MARINE ENVIRONMENT PROTECTION COMMITTEE 82nd session Agenda item 7	MEPC 82/INF.8/Add.2 26 July 2024 ENGLISH ONLY Pre-session public release: ☒

REDUCTION OF GHG EMISSIONS FROM SHIPS

Report of the Comprehensive impact assessment of the basket of candidate GHG reduction mid-term measures – full report on Task 3 (Impacts on States)

Note by the Secretariat

SUMMARY

Executive summary:	This document provides the full report on Task 3, Assessment of the impacts on States, of the comprehensive impact assessment of the basket of candidate GHG reduction mid-term measures as conducted by UNCTAD, together with the collation of substantive comments by members of the Steering Committee and external quality assurance and quality control (QA/QC) reviewers and responses provided by UNCTAD.
Strategic direction, if applicable:	3
Output:	3.2
Action to be taken:	Paragraph 2
Related documents:	MEPC 80/17, MEPC 80/17/Add.1; MEPC 81/7, MEPC 81/7/Add.1; MEPC 82/7, MEPC 82/7/1, MEPC 82/7/2, MEPC 82/7/4; MEPC 82/7/4/Add.1, MEPC 82/7/4/Add.2, MEPC 82/7/4/Add.3, MEPC 82/7/4/Add.4, MEPC 82/INF.8, MEPC 82/INF.8/Add.1, MEPC 82/INF.8/Add.3 and MEPC.1/Circ.885/Rev.1

Introduction

1 The Comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures consists of five distinct and interrelated tasks (MEPC 82/7/4, paragraph 5). At its eleventh meeting, the Steering Committee endorsed the moderator's suggestions on the outcome of Task 3 (Impacts on States), as set out in paragraph 27 of document MEPC 82/7/4. This document provides the full report of the assessment of the impacts on States conducted by UN Trade and Development (UNCTAD), together with the collation of substantive comments by members of Steering Committee and external quality assurance and quality control (QA/QC) reviewers and responses provided by UNCTAD, as set out in annexes 1 to 3.

Action requested of the Committee

2 The Committee is invited to take into account the information provided in this document, when considering documents MEPC 82/7/4 and MEPC 82/7/4/Add.3.

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ANNEX 1

Comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures

Task 3: ASSESSMENT OF IMPACTS ON STATES

Final report

29 July 2024

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Acknowledgements

The Impact Assessment contained in this report was prepared by UN Trade and Development (UNCTAD) at the request of the International Maritime Organization (IMO). It sets out the main findings of the modelling work and analytical assessment conducted by UNCTAD in accordance with the Revised Procedure for Assessing Impacts on States of Candidate Measures contained in MEPC.1/Circ.885/Rev.1 and the Revised Work Plan (Task 3) for the conduct of the Comprehensive Impact Assessment of the Basket of Candidate Mid-term Measures (Annex 3, MEPC 81/7).

The UNCTAD's project team were Jan Hoffmann, Frida Youssef, Hassiba Benamara, Onno Hoffmeister, and Hidenobu Tokuda from the Trade Logistics Branch, Division on Technology and Logistics, and Julien Bliesener, Ralf Peters, and Alessandro Nicita from the Trade Analysis Branch, Division on International Trade and Commodities. UNCTAD consultants who contributed to the report were Ronald A. Halim, Sotiria Lagouvardou, and Tristan Smith. Substantive contributions were received from GTAP Center at Purdue University, led by Erwin Corong who led and performed the modelling and co-led the GTAP analysis, with contributions from David Hummels and David Vanzetti; MDS Transmodal (MDST), led by Michael Garratt and Antonella Teodoro who consolidated data relating to changes in ship costs and transit times as computed by DNV, with data on trade and fleet deployment; Marine Benchmark, led by Torbjörn Rydbergh and Börje Berneblad who provided detailed data on ship movement, including fleet deployment and journeys; DNV who provided, for various ship types, data on expected changes in ship costs and speed resulting from the IMO mid-term measure; Equitable Maritime Consulting (EMC), led by Ronald A. Halim who provided estimates on the value of time (VoT), and prepared the impacts on maritime logistics costs as input for the GTAP analysis.

The report has also relied on data provided by Clarksons Research and the UNCTAD-World Bank Transport Costs Data Set maintained by UNCTAD Statistics. Additional sources are mentioned in the report.

The report has benefited greatly from consultations, discussions as well as information and data sharing involving the leaders of Task 2 (DNV) and Task 4 (Starcrest). The main findings under Task 1 (WMU) have further informed the preparation of the present UNCTAD report.

Special thanks go to the IMO Steering Committee members, the Moderator of the Steering Committee, and the IMO secretariat for the thorough review of the report, considered feedback and valuable guidance, especially given the extremely tight timelines and the complexity of Task 3. The extensive comments received as part of the Quality Assurance review are also gratefully acknowledged.

Disclaimer

This report has been completed by UN Trade and Development (UNCTAD). It contains the report on Task 3 on the assessment of the impacts of the candidate measures on States of the comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures.

