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International transport, trade and climate change

Introduction

The purpose of this information note is to give an overview of the relation between the regulation of international transport in order to mitigate climate change and the impact this may have on trade. International transport (aviation and maritime shipping) is an important driver of both trade and human-induced climate change. The regulation of greenhouse gas emissions from international transport potentially means raised costs for moving goods and people around the globe. This has implications for trade. Developing countries situated in remote locations and with a large trade exposure, such as some Small Island Developing States (SIDS), would be particularly affected by higher transport costs.

On the other hand, regulating emissions from maritime and air transport may also generate resources to finance climate change adaptation and mitigation measures in developing countries. A global climate policy that includes international maritime and air transport could thus offer opportunities for developing countries.

Until now, the inclusion of international transport emissions in a global climate policy framework has proven to be difficult. International transport is a truly global industry, and the responsibility for reducing emissions does not fall directly within the jurisdiction of any single country. The fact that a global solution is necessary to meaningfully tackle emissions from this sector makes it an interesting test case for sectoral approaches in other industries.

There are differences between shipping and aviation on key points. The aviation industry is characterised by its concentration into a few big airlines, its carbon intensity and its limited potential for fuel efficiency gains in comparison with the maritime sector.

This paper will show the importance of international transport for trade and climate change, the governance of shipping and aviation in the context of climate change, regulatory instruments for emissions mitigation, the costs of such instruments and ways to offset them for vulnerable countries.

The importance of international transport for both trade and climate change

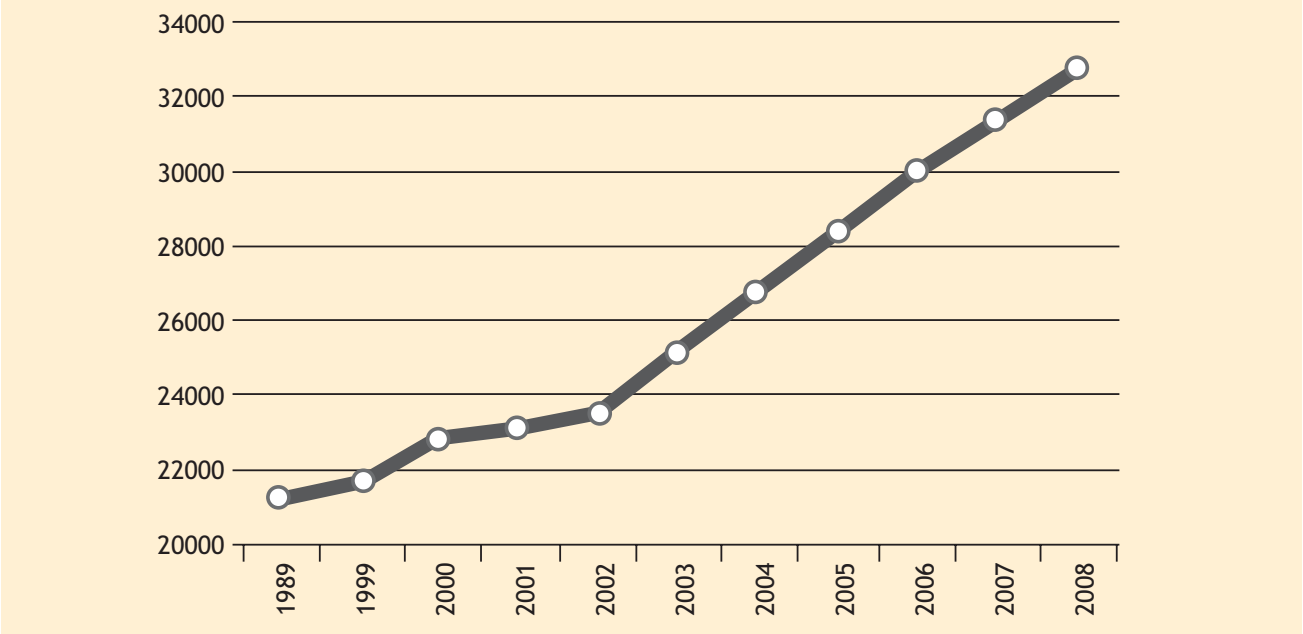
In terms of volume, more than 90 percent of world trade is transported by sea, while aviation supports eight percent of global economic activity and carries 40 percent of the value of freight.

