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Towards a carbon tax on international shipping: measuring economic effects to assess relevance and support implementation

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Regularly discussed at the international level over the last two decades without reaching a consensus, taxation on international shipping has been on the agenda of international negotiations since the Summit for a New Global Financing Pact held in Paris in June 2023 and the Paris Pact for People and the Planet (4P). Marked by strong political declarations and signals, including the launch of a taskforce on international taxation[1] to tackle the joint development, climate and nature agenda, the past year has further affirmed the opening of an unprecedented window of opportunity, which many countries in the South and North are eager to seize.

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1. https://www.elysee.fr/admin/upload/default/0001/15/91b013291db03bcc5f2f6b84de39a81ae0c04c7d.pdf

···/··· Convinced that collective action can drive tangible shifts in international taxation, such as the recent agreement among 140 countries under the auspices of the OECD to implement a 15% global minimum tax on multinationals, many small island developing states have intensified their advocacy for a carbon tax on international shipping.

After providing a brief history of international discussions on the subject, this note presents the results of the study "Navigating international taxation: the effects of a carbon levy on shipping", recently published by Ferdi. This study assesses the fiscal potential of a carbon tax on international shipping of $40 per tonne of CO2, its differential impact on 185 countries, and its effects on CO2 emissions generated by freight transport. The results show that the fiscal potential of such a tax ranges from $20 to $60 billion, depending on the scenario considered, with an economic cost associated with its impact on trade exceeding $160 billion. The application of the tax would have limited effects on greenhouse gas emissions from the transport sector, with an estimated relative variation for CO2 ranging between -0.72% and +0.12%. This variation is attributed to the reorganization of trade flows between partners and also between different modes of transport. The increase in transport costs resulting from the tax would lead to an inequitable loss of purchasing power between countries, with consumers in poor countries experiencing greater impacts compared to those in rich countries.

Therefore, if imposing a tax on shipping is justified as part of the implementation of an international carbon price floor, it is essential to consider support or compensation schemes for the poorest and most vulnerable countries. As an innovative financing mechanism capable of yielding a double environmental and development dividend, a tax on maritime transport has several drawbacks that make it less equitable, more costly, less incentivizing and less revenue-generating compared to other international tax systems.

At the crossroads of the climate and development agendas, a political window of opportunity to tax shipping

Shipping and CO_2

In 2018-2019, according to UNCTAD (UNCTAD, 2020), 11 billion tonnes of goods were traded internationally by sea. This figure has been steadily increasing until the Covid-19 crisis, nearly doubling from the 6 billion tonnes recorded in 2000.

According to data from the U.S. Census Bureau, prior to the Covid-19 crisis, seaborne trade accounted for approximately 45% of the total value of U.S. imports and 35% of its exports. For the European Union during the same period, seaborne trade represented slightlyover 45% of its foreign trade value (with non-EU countries) but accounted for around 75% by volume. Comprehensive data on transportation modes is not systematically available for the whole world. Estimates suggest that seaborne trade represents between 50% and 74% of international trade flows by value, depending on the source (Verschuur et al., 2022; International Chamber of Shipping[2]).

According to the International Maritime Organization (IMO), pollution from shipping, primarily due to the extensive use of heavy fuel oil, currently contributes to 3% of greenhouse gas (GHG) emissions worldwide. If the sector fails to adopt a credible trajectory for significantly reducing its contribution to global warming, and despite the progress made since 2008 in reducing its carbon intensity, emissions from the shipping sector could surge by 130% by 2050 (Faber et al., 2020).

Considering the sector's weight in merchandise trade, its greenhouse gas emissions, its future prospects, coupled with the fact that it is not covered by the Kyoto Protocol and not current-

2. https://www.ics-shipping.org/shipping-fact/shipping-and-world-trade-driving-prosperity/

ly taxed, an increasing number of voices, from the South and the North, are advocating for the implementation of a carbon tax on maritime transport.