Whilst this report has been commissioned by the International Maritime Organization (IMO), the information contained within this report represents the views of its authors only. It should not be interpreted as representing the views of the IMO or the Steering Committee on the comprehensive impact assessment of the basket of candidate mid-term measures.

This comprehensive impact assessment of the basket of mid-term GHG reduction measures consists of five distinct but interrelated tasks for which different reports have been prepared. Task 3 of the Comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures is being undertaken solely to assist IMO's Marine Environment Protection Committee (MEPC) in making evidence-based decisions. Any information included in this report is provided solely for analytical purposes and should not be interpreted as suggestions or recommendations for how the basket of mid-term GHG reduction measures should be designed. The policy combination scenarios and any other information included in this report are provided solely for analytical purposes and should not be interpreted as suggestions or recommendations for how the basket of mid-term GHG reduction measures should be designed.

The designations employed and the presentation of material on any map in this report do not imply the expression of any opinion whatsoever on the part of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The report has not been formally edited.

Abbreviations and symbols

$	United States dollar
BAU	business as usual
BAULG	business as usual low growth
CAPEX	capital expenditure
CGE	computational general equilibrium
CIF	cost, insurance and freight
CPI	consumer price index
FOB	free on board
GCD	Global Containership Database
GDP	gross domestic product
GFI	greenhouse gas fuel intensity
GHG	greenhouse gas
GTAP	Global Trade Analysis Project
ISIC	International Standard Industrial Classification of All Economic Activities
IMO	International Maritime Organization
LDCs	Least developed countries
MEPC	Marine Environment Protection Committee
MoA	mode of appearance
OPEX	operating expenses
RD&D	research, development and deployment
SC	Steering Committee for the Comprehensive Impact Assessment of the Basket of Candidate Mid-term Measures
SIDS	small island developing States
SITC	Standard International Trade Classification
SSP	Shared Socioeconomic Pathways
TtW	tank-to-wake
UNCTAD	United Nations Trade and Development
VoT	value of time
WCD	World Cargo Database
WtW	well-to-wake

Executive Summary

Introduction

This final report sets out the main findings of Task 3 modelling and analytical work conducted in accordance with the IMO Revised Work Plan for the Conduct of the Comprehensive Impact Assessment of the Basket of Candidate Mid-term Measures (MEPC 81/7, annex 3) and with the *Revised Procedure for Assessing Impacts on States of Candidate Measures* contained in MEPC.1/Circ.885/Rev.1.

The Steering Committee (SC) requested that UNCTAD focuses its assessment on the 10 policy scenarios featured in Table 1.[1] Four out of the 10 scenarios include three different revenue disbursement options and one option with no revenue disbursement. As a result, the overall number of simulation runs was set at 22.

Table 1. Task 2 policy scenarios selected for analysis under Step 2 of Task 3

Scenario number	Emis-sion trajec-tory	Sea-borne trade growth	Policy code	GFI scope	GFI flexibility		Levy		Feebate (% of gap)	Revenue disburse-ment modelling
					RU[1] (% of price)	SU[2] (% of price)	Levy ($/tCO₂eq)	Reward (% of gap)		
21	Base	Low	X.1	TtW	No flexibility		No levy		None	-
22	Base	Low	Y.1	WtW	No flexibility		No levy		None	-
23	Base	Low	X.4	TtW	120%	80%	No levy		None	-
24	Base	Low	Y.4	WtW	120%	80%	No levy		None	-
26	Base	Low	Y.2	WtW	No flexibility		150-300	90-65% to 2040	None	Yes
31	Base	Low	X.5	TtW	120%	80%	30-120	105% to 2040	None	Yes
32	Base	Low	Y.5	WtW	120%	80%	30-120	105% to 2040	None	Yes
36	Base	Low	Y.6	WtW	120%	80%	No levy		105% to 2040	-
43	Strive	Low	X.4	TtW	120%	80%	No levy		None	-
46	Strive	Low	Y.2	WtW	No flexibility		150-300	90-65% to 2040	None	Yes

[1] Remedial unit, *i.e.* Emission units purchased by ships with negative compliance balance from the Revenue body at a set price under the GHG Fuel Intensity flexibility mechanism.
[2] Surplus unit, *i.e.* Emission units sold by ships with positive compliance balance to the Revenue body at a set price under the GHG Fuel Intensity flexibility mechanism.
Source: DNV (2024a).

[1] The policy scenarios are conceptual. They do not represent the specific proposals that have been made for IMO mid-term measures.

UNCTAD's modelling builds on the outputs of Task 2, produced by DNV. The report by DNV defines two greenhouse gas (GHG) emission trajectories to 2050: Base and Strive trajectories, both on the well-to-wake (WtW) basis. The Base trajectory targets a 20 per cent reduction of the total annual GHG emissions from international shipping by 2030 and 70 per cent reduction by 2040, compared to 2008 levels. The Strive trajectory targets a 30 per cent reduction by 2030 and 80 per cent by 2040. Of the 10 scenarios, eight, assume a Base GHG emissions trajectory (scenarios 21, 22, 23, 24, 26, 31, 32, and 36), whereas two (scenarios 43 and 46) assume a Strive GHG emissions trajectory.

