussed as follows:

- Assessing the impact in terms of their impacts on the price of delivered cargoes which is of direct relevance to the economies of States, all of the levy quantum analysed, regardless of the trade and/or cargo type to which they apply have a positive impact and there is a rise in the final product.
- Another conclusion drawn from this preliminary assessment is that, despite the need to address the impacts on different ship types, voyages, and cargoes, it is relatively simple to analyse the potential impact of a simple fixed levy per tonne of CO2 emitted on freight rates and the price of delivered cargo.
- An examination of the impact of any market-based approach that employed a variable carbon price or metrics such as transport work instead of CO2 emissions (which is directly connected to fuel costs and freight rates) would be significantly more difficult to perform meaningfully.
- Nonetheless, assuming that the requisite zero-carbon technologies and fuels become available, the levy will have an impact on quickening the transition. The price difference between conventional fuel oil and zero-carbon fuels would be reduced depending on the levy quantum applied, while depending on how the funds generated are used - including the extent to which they are utilised in-sector - these funds could have a significant positive impact towards expediting the transition.

Geographic remoteness and accessibility to major markets

- The preceding analysis and voyage examples are designed to give Member States (India, Japan, Bangladesh and Indonesia) a better understanding of the possible impact of a levy per tonne of CO2 emitted as a result of increased marine fuel oil and voyage costs.
- The effect on states that are geographically isolated from their primary markets will, of course, be determined by the amount of any carbon price imposed.
- For example, if we take an example of India and Japan iron ore transportation via sea with a levy of $25 per tonne of CO2 (equivalent to $79 per tonne of fuel oil),), there

is an additional cost in the form of an increase in bunker price to 13.98% and thereby increasing the freight cost by 5.59% and increase in final landed price by 0.821% for iron ore that affects the final steel price with 0.1% increase in the Japanese market. If the levy slab rises, let's assume slab 3, i.e. for a levy of $100 per tonne of CO_2 (equivalent to $314 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 55.58% and thereby increasing the freight cost by 22.23% and increase in final landed price by 0.82% for iron ore that affects the final steel price with 0.3% increase in the price of iron ore delivered to Japan when shipped from India.

- If we compare, for the less geographically remote State in terms of connectivity to main markets, in this case, India and Bangladesh transporting iron ore to Bangladesh (a voyage of 394 NM) a levy of $100 per tonne of CO_2 (equivalent to $314 per tonne of fuel oil), there is an additional cost in the form of an increase in bunker price to 55.58% and thereby increasing the freight cost by 33.35% and increase in final landed price by 0.85% for iron ore that affects the final steel price with 0.3% increase in the price of iron ore delivered to Bangladesh when shipped from India.

Cargo value and type

Given the volatility of the prices on delivery of all the cargoes examined, the impact on the price of these cargoes on delivery of any of the levy quantum examined, up to and including $400 per tonne of CO_2, fell within the average monthly volatility of delivered cargo prices in 2021. On the basis of cargo delivery costs and freight rates in 2021, the impact of any of the levies magnitude considered on delivery prices would be minor in comparison to the volatility in delivery prices witnessed over the previous ten years. For example, if we takethen example of India-Japan iron ore transportation, with a levy of $100 per tonne of CO_2 (equivalent to $314 per tonne of fuel oil), the fright rate is rising to 5 % and with a levy of $200per tonne of CO_2 (equivalent to $628 per tonne of fuel oil), the fright rate is rising to 6 %

Transport costs: Increase in Freight cost

The impact on states will be determined by the amount of any carbon fee imposed. As demonstrated by the analysis above, which includes data on the impact of various levy quanta on freight rates, the proposed measure should not have a significant impact on transport costs beyond those already experienced in most trades due to significant volatility in fuel oil prices and variations in freight rates due to supply and demand changes. (plus unexpected developments such as the COVID-19 pandemic and the conflict in Ukraine). Furthermore, programmes funded by the proposed IMO Climate Fund could be designed to identify potential mechanisms for lowering transportation costs to LDCs and SIDS, as well as other geographically remote locations, while complying with existing and future regulations requiring a reduction in carbon intensity.

A suggested methodology for sharing the funds collected through the MBM by the IMO allowing India to gather a fair share

Introduction

The International Maritime Organization (IMO) has been actively developing market-based measures (MBMs) to address the environmental impact of the shipping industry, including the implementation of the Carbon Pricing Mechanism. The revenue produced by MBMs is intended to support sustainable shipping development and assist developing nations in meeting their environmental obligations. However, as of now, there are no specific agreements or negotiations between the IMO and India concerning the allocation of funds produced by MBMs. In this context, the IMO has recognized the financial constraints faced by developing countries, including India, and has advocated for the creation of a dedicated fund to support their participation in MBMs, such as the Carbon Pricing Mechanism.

The precise methodology for allocating funds to developing countries, including India, will be determined by a multitude of factors, including the type of MBM used, the revenue generated, and the level of involvement of developing countries. It is worth noting that the allocation of funds from MBMs is generally determined through a consensus-based decision-making process that involves all IMO member states. Therefore, the outcome of negotiations pertaining to the allocation of funds to India cannot be ascertained with certainty. Nonetheless, the IMO has expressed its intent to ensure that developing countries receive a fair and equitable share of the financial benefits produced by MBMs, which indicates that India is likely to receive an appropriate share of the benefits.