History of international discussions on marine fuel taxation

The International Maritime Organization, as the United Nations specialized agency responsible for preventing marine and air pollution from ships, has been exploring measures to combat greenhouse gas emissions from ships since the late 1990s. As early as 1997, the Kyoto Protocol to the United Nations Framework Convention on Climate Change[3] called on developed countries, through the IMO, to implement measures to mitigate pollution resulting from the use of marine fuels. However, the issue of taxing shipping fuels was entirely absent from early international conventions such as the Convention for the Prevention of Pollution from Ships (MARPOL), adopted in 1973[4], or the United Nations Convention on the Law of the Sea, adopted in 1982.

It wasn't until the COPs of the 2000s, the growing concern over the sector's rising GHG emissions, and the European Commission's initial proposal in 2007 to include the maritime sector in the EU Emissions Trading Scheme (ETS), which was rejected[5], that the issue of a carbon tax on shipping gained attention in international negotiations. Nevertheless, such a carbon tax is notably absent from the IMO's amendments to the MARPOL Convention (2011), which focus energy efficiency measures, as well as from the Paris Agreement (2015)[6] , which establishes a global framework for combating climate change and encourages states to take measures for emissions reduction.

In 2018, the IMO adopted an initial strategy aimed at reducing GHG emissions from international shipping by at least 50% by 2050 compared with 2008 levels. While this strategy marked an important first step towards reducing emissions from the maritime sector, it did not outline concrete measures to achieve this goal.

Since the early 2020s, discussions on the introduction of a carbon tax on shipping have been gathering momentum. Following on from the Sharm el-Sheikh implementation plan (COP27) and the Bridgetown agenda, the Summit for a New Global Financing Pact in Paris in June 2023 has put innovative sources of financing back at the heart of the negotiations. In preparation for the Summit, a working group co-chaired by France and Barbados looked at the most promising innovative solutions for providing additional resources to support countries vulnerable to climate change, including a carbon tax on shipping. The conclusions of the Summit presidency emphasized that new financial contributions, including mandatory mechanisms or taxes on activities that contribute most to climate change, should be considered.

In July 2023, the IMO adopted a revised strategy[7] which considerably strengthens the decarbonization objectives for international shipping. The aim is to reduce greenhouse gas emissions from international shipping by at least 40% by 2030 compared with 2008, ultimately achieving zero GHG emissions by 2050. Meeting again at the 81st session of the Maritime Environmental Protection Committee (MEPC81) in March 2024[8] , IMO member states have identified two legally binding medium-term measures to achieve the objectives of the revised strategy, including the introduction of carbon pricing regulations. Member states have until spring 2025 to reach agreement on the modalities of such pricing. Backed by 23 countries at the Summit for a New

3. https://www.un.org/french/millenaire/law/23.htm
4. https://www.imo.org/fr/About/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx
5. The EU Emissions Trading Scheme has finally been extended in January 2024 to all large ships entering EU ports, regardless of their flag.
6. https://unfccc.int/fr/a-propos-des-ndcs/l-accord-de-paris
7. https://www.imo.org/fr/MediaCentre/PressBriefings/pages/Revised-GHG-reduction-strategy-for-global-shipping-adopted-.aspx
8. https://www.imo.org/fr/MediaCentre/MeetingSummaries/Pages/MEPC-81.aspx

Global Financing Pact, the principle of a global tax on maritime transport was supported by 47 IMO member states at the IMO Committee meeting in March 2024.

Alongside the IMO negotiations, the second half of 2023 was marked by the African Climate Summit in September 2023. The Nairobi Declaration called for the consideration of a global carbon tax regime, encompassing maritime and air transport. During COP28 in Dubai in December, Antigua and Barbuda, Barbados, Spain, France and Kenya jointly launched a new task force on international taxation. The mission of the International Tax Task Force is to study options for mobilizing new, additional, predictable, and adequate financial resources to support the transition of vulnerable developing countries and their fight against the adverse effects of climate change. This task force aims to formulate concrete proposals for COP30 in 2025. Co-chaired by Barbados, France and Kenya, it seeks to capitalize on the political window of opportunity opened in 2023 and contribute to the implementation of international fiscal measures.

Towards an international consensus?

While the subject now holds a central place in discussions on new sources of financing to combat climate change and on the international financial architecture (Wemaëre et al., 2023), exchanges at the MEPC81 in March 2024 illustrate the various differences of opinion among IMO member states.