The examined policy scenarios employ a low seaborne trade growth projection (consistent with Task 2 modelling), and may address WtW GHG emissions or tank-to-wake (TtW) GHG emissions with sustainability criteria.

Four scenarios include a levy, with higher levy price applied in scenarios 26 and 46 compared to a lower levy price in scenarios 31 and 32, which also incorporate a GHG fuel intensity (GFI) flexibility compliance mechanism. The lower-levy scenarios differ in their GFI scope: TtW under scenario 31 and WtW under scenario 32. The higher-levy scenarios both follow a WtW GFI scope but differ in their GHG emissions trajectory. All ten scenarios include a GFI requirement. Six scenarios include GFI flexibility compliance mechanism (scenarios 23, 24, 31, 32, 36 and 43). One scenario includes a feebate mechanism (scenario 36). Across the scenarios used, there are systematic variations between the scenario specification parameters, allowing to gain insights into the sensitivity of the outputs and the impacts to flexibility mechanisms, feebate mechanisms, a levy (at one lower and one higher price), and variations in revenue disbursement (as well as emissions trajectory and GFI scope).

The present report describes the applied methods and presents the simulated percentage impact on imports, exports, gross domestic product (GDP), and consumer prices due to the increase in shipping time and maritime transport costs at three points of time namely, 2030, 2040 and 2050, in response to the hypothetical policy measures and due to the disbursement of the hypothetical revenues generated. Throughout this report, impacts on imports, exports and GDP are reported as impacts on real GDP and on import and export volumes or quantities.

Results presented in this report are aggregated by groups of economies with particular focus on the developing economies, the least developed countries (LDCs) and the small island developing States (SIDS), in accordance with the Terms of Reference of Task 3. The results for the world total are reported for comparison purposes. Detailed results at the level of States or, in some cases, slightly broader aggregates, are provided in the Annex.

For each of the scenarios featuring a levy, the impacts of three different hypothetical revenue disbursement schemes are considered: (1) with revenues disbursed to all States, (2) with revenues disbursed to developing economies, SIDS, and LDCs only, (3) with revenues disbursed exclusively to SIDS and LDCs as well as one intermediate scenario without any revenue disbursement. Under the three schemes, disbursements per State are proportional to the impact of the policy measure before revenue disbursement on GDP, and to population size. Meanwhile, the scheme without disbursement of revenues, serves as a control scenario to separate the effects of different components. Note that there has been no IMO decision or recommendation as to whether any, some or all of any revenues raised by any measure would be disbursed directly to States.

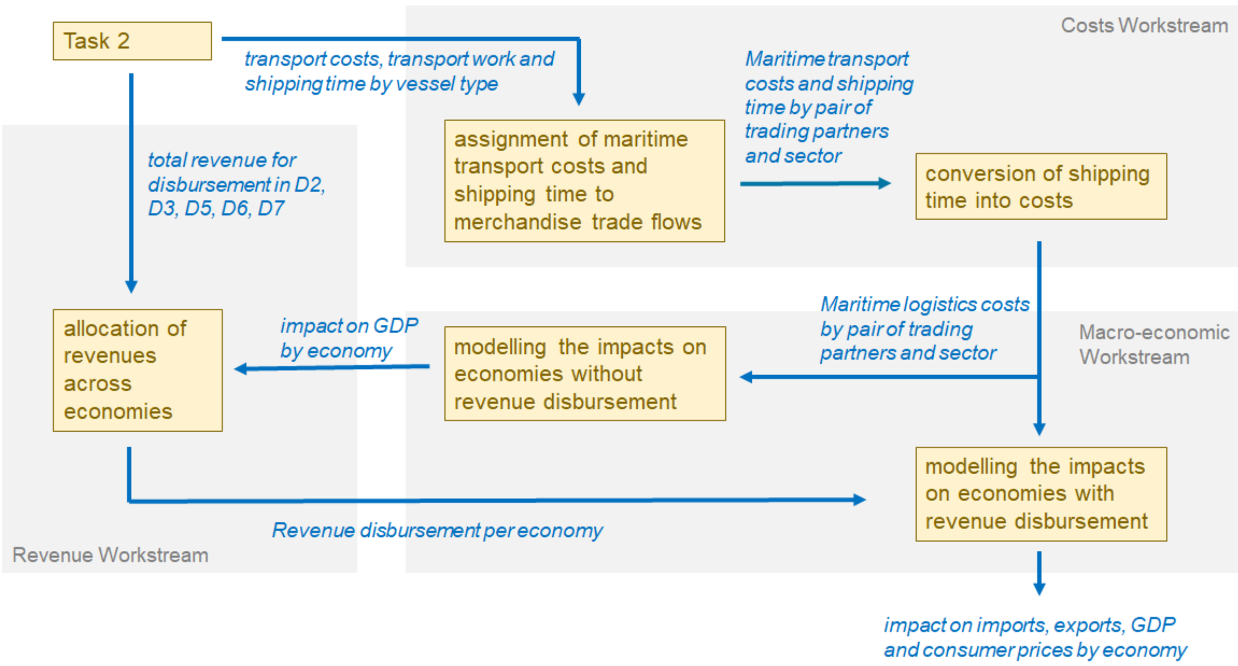
As it is not possible to cover with sufficient amount of detail all scenarios in this executive summary, a selection of scenarios is presented to illustrate different policy options. These illustrations do not imply any judgment by UNCTAD about preferences or priorities.