ICTSD

International Centre for Trade and Sustainable Development

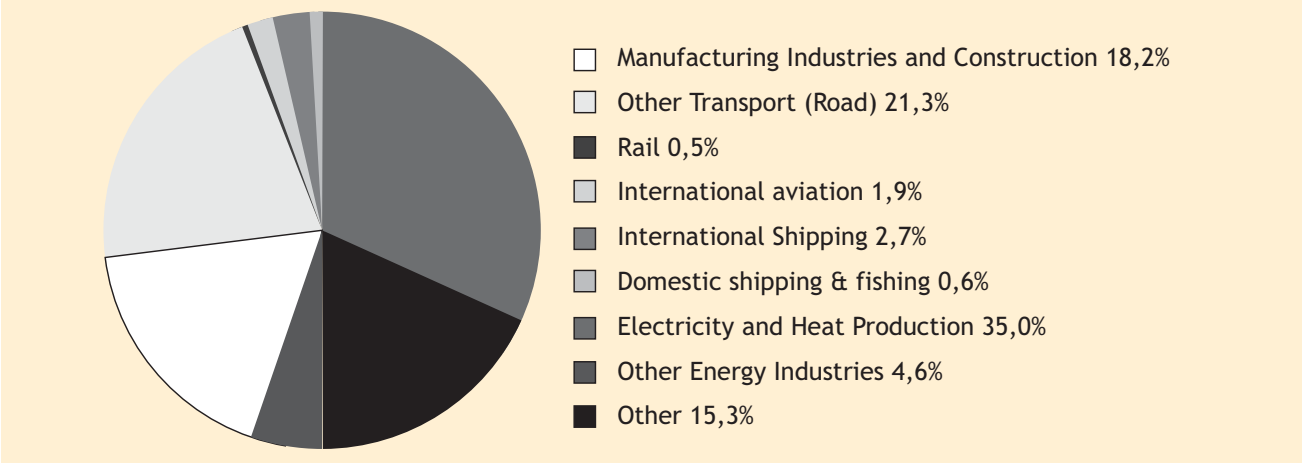
At the same time, international transport is the fastest growing source of CO_2 emissions. Emissions from the international maritime industry doubled between 1994 and 2007. They are projected to rise rapidly, possibly tripling by 2050 despite potentially significant efficiency improvements. In 2007, global CO_2 emissions from shipping stood at 1,006 metric tonnes, equal to 2,7 percent of global anthropogenic carbon emissions, or more than the total emissions of Germany, Canada, or the UK (IMO, 2009).

Figure 1: World seaborne trade (billion tonne-miles)



Source: International Chamber of Shipping

Figure 2: The division of global CO_2 emissions by sector

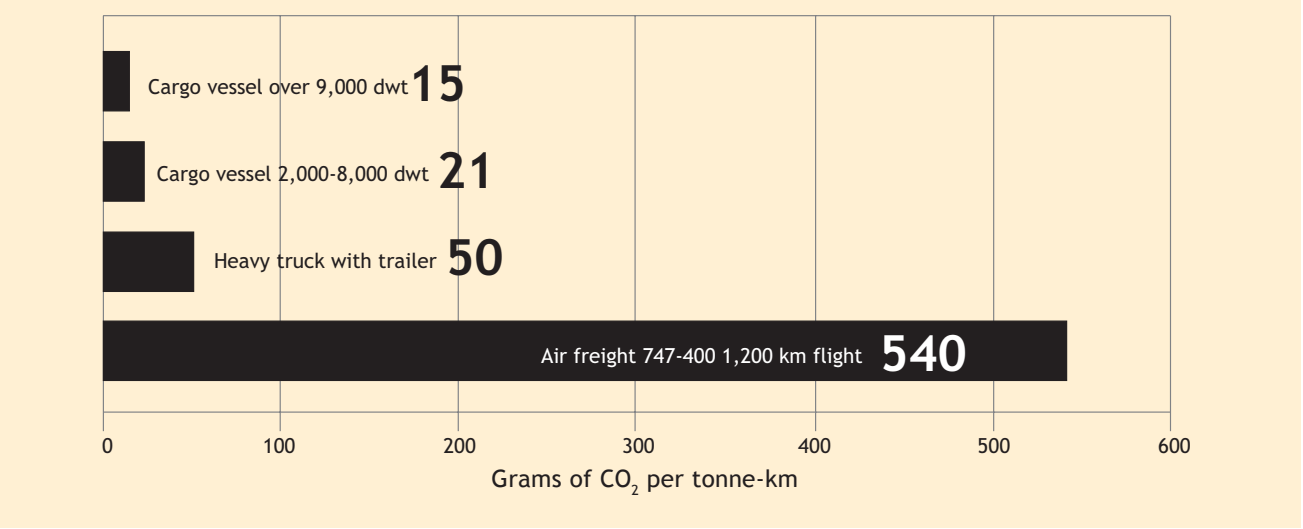


Source: Buhaug, Faber et al., 2nd IMO GHG study 2009

Aviation has by far the greatest climate impact of any transport mode, whether measured per passenger kilometre, per tonne kilometre, per dollar spent, or per hour travelling. Four to nine percent of the climate change impact of human activities is caused by aviation and this impact is two to five times that of its CO_2 emissions alone.[1] The two-to-five range relates to the climate impact of cirrus clouds that can form out of aviation-induced contrails. CO_2 emissions from international aviation doubled between 1990 and 2010. In the worst case scenario of the Intergovernmental Panel on Climate Change (IPCC), they will quintuple, from 0,3 Gt CO_2 per year now to 1,5 Gt CO_2 per year in 2050. Every segment of the industry, including manufacturers, airlines and airports is subsidised and enjoys major tax exemptions (notably the lack of VAT on international tickets and taxes on kerosene).

1 It is highly likely that the net impact of non- CO_2 effects – particularly contrails and other induced cloud formation – increases the global warming impact of aviation beyond that suggested by CO_2 emission alone. http://www.grida.no/publications/other/ipcc_sr/?src=/climate/ipcc/aviation/index.htm

Figure 3: Comparison of CO_2 emissions between different modes of transport



Source: NTM, Sweden

Governance of shipping and aviation in the face of climate change

The Kyoto Protocol calls on Annex I Parties (developed countries) to work on international transport through the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO).[2]

'Bunker fuels' or 'bunkers', as the issue of international transport is referred to in the climate negotiations, also remains in the negotiations under the UNFCCC. *Bunker fuel* is technically any type of fuel oil used aboard ships. Mostly it is the heavier, dirtier variant. In the climate negotiations, fuel used in airplanes is also called bunker fuel or 'bunkers'.