China, Brazil and Argentina oppose the GHG pricing mechanism under discussion at the IMO, arguing that an overly ambitious emissions reduction target would hinder the sustainable development of international shipping, significantly increase supply chain costs and have a negative impact on global economic recovery, particularly in emerging economies dependent on maritime trade. These countries, along with South Africa and the United Arab Emirates, propose a global cap on the carbon intensity of fuels, as well as a financial penalty for non-compliance, and betting on greener and decarbonized shipping.

At the opposite end of the spectrum are a large number of Small Island Developing States (SIDS), particularly vulnerable to the effects of climate change and the economic impacts of decarbonization. Despite their heavy reliance on shipping, countries like the Marshall Islands, Vanuatu and other SIDS such as Fiji, Palau and Tuvalu, alongside other signatories to the Kainaki II Declaration, have been advocating on an emissions tax for many years. They propose setting the price per tonne of CO_2 at a high level of $150.

Consideration is also being given to how the revenues from such a tax would be used, particularly whether it could contribute to the loss and damage fund established after COP27 in Sharm el-Sheikh. Representatives of the shipping industry, as well as countries such as China and Brazil, prefer to see the proceeds of any carbon tax used to finance the decarbonization of the sector, specifically the development of low-carbon shipping fuels. On the other hand, many countries, including France, the European Union and the SIDS, advocate mobilizing these revenues to support the transition of the poorest countries vulnerable to the effects of climate change. While the window of opportunity is real, all options remain open regarding the amount of such a tax, its collection methods, its governance and the utilization of the revenues collected.

Fiscal potential and effects of a carbon tax on international shipping

Simulate the effects of a tax to contribute to the international debate

Before seeking to specify the contours or implementation modalities of a carbon tax on international shipping, it is useful to estimate its potential and impacts. The aim of the study "Navigating international taxation: the effects of

a carbon levy on shipping", recently published by Ferdi[9], is to provide quantitative arguments for current international discussions, by documenting the impacts of a carbon tax on shipping and basing the analysis on publicly available data. This study offers insights that temper some of the results put forward by Pereda et al. (2023).

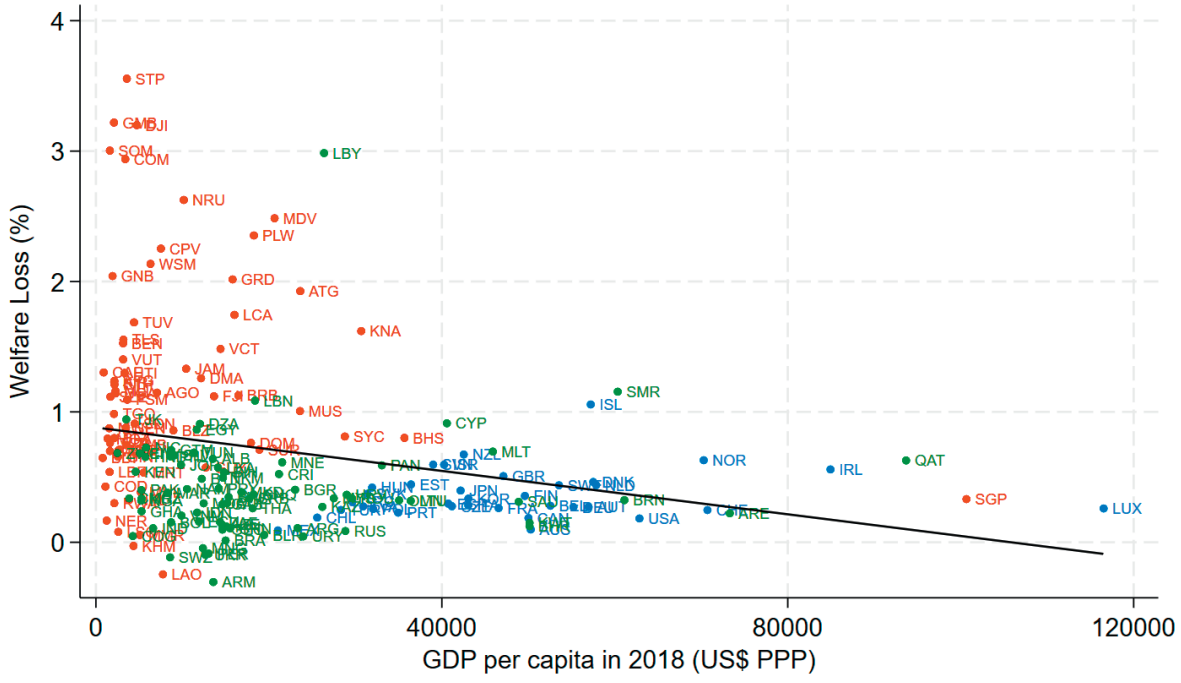
The study measures the effects of a hypothetical tax of $40 per tonne of CO_2 applied to shipping emissions worldwide, focusing on international trade flows since the transport of material goods is accounting for the bulk of global shipping. Our calculations are based on disaggregated trade data covering the period 2012-2018 for 185 countries and, because it is impossible to exploit any natural experiments, we develop in this study a multi-sector structural gravity model, designed to isolate maritime trade and then incorporate the price of maritime fuel into trade cost variables.