Furthermore, the interpretation of the GTAP modelling results presented in this report, should be interpreted while taking into account the main assumptions and limitations that were identified, including the assumptions of fixed structure of economies and instantaneous revenue distribution and benefits in the GTAP, among others.

Methodology

The impacts of the policy measures on GDP, imports, exports and consumer prices, were modelled in accordance with Circ.885/Rev.1, specifically paragraph 18 “the assessment of impacts on States consists in translating the impacts on fleet to impacts on States (e.g. trade and GDP changes)". As specified, the modelling incorporates both a computational general equilibrium model, and transport/logistics modelling with the structure as follows (Figure 1).

Figure 1. Main modelling steps and data flows



The *Costs Workstream* (see Figure 1) uses the data on maritime transport costs, shipping time and transport work compiled under Task 2 and combines them with Marine Benchmark data on individual ship voyages and MDS Transmodal data on bilateral merchandise trade. The aim was to compile mean maritime transport costs and shipping time per metric ton of traded goods, differentiated by commodity group and pair of trading partners.

Changes in shipping time are subsequently converted into their cost equivalents and added to the changes in maritime transport costs. Maritime transport costs and the cost equivalent of shipping time are then combined to generate one single variable measuring the change in maritime logistics costs. This variable is fed into the *Macro-economic Workstream* to simulate impacts on economies' total imports and exports, GDP and consumer prices. The *Macro-economic Workstream* used the GTAP (Global Trade Analysis Project) model, a widely used computational general equilibrium (CGE) model designed to analyse international trade policies and their economic impacts.

For certain scenarios that lead to the accumulation of revenues, the *Revenue Workstream* was run. Revenues remaining after rewarding eligible fuels were allocated to eligible countries according to the magnitude of the negative impacts (reductions in GDP relative to BAULG) of the measures without revenue disbursement and taking into account the income per capita. Three disbursement scenarios distinguished three groups of eligible countries: all countries; all developing countries; and, exclusively, SIDS and LDCs.

Under the *Cost Workstream* that focused on shipping costs and time, available data allowed UNCTAD to present results for 175 economies. Under the GTAP modelling, available data and computational constraints required UNCTAD to group some economies into aggregates, mostly regional groupings, reporting results for 111 economies and groups of economies.

The above actions set out under the various work streams are executed for every selected policy scenario (Table 1), and, where applicable, taking into account the three different revenue disbursement schemes and one control case, for each of the following time horizons: 2030, 2040 and 2050. Throughout the analysis, in line with Task 2, impacts on monetary values are measured as percentage changes in constant prices.

Limitations

Given the tight project timelines, the modelling work that simulated the impact on States, under a range of policy scenarios, was only feasible by making several assumptions and simplifications. The policy scenarios are conceptual and not based on, or representing, specific proposals that have been made for IMO mid-term measures.

Several limitations characterize the methods that have been described above. Many of these limitations are common to all scenarios and should have a minimal consequence on the comparative analysis of scenarios. However, some are specific to how a given scenario has been modelled – particularly in relation to how scenarios with revenues are modelled. It is therefore critical to bear in mind some of the underlying limitations when using the results of the present impact assessment for any further purposes.

Forecasting uncertainty affects the time trends in the target variables, which increase over time. Hence, within the present report, these target variables are not displayed in great detail. The GTAP simulations use a static approach, making the assessment of impact methodologically independent from time trends. Even if future actual values differ from projections, the relative impact of GHG reduction measures remains unaffected by forecast errors. The focus is on impacts rather than changes in absolute values over time, with most tables showing relative impacts compared to BAULG, rather than comparing time trends under different scenarios. It is still useful to set the impact in perspective with the trend over time, as GDP may be negatively impacted by GHG reduction measures but still show growth.

Given the significant differences between the world economies and taking into account relevant literature, in its analysis, UNCTAD divided the shock equally between importers and exporters, allocating 50 per cent of the shock from the increase in maritime logistics costs to axs (exports) and 50 per cent to ams (imports) (see Section 4.6.1 for more information regarding the methodology). The 50/50 modelling approach strikes a balance between these impacts. Therefore, there is a possibility that the impacts have been either overestimated or underestimated. A sensitivity analysis conducted to ensure scientific conference, indicates the possible magnitude of the impact.