Furthermore, the IMO is contemplating the maritime industry's "fair share" of mitigation measures, and it has already implemented several significant measures to improve technical and operational efficiency and reduce emissions. Despite these efforts, a comprehensive strategy to achieve significant reductions against established goals is yet to be formulated. Various proposals, including MBMs, have been put forward to reduce harmful emissions from international shipping, but their implementation has complex implications. The IMO is at a critical juncture in its endeavour to develop a consensus and transform proposals into viable plan of action.

Suggested Methodology

Determining the fair share of various countries in a global issue can be a complex and contentious task, as different countries may have different levels of responsibility, capacity, and vulnerability with respect to the issue in question. Nevertheless, here are some possible ways to approach this:

1. **Historical responsibility**
   Historical responsibility is a principle used in determining the fair share of countries in addressing global issues such as climate change. It suggests that countries that have historically contributed more to a problem, such as emitting more greenhouse gases, have a greater responsibility to address it. This principle has been recognized in international climate negotiations, where developed countries are called upon to take the lead in reducing emissions and providing support to developing countries. However, it remains a controversial concept, as it can be difficult to measure and assign responsibility for past emissions. Nonetheless, historical responsibility remains an important principle in global issue negotiations.
2. **Current capacity**
   Determining a country's current capacity is one approach to determining its fair share of responsibility in addressing global issues. This may involve evaluating a country's economic and technological resources, as well as its level of expertise in relevant areas. For example, in the case of the COVID-19 pandemic, countries with advanced healthcare systems and greater resources may be expected to contribute more to the global response, such as by providing medical equipment, vaccines, and funding for research and development. Similarly, in addressing climate change, countries with more advanced technologies and greater financial resources may be expected to take the lead in reducing emissions and supporting adaptation efforts. However, it is important to note that a country's capacity is not the only factor that should be considered in determining its fair share of responsibility. Other factors, such as historical responsibility and vulnerability, may also play a role. Ultimately, a comprehensive approach that considers multiple factors and involves negotiation and consensus-building among stakeholders may be necessary to determine the fair share of responsibility for countries in addressing global issues.

3. **Vulnerability**

In the context of global challenges, vulnerability refers to a country's susceptibility to the negative impacts of an issue. In determining a country's fair share in addressing a global issue, vulnerability can be taken into account. For instance, countries with high levels of biodiversity and facing a significant risk of losing it due to human activities can be expected to receive more support from other countries to protect it. This is because biodiversity loss has significant impacts on the ecosystem, economy, and society of the affected country, as well as global environmental sustainability. By providing support, other countries can help to reduce the vulnerability of the affected country and promote a more equitable distribution of responsibility in addressing the issue. Therefore, vulnerability can be an important factor in determining a country's fair share in addressing global challenges.

4. **Proportional share**

India is one of the world's top maritime nations, with a 7,500-kilometer coastline, 12 major ports, and 200 notified minor and intermediate ports. Ports in India handle approximately 95% of total trade volume and 70% of total trade value. The major ports of India are strategically located, allowing access to the major shipping routes connecting Europe, Africa, and the Middle East with Asia. The country's ports have modern infrastructure and facilities, such as deep-draft berths, container terminals, and bulk-handling facilities, which allow them to compete in global maritime trade. India accounts for a sizable portion of global maritime trade. According to the World Maritime Report 2020, India's total share of global seaborne trade in 2019 was around 9.2%. Hence the fund should be allocated on the basis of the percentage share of India’s trade.

5. **Negotiation and consensus-building**

Determining a fair share of countries in a global issue may involve negotiation and consensus-building among stakeholders, where multiple factors such as historical responsibility, current capacity, vulnerability, and proportional responsibility are considered to find a mutually acceptable solution. This approach recognizes the need to balance the interests and concerns of all parties involved in addressing global challenges. Negotiation and consensus-building can be a complex and challenging process, but they can be critical to achieving effective and equitable solutions to global issues. Therefore, this approach highlights the importance of cooperation and collaboration among countries, organizations, and individuals to work towards a shared goal of addressing global challenges.

Conclusion

Determining the fair share of countries in addressing global challenges involves considering multiple factors such as historical responsibility, current capacity, vulnerability, proportional responsibility, and negotiation and consensus-building. Historical responsibility suggests that countries that have contributed more to a problem have a greater responsibility to address it, as recognized in international climate negotiations. Current capacity involves evaluating a country's economic and technological resources, as well as its level of expertise in relevant areas. Vulnerability refers to a country's susceptibility to the negative impacts of an issue, such as the loss of biodiversity. Proportional responsibility involves assigning greater responsibilities to countries with stronger economies and larger populations, as in the case of refugee resettlement. Finally, negotiation and consensus-building among stakeholders may be necessary to determine a mutually acceptable solution that considers the interests and concerns of all parties involved.

Each of these factors has its own strengths and limitations, and a comprehensive approach that considers all of them is necessary to determine an equitable allocation of responsibilities. For example, while current capacity may be a useful factor to consider, it should not be the only one, as it can leave smaller and poorer countries with a disproportionately larger burden. Similarly, while proportional responsibility can be useful in addressing global issues that require significant financial and institutional resources, it may raise concerns about fairness and equity.

Negotiation and consensus-building are critical to achieving effective and equitable solutions to global issues, as they recognize the need to balance the interests and concerns of all parties involved. This approach highlights the importance of cooperation and collaboration among countries, organizations, and individuals to work towards a shared goal of addressing global challenges. Ultimately, a fair allocation of responsibilities should be based on a combination of these factors, considering the specific context and needs of each global issue, and ensuring that no one is left behind in the pursuit of a more sustainable and equitable world.

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