Not much progress has been made either in the UNFCCC or the IMO or ICAO on bunker fuels. A key issue is reconciling the IMO's specific principle of 'no favourable treatment' (i.e., all ships are regulated equally regardless of where the ship is owned or registered) and the fundamental ICAO principle of non-discrimination with the UNFCCC's principle of 'common but differentiated responsibilities' (CBDR),[3] which is valid for the wider climate change negotiations.

The practical consequences of CBDR are that different obligations are imposed on the parties to the UNFCCC, depending on their level of development. The prime example is the Kyoto Protocol, where only countries listed in its Annex I (developed countries) have quantified emissions reduction obligations. In practice this means that developed countries, which have the biggest capability to reduce greenhouse gas emissions, should take the lead in the fight against climate change.

However, developed countries argue that any of their actions against climate change will remain futile if the major emerging economies do not do enough to mitigate their emissions. Developing countries account for more than 70 percent of current maritime emissions and more than 80 percent of shipping capacity is registered in non-Annex I countries (UNCTAD, 2007).

Developing country Parties meanwhile have resisted the notion of a global approach in which they have to take on emissions reduction obligations. They maintain that the largest share of emissions from international shipping has originated from the emissions in historical development of developed countries. Developing countries are reluctant to open a precedent, such as a sectoral approach, that requires them to reduce CO_2 at the same levels and costs as developed countries.

Regulatory options for maritime transportation in the face of climate change

Simply put, there are currently two main types of policy for GHG reduction in the IMO debate: market-based instruments (MBIs) and efficiency requirements.

Market-based instruments[4] (MBIs)

MBIs are proposed as the most comprehensive approach by the IMO to address climate change. The measures currently proposed include:

a) emissions trading schemes[5] (e.g. the Marine Emissions Trading Scheme or METS, proposed by the European Union);

2 Article 2.2 Kyoto Protocol

3 Article 4.1(c) of the UNFCCC

4 Increasingly also called 'market-based *measures*' or 'MBMs'

5 Proposal by France, Germany and Norway, MEPC 59/4/25. This proposal also includes a GHG Fund as a separate legal entity under the structure of a new IMO convention

b) a fuel levy;

c) an energy efficiency credit trading scheme (proposed by the United States);

d) a 'cap-levy-and-trade' or 'hybrid' scheme;

e) an International Maritime Emissions Reduction Scheme (IMERS).

The EU is in favour of including shipping emissions in a global sectoral approach through a special **global cap-and-trade scheme** for the maritime sector, the Maritime Emissions Trading Scheme (METS).

A **levy** or carbon charge on bunker fuels might reduce bunker demand and associated CO_2 emissions through energy efficiency improvements in ships, changes in operating practices and switching to alternative fuels.

The US government MBI proposal to IMO is for a closed trading system for the **trading of energy efficiency credits** that can be earned through the application of certified technologies and/or operational measures.

The so-called **'cap-levy-and-trade'** scheme establishes a cap on CO_2 emissions from the maritime sector in line with a UNFCCC decision. Parties ensure that all their ships pay a levy to an administrative entity based on documented fuel consumption. An international Maritime GHG fund is established for adaptation projects in developing countries. Shipping operators need to buy CO_2-credits (including from the Clean Development Mechanism) to offset emissions above the cap.

The **International Maritime Emissions Reduction Scheme (IMERS)** is a unique proposal for a levy on fuel for ships, which differentiates responsibilities between developed and developing countries. Under the proposal, a carbon levy is applied to fuel used by ships for delivering cargo to destinations with commitments to reduce emissions – i.e. Annex I countries to the UNFCCC. This levy would be set at the average market carbon price level. Responsibilities are differentiated between developing and developed countries. The liability for the levy is with the fuel purchaser, and stays with the ship.

In order to be environmentally effective, revenues from all these measures should be spent at least partially on emission reductions. Emission reductions in non-Annex I countries, through measures such as technology transfer, seem the best way to improve the environmental effectiveness of the instrument.

Efficiency Instruments

There are two potential indicators for a ship's efficiency: the Energy Efficiency Operational Indicator (EEOI) and the Energy Efficiency Design Index (EEDI), both developed by the IMO. The EEOI may not be a suitable basic parameter for a mandatory policy because its value varies greatly over the business cycle It is also hard to compare the EEOI across ship types, and the IMO has endorsed its use as a voluntary measure.

Regulatory options for the maritime industry: conclusions

Given the large size of the international maritime sector bunkers inventory and projections for growth, significant in-sector reductions will be necessary to meet any meaningful global long-term climate stabilization goals. Reducing emissions in-sector through policy-driven technological changes and operational measures (e.g. speed reduction) coupled with a market-based trading mechanism seems necessary, possible, and cost-effective.

Market-based policy options are likely to be most effective environmentally. They will also be cost-effective if administrative burden can be kept low.

Operational policy options may have a high level of environmental effectiveness and can be cost-effective if administrative burdens can be kept low.

Technical policy options, aimed at improving the design efficiency of the fleet may be less environmentally effective and are less cost-effective (many technical measures are expensive). They will, however, have a low administrative burden.