In a first step, we estimate the elasticity of trade flows to the price of marine fuel, for each HS2-level sector in the harmonized system. We then use these elasticities to quantify the effect on 2018 flows of an increase in fuel prices resulting from the application of a tax in that year.

The increase in the price of marine fuel affects transport costs between almost all pairs of countries, and generates redirections of flows, which can only be properly taken into account through a general equilibrium comparative static analysis. Our work therefore goes beyond the simple estimation of elasticities carried out in the first stage, and enables us to quantify the tax incidence via its impact on the level of well-being in each country, measured by the purchasing power of a representative consumer. Variations in purchasing power give us information in relative terms on which countries are most affected by the tax. They also enable us to calculate the economic cost of the tax, defined as the equivalent variation in aggregate income country by country.

9. V. Dequiedt, A.-A. De Ubeda and E. Mien (2024)

Graph 1 - Impact of carbon tax on welfare per country as a function of GDP per capita



Red: LDCs and SIDS; blue: OECD countries; green: other countries
Source: Dequiedt et al, 2024

LDCs and SIDS particularly affected by the introduction of the tax

Our main results underline that, on average, poor countries would suffer a more negative impact than rich countries, since we establish that welfare losses are negatively correlated with GDP per capita. More precisely, assuming a carbon tax of $40 per tonne of CO2 fully passed on the price of fuel, OECD countries would suffer an average loss of purchasing power, i.e. welfare, of 0.37% on tradable goods, while the Least Developed Countries (LDCs) would suffer a loss of purchasing power of 1.11%. The average loss for all countries would be 0.73%.

Graph 1 (see previous page) illustrates the negative relationship between GDP per capita and loss of purchasing power. Each point represents a country, color-coded to highlight LDCs and SIDS on one side, and OECD countries on the other. The negative-slope line shown in black is obtained by a simple linear regression for purely descriptive purposes.

Table 1 (see next page) presents the same data in an alternative form, ordering all the countries in our sample from most to least impacted. Unsurprisingly, Small Island Developing States such as Sao Tomé and Principe, Comoros, Cuba and Haiti are among the countries most affected by the introduction of the tax. The same applies to LDCs such as Gambia, Djibouti and Guinea-Bissau. These two figures reveal an inequitable distribution of incidence by country, which can be explained both by the geographical distance of poor countries from world markets and by the specific composition of their import and export baskets. While this distribution is not surprising, our study enables us to confirm it rigorously and quantify its scale.

The measurement of the tax's effects on well-being can be completed for each country by quantifying the economic costs associated with implementing the tax. This quantification is based on calculating the loss of wealth, calculated at reference prices without the tax, generating the same variation in well-being as the tax. **Table 2** (see page 8) details these economic costs by country. As this measure is not relative to GDP, countries with the highest GDP are naturally among those bearing the highest economic cost.