The transport costs database used in GTAP 11 employs estimated modal shares, calculated based on the fractional share of the transport margin attributable to air, maritime, and other transport modes. This can lead to some inconsistencies in maritime transport costs and modal share data, especially for economies with poor or unavailable trade data.

DNV modelling work under Task 2 incorporates an exogenous projection of maritime transport demand from the 4th IMO GHG Study. The BAULG scenario projects the changes in maritime transport costs based on DNV's modelling and serves as a benchmark in the GTAP model. In the GTAP model, transport costs are determined by the interaction between transport supply and demand, with demand changing in proportion to commodities being transported from one country to another. Therefore, the current assessment not only allows for the analysis of changes in transport demand and supply at the detailed commodity- and partner-specific levels, but also at the global level. In turn, changes in route specific as well as global transport demand and supply affect maritime logistics costs and revenue.

The GTAP model does not reflect potential technological change, for example, the impact of climate change mitigation efforts taking place outside of the maritime sector, or other potential changes that result from developments such as climate change or geopolitical changes. This assumption is neither optimistic nor conservative, as economies could grow faster or slower than assumed. Climate-vulnerable economies might experience lower growth, making them more susceptible to higher maritime logistics costs and rendering the estimates optimistic.

The model simulations only consider changes in maritime transport costs, excluding potential modal shifts to alternatives like air or land transport, leading to conservative impact estimates. This is appropriate since reliable economic estimates of modal shifts are limited, with such estimates being typically not significantly different from zero and implying limited scope to substitute against maritime transport services. It also excludes secondary impacts on emissions from international shipping and the wider economy. The assumption that all sectors will reduce their GHG emissions by 2050 implies that secondary impacts on emissions will not be significant. However, if not all other sectors reduce their GHG and significant shifts in transport demand to more GHG intensive modes (e.g. aviation) or less GHG intensive modes (e.g. electrified rail and road) take place, then the implications of this assumption can be significant.

As GTAP is solved in each time-step as a static model, to find an equilibrium it must disburse all the revenues to economies within each time step. Therefore, instantaneous distribution is assumed with benefits from revenue disbursement to economies accruing instantaneously in the time-step. In practice, it is conceivable that revenue distribution could lag the process of collection, given the various models or administrative steps associated with distribution.

Revenues generated under Task 2 are aggregated and distributed to households in GTAP, thereby stimulating economic activity without specific sectoral allocation. The model does not distinguish between in-sector and out-of-sector revenue use, this likely leads to an overestimation of the benefits compared to more constrained revenue uses.

Aggregations can introduce bias in the results, potentially inaccurately representing the unique economic characteristics of individual economies. There is also an additional consequence in the reliability of results for certain economies. For aggregated economies, individual impacts are estimated but as a disaggregation of the GTAP output. This limitation means that if an economy is well represented by the aggregation, obtaining its results in this way should be reliable. However, if the economy's circumstances differ significantly, then the disaggregated result is more likely to be less reliable. This is particularly important when interpreting the impacts for SIDS and LDCs, as these economies are more likely to be aggregated within the GTAP model.

One of the key inputs to the Task 3 modelling is the cost intensity data relating to the impacts on fleets of different scenarios. These are subject to uncertainties in several key assumptions e.g. relating to future projections of technology cost, fuel/energy prices, investment decision making etc. Because the variations in the maritime logistics costs between scenarios in Task 3 are significantly driven by these inputs, the limitations and Quality Assurance/Quality Control associated with Task 2, should also be considered when interpreting the results of Task 3, particularly the comparisons between scenarios.

This modelling does not consider the implications of any other future national or international GHG reduction or air pollution measures.

Impacts

Impacts on maritime logistics costs

Globally, the effects of policy measures on maritime logistics costs (the sum of transport costs and time costs converted into monetary equivalents), in constant prices, are estimated to increase over time.

By 2050, these costs are expected to rise and range between 34.7 and 36.8 per cent across the different scenarios analysed compared to BAULG, irrespective of the GHG emissions trajectory or the policy scenario. This aligns with Task 2 findings, where cost components were comparable across all scenarios in the long run. The increase in maritime logistics costs occurs earlier and more strongly in higher-levy scenarios than in lower-levy scenarios. For the non-levy scenario, the increase is slower by 2030, increasing significantly by 2050 to approximately the same levels with the levy scenarios.

In the short run, to 2030, scenarios with higher GHG price as well as a GFI requirement (scenarios 26 and 46) increase by the highest amounts (19.1 per cent higher than BAULG in scenario 46 and 15.8 per cent higher than BAULG in scenario 26). In contrast, under the lower-levy scenarios 32 (WtW GFI scope) and 31 (TtW GFI scope with sustainability criteria), the increase is simulated to be 7.3 per cent and 6.4 per cent, respectively. This is similar to the increase in maritime logistics costs in the scenarios that do not include a levy, namely scenarios 23 and 24 which see an increase of 6.32 and 5.78, respectively. Of all scenarios, scenario 24 has the lowest short run increase in maritime logistics costs.