Voluntary measures are often very cost-effective but not so effective because of free-riders.

A combination of policies will naturally lead to a higher administrative burden and reduce cost- effectiveness when markets are functioning well. They could be beneficial though when market failures exist.

In conclusion, one can say that emissions trading for maritime transport and the emissions levy with hypothesised revenues are best capable of reaching the primary policy objective of reducing CO_2 emissions of maritime transport. Emissions trading is feasible to implement. The emissions levy may be harder to implement as it requires consensus amongst member states on both the implementation of the levy and the revenue projections.

In the case of maritime shipping, the policy instrument for emissions reduction is predominantly determined by the amount of economic and environmental impact certainty each instrument provides. With a levy, the

economic impacts are more predictable, while the environmental impacts are more uncertain, due to the fact that there is no cap on emissions. With tradable permits, an emissions cap is determined but the economic impacts are less predictable. Table 1 reflects these insights.

Table 1: The extent to which the policy instruments proposed for maritime emissions achieve the policy objectives. Reducing emissions in the sector – through policy-driven technological changes and operational measures (e.g. speed reduction) coupled with an MBI, such as a levy or emissions trading – seems necessary, possible and cost-effective

Type / Base	Market based Instruments	Standards	Voluntary measures
Maritime GHG emissions	Most effective Most cost-effective		
Operational efficiency			Not so effective Very cost-effective
Design efficiency		Less effective Less cost-effective	

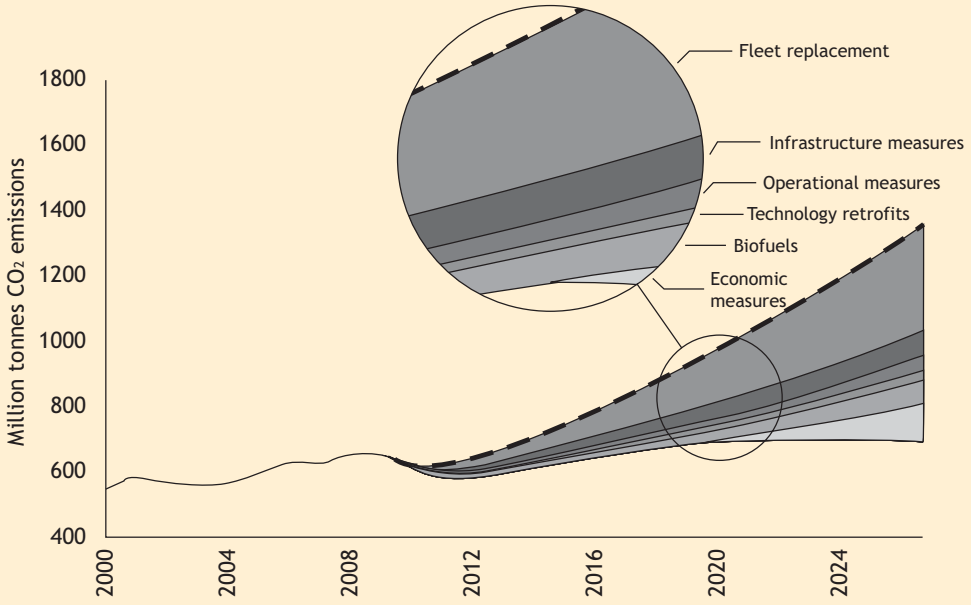
Source: Faber, 2009

Regulatory options for aviation in the face of climate change

For aviation, the situation is more clear-cut than in the maritime sector: technology standards and emissions trading seem the most likely measures. Until now, the only example of aviation being included in emissions trading is the EU's Emissions Trading System (ETS). ETS measures will be applied in the EU to all airlines from 2012 regardless of their country of origin.[6] The idea is that the scheme will form the foundations of a wider, global model.

Figure 4: Carbon-neutral growth from 2020 - where emissions reductions will be achieved

The top (dashed) line shows where emissions would be if there was no new technology or fleet replacement, based on forecast passenger growth. Each segment adds to emissions reduction potential. Economic measures kick-in 2020 to make up any shortfall in emissions reductions and provide for a cap in net emissions from 2020 - carbon neutral growth.



Source: IATA

The 'carbon-neutral growth' scenario from IATA; in this scenario aviation's net CO2 emissions will remain flat after 2020 even as demand grows.

6 Chiavari/Withana/Pallemaerts, 2008; *The Role of the EU in Attempting to 'Green' the ICAO*

Economic and trade impacts of maritime transport emission regulation

Market-based instruments – such as a levy or a cap-and-trade scheme – impose an additional financial burden on transport, which may result in reduced imports and exports. This may have several impacts on developing countries, such as higher costs of food imports and lower demand for their products.