Tax potential and effect on CO_2 emissions

Beyond welfare effects, our structural approach allows us to document the effect of a carbon tax on all bilateral trade flows and how it would impact the overall geography of world trade. We estimate that the average distance traveled at sea per $1 of merchandise would be reduced by 2.59% with the tax.

Carbon intensity depends largely on ship type and size, which are difficult to assess accurately. By assigning each product transported by sea an average carbon intensity, based on the type of ship most likely to be used (Ministère de la transition écologique et solidaire, 2018), we formulate several scenarios. After implementation of the tax, we estimate the reduction in CO2 emissions from shipping at around -1.75%. The impact on emissions from international freight transport, all modes combined, would be more modest, between -0.72% and +0.12% depending on the scenario adopted. This is due to the reorientation of trade flows towards more carbon-intensive modes of transport, if this tax on maritime transport were adopted independently of a more global carbon tax.

Depending on the scenario adopted, the revenue collected via the carbon tax on shipping would be between $19.6 and $59.5 billion. This revenue must be compared with the economic cost of the tax's effects on trade, which we estimate at $166 billion worldwide. Although this comparison does not amount to an estimate of the marginal cost of funds, since we do not model environmental externalities, it does enable us to quantify the scale that these environmental externalities would have to take on for the tax to

Table 1 – Welfare loss or gain by country, in percent

Country	Change	Country	Change	Country	Change	Country	Change
Sao Tome and Principe	-3.56	Egypt	-0.87	Sweden	-0.44	Indonesia	-0.23
Gambia	-3.22	Belize	-0.86	Dem. Rep. of Congo	-0.43	Portugal	-0.23
Djibouti	-3.20	Andorra	-0.83	Eritrea	-0.42	United Arab Emirates	-0.22
Somalia	-3.01	Seychelles	-0.81	Hungary	-0.42	Viet Nam	-0.21
Libya	-2.99	Bahamas	-0.80	Paraguay	-0.41	Chile	-0.19
Comoros	-2.94	Burkina Faso	-0.80	Namibia	-0.41	Canada	-0.19
Nauru	-2.63	Mozambique	-0.80	Bulgaria	-0.40	USA	-0.18
Maldives	-2.49	Chad	-0.76	Pakistan	-0.40	Niger	-0.17
Cook Isds	-2.41	Dominican Rep.	-0.76	Japan	-0.40	Ecuador	-0.16