In the long run, to 2050, the increase in maritime logistics costs for the base GHG reduction trajectory is consistently lower in scenarios that include a levy as well as a GFI requirement.

The relative size of maritime logistics cost increases across scenarios are both consistent with, and explained by, the findings of Task 2. For example, bearing in mind the cost intensities in Task 2, differences in maritime logistics costs can arise from both the increase in maritime transport costs (which can differ depending on fuel/energy and energy efficiency incentivisation that vary across the different policy scenarios) as well as the differences in ship speed (shipping time costs). Scenarios which have higher speeds have lower shipping time costs and vice versa.

Developing economies and LDCs are simulated to experience, on average, relatively higher impacts on the maritime logistics costs of their imports. LDCs are simulated to face higher impacts on the maritime logistics costs of their exports relative to the developing economies, developed economies, and SIDS.

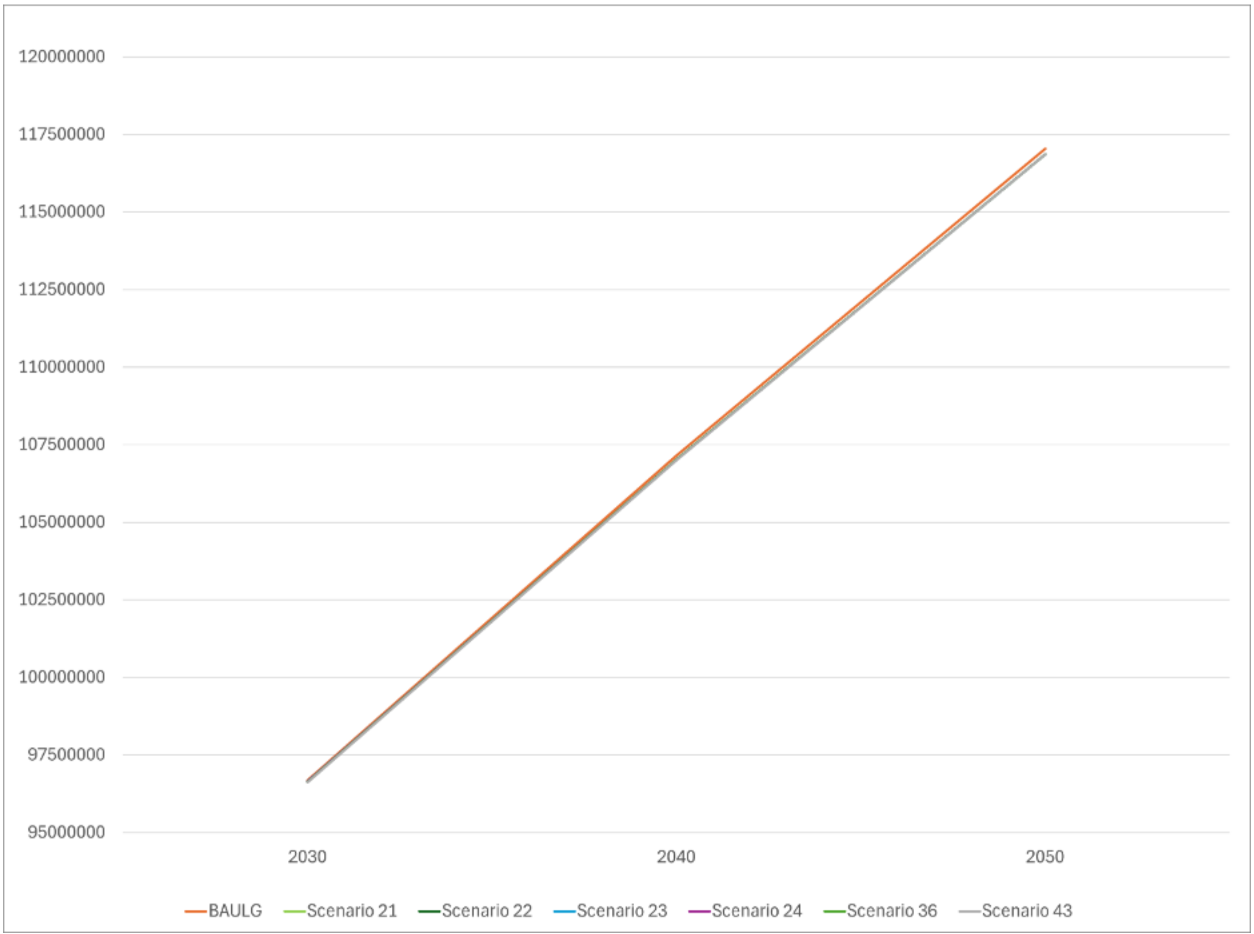
Impacts on gross domestic product

At global level, all modelled scenarios consistently result in a reduction in GDP compared to BAULG, i.e. the impact is negative. In the long run (2050), the impact on GDP varies from -0.08 to -0.16 per cent, depending on the scenario. Scenarios with a levy and revenue distribution in combination with a GFI requirement result in the smallest impact (-0.08 to -0.14 per cent) on the world GDP compared to the BAULG. All scenarios without a levy and revenue distribution have similar long-run impacts on GDP ranging from -0.15 to -0.16 per cent compared to BAULG.