Table 2: Emissions, costs and benefits for different regions and country groups

Region of destination	CO_2 emissions on routes to regions Mt CO_2	First order estimate of cost increase of maritime transport, in USD bln. (CO_2: USD 15-30 per tonne)	First order estimate of cost increase of maritime transport, as % of GDP (CO_2: USD 15-30 per tonne)	Benefits from using 67% of auction revenues to compensate developing countries, based on value of imports
Region				
North America	120	1.8-3.6	0.01-0.02%	Almost none[1)]
Central America and Caribbean	53	0.8-1.6	0.07-0.13%	0.9-1.8
South America	59	0.9-1.8	0.05-0.09%	0.7-1.4
Europe	277	4.2-8.3	0.02-0.05%	Almost none[1)]
Africa	68	1.0-2.0	0.1-0.2%	0.7-1.3
Middle Eastern Gulf, Red Sea	62	0.9-1.9	0.08-0.15%	1.0-2.1
Indian Subcontinent	24	0.4-0.7	0.03%-0.06%	0.6-1.1
North East Asia	194	2.9-5.8	0.03-0.06%	5.1-10.2 [2)]
South East Asia	116	1.7-3.5	0.17-0.35%	1.5-3.1
Australasia	35	0.5-1.0	0.06-0.13%	Almost none[1)]
World	1006	15.1-30.2	0.03-0.06%	
Country groups				
Annex I countries	469	7.0-14.1	0.02-0.04%	None
Non-Annex I countries	582	8.7-17.5	0.08-0.15%	10-20
G77	465	7.0-13.9	0.07-0.14%	6.7-13.4
Least Developed Countries	13	0.2-0.4	0.06-0.12%	0.3-0.5
Small Islands and Developing States	99	1.5-3.0	0.45-0.89%	0.7-1.5

Source: CE Delft et al., 2010

1) Comprises mainly but not exclusively developed countries.

2) Comprises mainly but not exclusively developing countries.

In order to investigate the potential impact of climate policy in maritime shipping on consumer prices, a few typical examples of goods transported by maritime ships have been analysed. Table 2 shows the expected increase of the price of imports given the assumptions for the year 2010. The last 3 columns show an estimate of percentage increase in the price of imports resulting from increase in shipping costs due to a carbon price (through a fuel levy or emissions trading) of € 7, € 25 and € 45 per tonne of CO_2 respectively.

In general, increased freight costs will have a larger impact where goods have a low value to weight ratio, as the increase in freight cost is a larger share of the final cost than for higher value added products. The impact on producers in exporting and importing countries will vary, depending on market shares and price elasticities. And the freight rate in the direction where demand is highest is typically higher than a freight rate in the other direction. It is likely that developed countries will pay a larger share of the cost increases (Faber et al., 2010).

From these numbers it appears that the expected increase in the value of imports due to CO_2 policy in maritime shipping can be substantial for raw materials. The reason is that a relatively high share of the value of raw materials can be attributed to maritime transport costs.

The increase in consumer prices, rather than the increase in the value of imports, is more useful in measuring the economic impact of a policy. Percentage increase in consumer prices will, on average, be lower than the increase in the value of imports because consumer prices are, as a general rule, higher per unit (due to value added in the importing country). Therefore, one can treat the percentage price increase estimated for the value of imports as a higher bound estimate for the increase in consumer prices. The difference between the expected percentage increase between import prices and consumer prices will be the highest for manufacturing goods, as these are most likely subjected to several transactions resulting in price mark-up before they reach the consumer.

Where there is a larger market share for domestic production, the less likely it is that the exporter would be able to pass an increase in transportation costs through to the end consumer due to competition from domestic producers. Conversely, where there is little or no domestic production, the exporter is more likely to be able to pass the increased costs on to the end consumer.

Table 3: Increase in import value of two selected imports

Commodity	Exporter	Year	Ad valorem maritime transport costs	Transport mode	Transport costs increase (allowance price US$ 15-30)	Increase in import value
Coffee	Brazil	2006	0.02	Container	8-16%	0.1-0.3%
Cereals	Argentina	2005	0.30	Clean Bulk	4-11%	1-3%
		2006	0.23	Clean Bulk	4-11%	1-3%

Source: OECD Maritime Transport Costs Database, Faber et al., 2010

Some countries, and SIDS in particular due to their remote location and trade exposure, depend heavily on maritime transport for their food imports. Table 3 presents a selection of countries where food imports account for a large share of GDP. Furthermore, the table indicates the increase in the costs of food imports assuming a tax level or emissions trading price of $30/tonne of CO_2 and that all CO_2 emissions will be covered by the scheme (this tax level corresponds to roughly $90 per tonne of fuel). The table shows that as a share of GDP, increased costs of food imports range from 0.03-0.6 percent for a carbon price of US$30/tonne of CO_2.

Table 4: Food imports relative to GDP in selected developing countries

Country	Share of food imports in GDP, 1999-2004 (%)	Increase in costs of food imports (% of food imports by value) at US$30/ton of CO_2	Increase in costs of food imports (as a % of GDP)
Sao Tome and Principe	28.02	0.37-0.62	0.10-0.17
Cape Verde	15.94	0.18-0.30	0.03-0.05
Tonga	12.77	0.33-0.55	0.04-0.07
Dominica	11.52	0.11-0.18	0.01-0.02
Samoa	11.23	0.32-0.53	0.04-0.06
Saint Lucia	10.95	0.03-0.06	0.003-0.007

Source: FAO Statistical Yearbook 2005-2006, table C. 13 and CE Delft, 2008.

Small island developing states, least-developed countries and land-locked developing countries stand to be most affected by higher bunker fuel costs due to their often remote locations, as well as their size and economic potential. Under a high impact scenario, their maritime trade with the EU, for instance, would decline by 0.2 percent of GDP. Overall, there is little difference between the country groups, especially if imports and exports are used for the assessment basis.

Including maritime transport in a climate policy is likely to result in a demand for ships with lower CO_2 emissions, which can be achieved either by modifying existing ships or replacing them with new ships. As a consequence, emission mitigation policy for maritime shipping is likely to have a positive effect on demand for shipyard services.