Palau	-2.35	Zambia	-0.75	North Macedonia	-0.39	South Africa	-0.16
Cabo Verde	-2.25	Nicaragua	-0.73	Marshall Isds	-0.39	Bolivia	-0.16
Samoa	-2.14	Solomon Isds	-0.71	Morocco	-0.38	Kuwait	-0.15
Yemen	-2.10	Suriname	-0.71	Slovakia	-0.37	Azerbaijan	-0.14
Guinea-Bissau	-2.04	Guatemala	-0.71	Equatorial Guinea	-0.37	Bahrain	-0.12
Grenada	-2.02	Tanzania	-0.71	Croatia	-0.37	Iran	-0.12
Antigua and Barbuda	-1.93	Madagascar	-0.70	Finland	-0.36	Argentina	-0.11
Cuba	-1.80	Malta	-0.70	Botswana	-0.35	India	-0.11
St Lucia	-1.75	Tunisia	-0.69	Romania	-0.34	China	-0.11
Tuvalu	-1.69	Zimbabwe	-0.69	Serbia	-0.34	Australia	-0.10
St Kitts and Nevis	-1.62	Cote d'Ivoire	-0.68	Malaysia	-0.34	Georgia	-0.10
Timor-Leste	-1.56	New Zealand	-0.67	Cameroon	-0.34	Mexico	-0.09
Benin	-1.53	El Salvador	-0.67	Kyrgyzstan	-0.34	Russia	-0.09
St Vincent and the Gr.	-1.48	Philippines	-0.66	Rep. of Korea	-0.34	Lesotho	-0.08
Vanuatu	-1.40	Guinea	-0.66	Singapore	-0.33	Belarus	-0.06
Jamaica	-1.33	Honduras	-0.66	Nepal	-0.33	Myanmar	-0.06
Central African Rep.	-1.30	Burundi	-0.65	Brunei Darussalam	-0.32	Rep. of Congo	-0.05
Haiti	-1.30	Albania	-0.64	Oman	-0.32	Uruguay	-0.05
Dominica	-1.26	Norway	-0.63	Nigeria	-0.32	Brazil	-0.02
Afghanistan	-1.24	Qatar	-0.63	Lithuania	-0.32	Cambodia	0.03
Syria	-1.23	Montenegro	-0.61	Saudi Arabia	-0.31	Mongolia	0.04
Kiribati	-1.23	Slovenia	-0.60	Greece	-0.31	Peru	0.09
Ethiopia	-1.21	Israel	-0.60	Colombia	-0.30	Ukraine	0.10
Mali	-1.16	Jordan	-0.59	Rwanda	-0.30	Eswatini	0.11
San Marino	-1.16	Panama	-0.59	Rep. of Moldova	-0.30	Lao PDR	0.24
Angola	-1.15	Guyana	-0.57	Spain	-0.30	Armenia	0.30
Uganda	-1.14	Sri Lanka	-0.57	Gabon	-0.29		
Barbados	-1.13	Ireland	-0.56	Italy	-0.29		
Fiji	-1.12	Kenya	-0.54	Belgium	-0.28		
Sierra Leone	-1.12	Liberia	-0.54	Czech Rep.	-0.28		
FS Micronesia	-1.10	Bosnia Herzegovina	-0.54	Latvia	-0.28		
Lebanon	-1.09	Mauritania	-0.54	Kazakhstan	-0.27		
Iceland	-1.06	Costa Rica	-0.52	Austria	-0.27		
Mauritius	-1.01	United Kingdom	-0.51	Germany	-0.27		
Togo	-0.99	South Sudan	-0.51	France	-0.26		
Tajikistan	-0.94	Turkmenistan	-0.50	Thailand	-0.26		
Cyprus	-0.91	Bhutan	-0.49	Luxembourg	-0.26		
Sudan	-0.91	Denmark	-0.46	Poland	-0.26		
Algeria	-0.91	Niue	-0.46	Turkey	-0.25		
Senegal	-0.88	Estonia	-0.45	Switzerland	-0.25		
Malawi	-0.88	Netherlands	-0.44	Ghana	-0.24		