Figure 2 presents the development of real GDP under BAULG and a subset of scenarios, including scenario 22. By 2050, the results of scenario 22 show the largest impact (-0.16 per cent) on the world real GDP compared with GDP under the BAULG.

Figure 2. World real GDP values in different scenarios

(Millions of dollars in 2017 prices)



Note: The GDP value in 2017 is based on GTAP data base. The BAULG have been based on the forecasts by the International Institute for Applied Systems Analysis (IIASA), SSP2, released in January 2024, combined with the development of transport margins as recorded in BAULG. Values are in constant 2017 US dollars. These values do not represent an economic projection by UNCTAD or any of the authors and were used solely to model the impact in GTAP.

Table 2 presents results for all scenarios showing both the short run (2030) GDP impacts and the long run (2050) impacts. Results are presented for all four variations of revenue distribution, including no revenue distribution.

In the short run (2030), impacts on the world GDP vary between -0.03 to -0.07 per cent with reference to BAULG, depending on the scenario. Scenarios with a GFI requirement in combination with a high levy price and revenue disbursement have larger impact in the short run, particularly if also under a Strive scenario (scenario 46). In the long run (2050), GDP impacts vary between –0.08 to –0.16 per cent with reference to BAULG, depending on the scenario.

The difference in absolute GDP between BAULG and the lowest and highest GDP impact scenarios varies between US$ 95.9 billion (of 2017) for Scenario 26 (revenues disbursed only to SIDS and LDCs), and US$ 188.6 billion (of 2017) for Scenario 22.[2]

These results also show that in the scenarios with a GFI requirement combining a low levy price (scenarios 31 and 32), the impact on real GDP, in the short run, can be similar to other scenarios, even when there is no revenue distribution. In the long run (2050) scenarios that envisage a levy have a smaller impact.

These findings are consistent with and explained by the differences in maritime logistics costs that have been observed between scenarios. This, in turn, is consistent with and explained by Task 2 results. The findings are novel and may at first seem to differ from other literature. For example, key references in the existing literature (e.g. Sheng et al (2018), Pereda et al. (2023)) have focused on understanding GDP impacts that occur due to carbon pricing relative to a BAU scenario, but have not considered the relative impacts of carbon pricing compared to a fuel standard or any other measure achieving an equivalent GHG reduction trajectory as is studied in the present report.

Table 2. Summary table of key GDP impacts (world aggregate only)[3]

Policy scenario	Levy	Revenue disburse-ment	Group of beneficiary economies	Feebate	GFI Flexibility	GFI scope	GDP impact by 2050 (world) compared to BAULG	GDP impact by 2030 (world) compared to BAULG
21	No	No	None	No	No	TtW	-0.16%	-0.04%
22	No	No	None	No	No	WtW	-0.16%	-0.04%
23	No	No	None	No	Yes	TtW	-0.16%	-0.04%
24	No	No	None	No	Yes	WtW	-0.16%	-0.03%
26	Yes	No	None	No	No	WtW	-0.15%	-0.08%
	Yes	Yes	All economies	No	No	WtW	-0.09%	-0.05%
	Yes	Yes	Developing economies, LDCs, SIDS	No	No	WtW	-0.09%	-0.05%

[2] According to the United States Bureau of Labor Statistics, US$ 1 in 2017 is equivalent to US$ 1.28 in 2024 (US Bureau of Labor Statistics, 2024). Therefore, extrapolating to 2024 US$, the net impact would range between US$ 122.7 billion and US$ 241.4 billion.
[3]Table 2 presents aggregated results, with impacts weighted according to each economy's share in the world GDP. In contrast, Figure 3 shows results for all economies, where the median and mean displayed are unweighted, meaning each economy is given equal weight. The differences arise because some larger economies, which carry more weight in Table 2, tend to experience relatively lower impacts or a smaller reduction in real GDP. For this reason, it is important to look at both sets of results when interpretating the findings relating to impacts.