As with all environmental regulations, in the end a balance must be struck between minimising the costs of regulations and building sufficient incentives in policies to promote R&D and pollution reduction.

Economic impacts on aviation

Including aviation in the EU ETS is currently the best assessed measure on aviation climate regulation. The EU study *Giving Wings to Emissions Trading*[7] calculates several policy options for including aviation in the ETS. The demand for air transport volume might decrease by up to 2,4 percent under the EU ETS.

Table 5: Impacts on transport volume on the EU market of the three selected Options (opportunity costs not passed on)

Effect	Effects relative to BaU case 2012					
	Option 1		Option 2		Option 3	
	EU	Non-EU	EU	Non-EU	EU	Non-EU
Allowance price €10 per tonne						
Aircraft km	-0.2%	0.0%	-0.2%	0.0%	-0.6%	-0.1%
Revenue Tonne Km	-0.1%	0.0%	-0.1%	0.0%	-0.5%	-0.1%
Allowance price €30 per tonne						
Aircraft km	-0.4%	0.0%	-0.3%	0.0%	-1.8%	-0.2%
Revenue Tonne Km	-0.2%	0.0%	-0.4%	0.0%	-1.4%	-0.2%

Source: CE Delft, 2005

Demand for long-haul flights has a low response to price changes. Even if a slight drop in demand is experienced, it is not likely to significantly affect the upward trend in tourist arrivals in most vulnerable countries. In practice, therefore, a small rise in prices will most likely not deter passengers from travelling.

How to offset costs of maritime transport emissions regulation for vulnerable countries?

There are two main options to reduce the undesired economic impacts of a climate mitigation policy on developing countries: (i) limiting the scope of that policy; and (ii) using the revenues from economic instruments to offset the costs of the climate mitigation measures for developing countries.

Although global sectoral approaches seem appropriate[8] in international transport sectors, the UNFCCC stipulates that sectoral approaches should respect the principle of common but differentiated responsibilities (CBDR), and states that developed country Parties should meet the incremental costs incurred by developing country Parties participating in such schemes. Two 'equity safeguards' have been proposed to ensure that global policies are in line with the principles, including CBDR, of the convention: a) the transfer of revenues to developing countries and b) limiting the scope of mitigation policy.

Option 1. Transfer of revenues to developing countries

Many countries have suggested the inclusion of international aviation and marine emissions in a climate mitigation policy as a deliberate mechanism for raising funds for adaptation and mitigation in developing countries.[9] Also, to make good on the promise made by developed countries to help developing countries with climate change mitigation and adaptation through a US$100 billion a year long-term fund by 2020, "innovative sources of finance"[10] will have to be tapped. It is commonly accepted[11] that revenues raised from regulating international transport are such innovative sources of finance.

Policies should be designed to raise revenue, either through auctioning permits under an ETS, or via levies. The potential revenues from global mitigation policies in the shipping and aviation sectors could be as much as US$35 billion per year and could thus make a significant contribution to meeting international climate financing commitments. This revenue should be spent exclusively in developing countries, for instance for compensating the increased costs of imported goods and for adaptation to climate change and technology transfer under programmes already operated by IMO and ICAO.

There are several ways to reduce the economic impact on non-Annex I countries by using revenues from climate regulation in the shipping and aviation sectors:

7 http://ec.europa.eu/environment/climat/pdf/aviation_et_study.pdf

8 Because of their trans-boundary nature, the risk of market distortion and carbon leakage, and the principles of equal treatment in IMO and ICAO

9 Earmarking revenues from global market-based instruments would also bring them in line with the ICAO Council Resolution on Environmental Charges and Taxes adopted in December 1996 and endorsed by the 32nd ICAO Assembly. This resolution strongly recommends that "the funds collected should be applied in the first instance to mitigating the environmental impact of aircraft engine emissions."

10 Para. 8 of the Copenhagen Accord

11 See, e.g. http://ec.europa.eu/economy_finance/articles/international/documents/innovative_financing_global_level_sec2010_409en.pdf

a) direct compensation – a country which faces an increase in import costs of a certain amount would get this amount from the revenues. In practice, it could be hard to measure the impact on costs of imports and it may be difficult to include land-locked countries in such a scheme;

b) compensation based on import shares – countries would get compensation in proportion to their share in global imports (assuming that the importer bears the cost).[12] In practice, it would be easier to implement than the previous option as trade-data are collected regularly. It could also be extended to land-locked countries;

c) compensation based on need for climate finance – in this case, countries would get compensation in proportion to their need for climate finance, perhaps based on their nationally appropriate mitigation actions and national adaptation programmes of action,[13] or other types of adaptation plans.

Directly compensating countries for higher import prices would be administratively very complex. A compensation based on the quantity of imports would create net beneficiaries and net contributors, but it would probably be feasible from an administrative point of view. Compensation based on climate financing needs would be more in line with the general objective of an ETS.

In order to ensure transparency and predictability, revenues from market-based instruments could be collected and managed by an international body with equitable representation, rather than by national governments. These funds can help expand participation in a post-Kyoto accord. As such several of the proposed MBIs may be more effective in raising revenues to help in achieving a global climate change 'deal' than in reducing CO_2 emissions from the maritime sector.