Source: Dequiedt *et al.*, 2024

Table 2 – Economic cost of implementing the tax, in billions of dollars

Country	Loss	Country	Loss	Country	Loss	Country	Loss
USA	-20.07	Sudan	-0.55	Paraguay	-0.15	Solomon Isds	-0.02
China	-20.01	Ghana	-0.55	Zimbabwe	-0.14	Comoros	-0.02
Japan	-13.26	Lebanon	-0.54	Burkina Faso	-0.13	Guinea-Bissau	-0.02
Germany	-7.97	Dominican Rep.	-0.52	Malta	-0.13	South Sudan	-0.02
Rep. of Korea	-7.75	Slovakia	-0.51	Kyrgyzstan	-0.13	Belize	-0.02
United Kingdom	-6.87	Angola	-0.49	Jamaica	-0.13	Georgia	-0.02
Italy	-4.43	Libya	-0.49	El Salvador	-0.12	Andorra	-0.01
France	-4.19	Portugal	-0.48	Bosnia Herzegovina	-0.12	Vanuatu	-0.01
Netherlands	-3.93	Kenya	-0.46	Syria	-0.12	Uruguay	-0.01
Saudi Arabia	-3.14	Cote d'Ivoire	-0.42	Luxembourg	-0.11	Samoa	-0.01
Spain	-3.02	Argentina	-0.42	Madagascar	-0.11	Grenada	-0.01
Russia	-2.86	Yemen	-0.42	Malawi	-0.10	Central African Rep.	-0.01
India	-2.53	Guatemala	-0.37	Guinea	-0.10	Timor-Leste	-0.01
Algeria	-2.33	Qatar	-0.37	Bahamas	-0.10	Kiribati	-0.01
Singapore	-2.17	Oman	-0.36	Mauritius	-0.09	St Vincent and the Grenadines	-0.01
Canada	-2.11	Tunisia	-0.36	Namibia	-0.09	Bhutan	-0.01
Philippines	-2.04	Costa Rica	-0.36	Nepal	-0.09	FS Micronesia	-0.01
Iran	-2.03	Bulgaria	-0.35	Latvia	-0.09	Cook Isds	-0.01
Egypt	-1.96	Kazakhstan	-0.35	Mauritania	-0.09	St Kitts and Nevis	-0.01
Turkey	-1.95	Ethiopia	-0.34	Tajikistan	-0.08	Sao Tome and Principe	-0.01
Belgium	-1.91	Jordan	-0.34	Maldives	-0.08	San Marino	-0.01
Malaysia	-1.84	Sri Lanka	-0.34	Myanmar	-0.08	Palau	-0.01
Indonesia	-1.76	Slovenia	-0.33	North Macedonia	-0.08	Dominica	-0.01
Nigeria	-1.71	Zambia	-0.33	Turkmenistan	-0.07	Eritrea	-0.01
Thailand	-1.56	Bahrain	-0.31	Fiji	-0.07	Nauru	0.00
Poland	-1.55	Tanzania	-0.31	Haiti	-0.07	Tuvalu	0.00
United Arab Emirates	-1.51	Panama	-0.30	Botswana	-0.07	Lesotho	0.00
Sweden	-1.43	Benin	-0.29	Rwanda	-0.07	Niue	0.00
Switzerland	-1.35	Senegal	-0.28	Belarus	-0.07	Eswatini	0.01
Viet Nam	-1.32	Brazil	-0.28	Albania	-0.06	Cambodia	0.02
Norway	-1.28	Afghanistan	-0.27	Gambia	-0.05	Armenia	0.03
Israel	-1.24	Cameroon	-0.26	Liberia	-0.05	Lao PDR	0.06
Colombia	-1.14	Mozambique	-0.22	Brunei Darussalam	-0.05	Ukraine	0.15
Kuwait	-0.94	Croatia	-0.22	Bolivia	-0.04	Peru	0.19
Austria	-0.92	St Lucia	-0.21	Rep. of Moldova	-0.04	Mongolia	0.22
Mexico	-0.91	Cyprus	-0.20	Niger	-0.04		
Ireland	-0.87	Azerbaijan	-0.20	Rep. of Congo	-0.04		
Denmark	-0.86	Honduras	-0.19	Marshall Isds	-0.04		
Czech Rep.	-0.85	Djibouti	-0.19	Seychelles	-0.04		
New Zealand	-0.83	Dem. Rep. of Congo	-0.19	Cabo Verde	-0.04		
Australia	-0.81	Serbia	-0.19	Equatorial Guinea	-0.04		
Hungary	-0.77	Iceland	-0.18	Gabon	-0.04		
Pakistan	-0.76	Cuba	-0.18	Suriname	-0.04		
Romania	-0.73	Uganda	-0.18	Sierra Leone	-0.04		
Finland	-0.67	Estonia	-0.17	Burundi	-0.04		
Greece	-0.62	Togo	-0.17	Montenegro	-0.03		
Morocco	-0.59	Nicaragua	-0.17	Guyana	-0.03		
Ecuador	-0.59	Lithuania	-0.17	Chad	-0.03		
Chile	-0.59	Mali	-0.16	Barbados	-0.02		
South Africa	-0.57	Somalia	-0.16	Antigua and Barbuda	-0.02		

Source: Dequiedt *et al.*, 2024

be efficient. The cost/revenue ratio ranges from 2.78 to 8.47, which is well above standard estimates of the marginal cost of public funds, below 1.5 including in developing countries (Auriol and Warlters, 2012)[10]. While a high cost/revenue ratio is not necessarily problematic for a tax that aims to change behavior and not just generate revenue, it is nevertheless an important warning when combined with our result on the low magnitude of the tax's effect on shipping emissions. These results can be contrasted with those of Pereda et al. (2023), who use the GTAP computable general equilibrium model on 2014 data to estimate the effects of a shipping tax of $50 per tonne of CO2. These authors suggest an effect on shipping emissions of -7%, well above the estimates in our study, and a positive average effect on GDP.