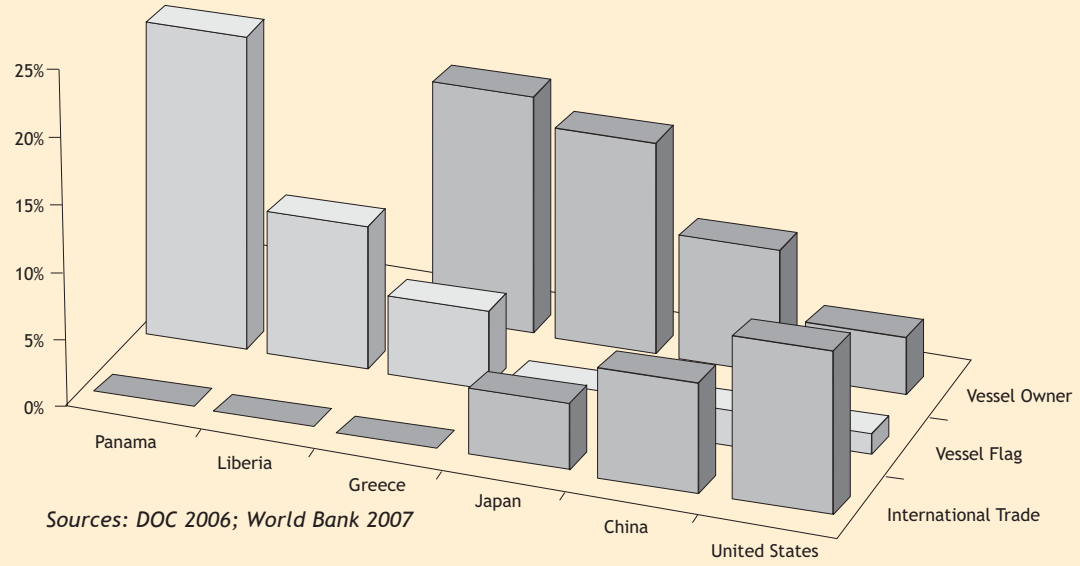
Option 2. Limiting the scope of emissions mitigation policy

There are various options available to limit the scope of a climate mitigation policy with regard to international aviation and maritime transport.

First, in principle, market-based options could be applied to carriers from Annex I countries or ships registered in Annex I countries only. This would follow the CBDR principle, under which developed country Parties should take the lead in combating climate change and the adverse effects thereof. Since Annex I and non-Annex I country carriers may compete on the same routes, this could lead to unequal competition. It is doubtful whether the international community would accept unequal competition within the aviation and maritime sectors (e.g. 'developing' economies, such as Singapore and Hong Kong have highly competitive airlines). Furthermore, ships can easily change flags (see Figure 1 below)). This would amount to carbon leakage (an increase in carbon dioxide emissions in one country as a result of emissions reduction in another country with a strict climate policy).

Box 1: Assigning Emissions From Ships

Figure 5: Comparison of International Trade (Percent of Global Value of Merchandise Trade), Vessel Flag (Percent of Global Deadweight Tons, DWTs), and Vessel Owner (Percent of Global DWTs) by Country



Sources: DOC 2006; World Bank 2007

12 Innovative Financing and International Maritime Emission Reduction Scheme. Proposal by Nigeria and Liberia, Draft COP 15 decision, 4 November 2009

13 NAPAs provide a process for least-developed countries (LDCs) to identify priority activities that respond to their urgent and immediate needs to adapt to climate change – those for which further delay would increase vulnerability and/or costs at a later stage.

Box 1: *Continued*

Figure 5 shows that the majority of shipping capacity is comprised of vessels flagged in countries that engage in relatively little international trade, and the ownership of a large portion of the global shipping fleet does not correspond to international trade flows. The potential for evasion of a fuel levy is high in the marine sector since changing vessel flags is easy and large quantities of fuel can be bunkered onboard a ship, affording great flexibility in choosing where to flag a vessel and purchase fuel in order to minimise costs.

While little progress has been made on assigning emissions from bunker fuels, the most promising option appears to be dividing the emissions between the countries of origin and destination for either the aircraft/ship or its passengers/cargo (Faber, Boon et al. 2007). Other options, such as basing the assignment on national fuel sales, the nationality of the carrier or shipper, or country of vehicle registration could cause serious market distortions and evasive behaviour. For instance, national emissions could be 'mitigated' by purchasing fuel elsewhere, changing the nationality of carriers and shippers, or registering aircraft and marine vessels in another country.

A more realistic possibility is to limit the scope of a climate policy for international aviation and maritime transport by applying de minimis thresholds. The effect of these thresholds should be to exempt traffic to and/or from SIDS and LDCs.

In practice, as already specified for the inclusion of aviation in the EU ETS, a series of interlocking thresholds would be applied and these would be subject to detailed negotiation. Options include thresholds that exempt transport below a certain size on routes to and/or from the most vulnerable developing countries. And finally, to address the food security issue, one could think of the exclusion of certain types of cargo, such as food.

How to offset the impact of civil aviation regulation?

It is not self-evident how the emissions of international flights should be allocated to countries, which makes it difficult to argue on the basis of CBDR. The passenger levy is primarily seen as a solidarity levy, based on the personal capability of airline passengers to compensate the poorest and most vulnerable people for the impacts caused by these international emissions. There may be circumstances – as in the case of relatively poor migrant workers – where an exemption might be justified. However, the best way to deal with such cases would be for the relevant *government* to pay the levy on behalf of these passengers from sources such as international climate change finance or development assistance. Summary.