Recommendations - Question the rationale of such a tax and identify the conditions for its relevance.

By simulating the implementation of a tax on maritime transport for 185 countries, our study provides a complete picture of the effects of such a tax, and can feed into an analysis based on the usual criteria for assessing compulsory levies: effectiveness, incentive character and equity. This leads to the identification of several points of attention to be considered in the pursuit of international discussions and negotiations.

The fiscal potential of a maritime trade tax of $40 per tonne of CO2 is estimated at between $19.6 and $59.5 billion, for an economic cost of $166 billion. The cost/revenue ratio is therefore between 2.78 and 8.47, well above the marginal cost usually considered for public funds. In other words, if the sole objective is to mobilize between $20 and $60 billion, other, more effective means certainly exist.

In addition to mobilizing resources, a carbon tax has the objective of incentivizing changes in behavior that should lead to a reduction in CO2 emissions. It is indeed a Pigouvian tax that internalizes the environmental externalities associated with CO2 emissions. Our results show, however, that the size of the tax's effect on the reduction of carbon emissions from shipping, estimated at 1.75%, seems a long way from the ambitions to reduce GHG emissions from the maritime sector as set out by the IMO. The magnitude of the effect on emissions from the international transport sector, all modes combined, is even smaller, estimated at between -0.72% and +0.12%, due to the redirection of trade flows towards modes of transport that emit more than maritime transport. Admittedly, our results measure short-term effects and disregard the consequences of the tax on consumer preferences or technological progress in the transport sector, but it seems risky to consider that the introduction of such a tax, without any other accompanying measures, would have significant effects in terms of modifying preferences and encouraging technological evolution in the sector.

These first two points call into question the double-dividend narrative regularly put forward in discussions of environmental taxes. In this case, the funds raised by a tax on maritime transport are mobilized at a high economic cost and for a minor reduction in externalities.

A carbon tax on shipping is also intended to apply the polluter-pays principle, with the cost borne by those whose consumption or production behaviors generate emissions. However, the results relating to the differentiated effects country by country underline the highly inequitable nature of the tax, with a more marked effect on consumer purchasing power in poor countries than in rich ones.

The results of the study "Navigating international taxation: the effects of a carbon levy on shipping" lead to two main recommendations.

- Working towards a global harmonization of carbon prices is an economically relevant ob-

10. Auriol and Warlters 2012 estimate the average marginal cost of public funds in 38 African countries at 1.2 for five different taxes.

jective that should leave no sector untouched, and raises questions of fairness. A carbon tax on shipping that is not accompanied by a carbon tax on air freight runs the risk of redirecting trade flows from a low-carbon mode, shipping, to a much more carbon-intensive mode, air freight, thereby considerably reducing the tax's effect on overall emissions. Equity considerations, meanwhile, are linked to discussions about the destination of the tax proceeds. Some voices advocate using the revenues to decarbonize the maritime sector, while others see it as an opportunity to support climate action and protect global public goods, along the lines outlined in the Landau report 20 years ago (Landau, 2004). The fiscal impact of a tax on maritime transport is likely to be very inequitably distributed, with a disproportionately negative impact on SIDS and LDCs, which undoubtedly argues in favor of using the revenue to benefit them first.

- Finding additional and innovative sources of financing to support the transition of vulnerable countries must involve comparing the advantages and disadvantages of different international taxes. Recent works aim to estimate the fiscal potential as well as the economic and/or environmental effects of implementing a carbon tax on shipping (Pereda et al., 2023; Dequiedt et al., 2024), a carbon tax on civil aviation (Dama et al. 2023), a tax on financial transactions (Capelle-Blancard, 2023) or a tax on the ultra-rich (Chancel et al. 2024, work by G. Zucman[11] prepared for the G20). As an innovative financing mechanism aiming for a double dividend, a carbon tax on shipping needs to be put into perspective with the other international tax schemes under consideration, some of which could be fairer, less costly, with more incentive effect or with a higher potential. This comparative analysis should help prioritize international political action.

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