While international transport, both aviation and maritime shipping, is a critical element of the global economy and trade. it is also one of the main drivers of human-induced climate change.

Regulation of greenhouse gas emissions from the international transport sector is needed to reduce global emissions; however, regulation often translates to higher costs of moving people, resources and goods around the globe. Developing countries situated in remote locations and with a large trade exposure, such as some Small Island Developing States (SIDS), would be particularly affected by higher transport costs. On the other hand, regulating emissions from maritime and air transport could potentially generate resources to finance climate change adaptation and mitigation measures in developing countries. A global climate policy that includes international maritime and air transport could thus offer opportunities for developing countries.

Due to the global nature of the transport industry, sectoral approaches may be more appropriate for tackling emissions reduction in international transport. While maritime shipping and aviation are often lumped into the umbrella sector of international transport, they are distinct industries and should be considered separately.

Of the many challenges facing the industry in regards to emission reductions is reconciling the IMO's specific principle of "no favourable treatment" (i.e., all ships are regulated equally regardless of where the ship is owned or registered) and the fundamental ICAO principle of non-discrimination with the UNFCCC's principle of "common but differentiated responsibilities" (CBDR).

Despite the climate change governance challenges that maritime shipping and aviation face, many regulatory options have been proposed, each with distinct economic impacts. For aviation, the regulatory options are straightforward: either technology standards or emissions trading schemes.

For maritime shipping there are currently two main types of policy for GHG reduction considered by the IMO: market-based instruments (MBIs) and efficiency requirements. MBIs include emissions trading schemes, fuel levies, energy efficiency credit trading schemes, and "cap-levy-and-trade" or "hybrid" schemes. The EU is in

favour of a global sectoral cap-and-trade scheme – the proposed Maritime Emissions Trading Scheme (METS). Others suggest that a fuel levy on bunker fuels energy efficiency credit trading scheme would incentivise energy efficiency improvements.

Market-based instruments to regulate emissions will impact international trade because they impose an additional financial burden on transport, which could result in reduced imports and exports.

There are two main options to reduce the undesired economic impacts of a climate mitigation policy on developing countries: (1) limiting the scope of the policy; and (2) using the revenues from economic instruments to offset the costs of the climate mitigation measures for developing countries.

The second "equity safeguard" would allow revenues from policy options to transfer to climate change mitigation or adaptation in developing or climate-sensitive areas. There are three strategies that could be employed: direct compensation, compensation based on import shares and compensation based on need for climate finance. Independent of the specific strategy chosen, revenues from market-based instruments could be collected and managed by an international body with equitable representation.

The way forward

Given that nothing concrete has come out of the Copenhagen Climate Conference for either aviation or maritime emissions reductions, many challenges remain for these two sectors. Without a clear mandate for ICAO or IMO, the bunkers issue could remain in policy limbo for the foreseeable future.

From an industry perspective, there may now be an increased risk of the 'patchwork quilt' of policies that airlines and the shipping industry have been so keen to avoid, as individual countries or regions implement their own measures to deal with emissions.[14]

Policy-makers need to consider options that will involve the most participants, keeping in mind the interests of developing countries. Three possible institutional arrangements may deserve some attention.

We are in the situation where for political reasons negotiations in the IMO and ICAO are blocked as some countries are concerned that moving away from the principle of CBDR in these for a may have repercussions in the wider climate negotiations. Alternatively, the redistribution of revenues from MBIs may contribute towards the practical implementation of CBDR.

Alternatively, the IMO and ICAO wait for a clearer picture from global climate negotiations until countries agree on binding targets for global CO_2 reduction. Under this approach, however, the IMO and ICAO will meet pressure from every corner and may lose authority in a ship-based CO_2 reduction regime.

A middle road is to turn to voluntary CO_2 reduction and avoid seeking binding commitments from developing countries. This method may attract more participants, but it has limits in that voluntary reduction may not meet the target set by other stakeholders and UNFCCC.

> From a sustainable development perspective, it is very important to take into account that climate change, whether induced by the maritime transport sector or by other sectors, is a global issue, and thus, mitigation measures would require participation from all nations. However, the amount and type of contribution could differ as per the divergent circumstances of different states, particularly developing countries. This forms the crux of CBDR principles adopted by the UNFCCC and has been very well integrated within the framework of the Kyoto Protocol. A similar kind of effort is needed to address GHG emission from international transport. Before adopting any measure, whether it is technological, operational or market based, the approach towards implementation of these measures must beclear. Finally, to reach this level of understanding and cooperation, better coherence is needed between the work of IMO, IATA, ICAO, UNFCCC, the WTO and other international organisations.

Many questions for further research remain if we want to address the problem of rapidly increasing emissions from bunker fuels. Among them are:

- What is the environmental effect of exempting countries (or routes/sizetreshold/products) from climate regulation? And what is the economic effect on individual countries?
- When the proceeds of auctioning allowances are used to finance climate policy in developing countries, what will be the balance of costs and benefits for all countries involved?
- What will be the impact on trade patterns of individual countries? For instance, how will value chains change when the price of raw materials relative to finished products increase as a result of higher transport costs?

14 See e.g. the EU proposal to include shipping and aviation in the EU ETS

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