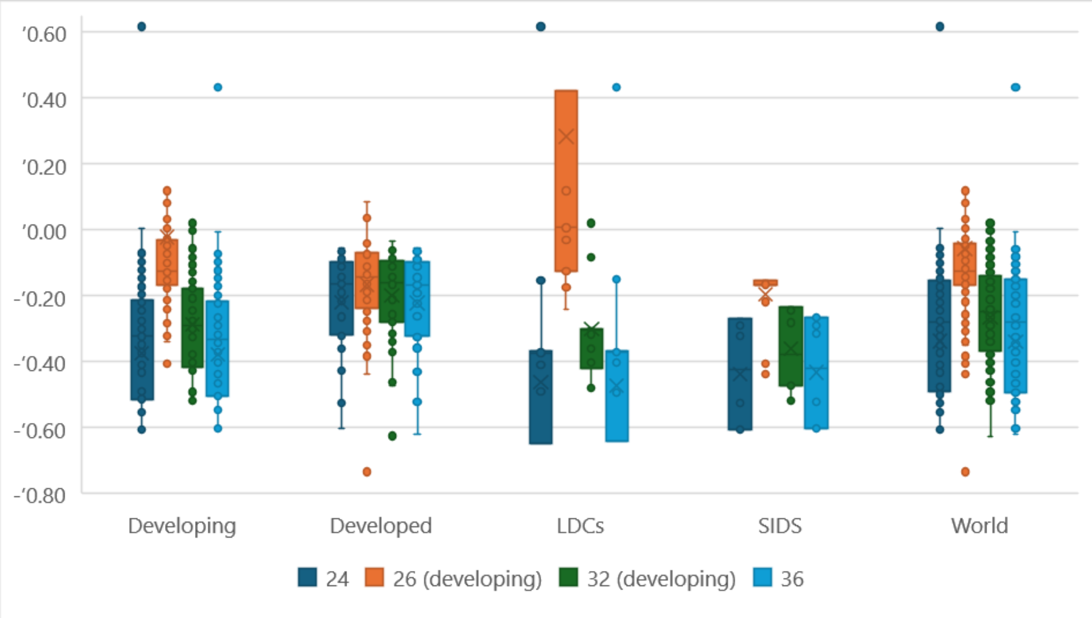
Policy scenario	Levy	Revenue disburse-ment	Group of beneficiary economies	Feebate	GFI Flexibility	GFI scope	GDP impact by 2050 (world) compared to BAULG	GDP impact by 2030 (world) compared to BAULG
	Yes	Yes	LDCs, SIDS	No	No	WtW	-0.08%	-0.05%
31	Yes	No	None	No	Yes	TtW	-0.15%	-0.04%
	Yes	Yes	All economies	No	Yes	TtW	-0.14%	-0.03%
	Yes	Yes	Developing economies, LDCs, SIDS	No	Yes	TtW	-0.14%	-0.03%
	Yes	Yes	LDCs, SIDS	No	Yes	TtW	-0.14%	-0.03%
32	Yes	No	None	No	Yes	WtW	-0.15%	-0.04%
	Yes	Yes	All economies	No	Yes	WtW	-0.14%	-0.04%
	Yes	Yes	Developing economies, LDCs, SIDS	No	Yes	WtW	-0.14%	-0.04%
	Yes	Yes	LDCs, SIDS	No	Yes	WtW	-0.14%	-0.04%
36	No	No	None	Yes	Yes	WtW	-0.16%	-0.04%
43	No	No	None	No	Yes	TtW	-0.16%	-0.04%
46	Yes	No	None	No	No	WtW	-0.15%	-0.10%
	Yes	Yes	All economies	No	No	WtW	-0.11%	-0.07%
	Yes	Yes	Developing economies, LDCs, SIDS	No	No	WtW	-0.11%	-0.07%
	Yes	Yes	LDCs, SIDS	No	No	WtW	-0.10%	-0.07%

The modelling of impacts on economies and groups of economies indicates that there is significant variation between different groups of economies. In every scenario and for each of the years under consideration, namely 2030, 2040 and 2050, the developing group of economies sees a larger impact on its GDP compared to the group of developed economies. In many scenarios, LDCs and SIDS see the largest impact on their GDP compared to all other groups of economies. However, in scenarios with a GFI requirement and a levy, particularly in those with a higher levy price, or when revenues are disbursed to SIDS and LDCs only, SIDS and LDC groups of economies experience smaller impacts on their respective GDP compared to the other groups of economies (e.g. developed and developing).

Figure 3 shows the variation in the impact on the real GDP of individual economies across the different economy groupings, in the long run (2050), relative to the BAULG. For illustration purposes, four scenarios are presented, including two scenarios which combine a levy with a GFI requirement (scenarios 26 and 32). For both these scenarios, results are shown only for the case in which revenues are disbursed to all developing economies (including SIDS and LDCs). The four scenarios are comparable in that they all assume the Base emissions trajectory and use the WtW GFI scope. These variations reflect whether they include a GFI requirement with a flexibility mechanism (scenarios 24 and 32), a levy in combination with a GFI requirement (at high price in scenario 26 and low price in scenario 32), a GFI requirement in combination with a flexibility mechanism and a feebate mechanism.

Figure 3. Real GDP impact in 2050 by economy, sample of four scenarios

(Percentage difference to BAULG)



Note: Scenarios 26 and 32 are combined with revenue distribution. For the purposes of this illustration, the option of revenue distribution to developing economies was considered. For the underlying data, see Annex 4, Annex 8, Annex 11 and Annex 13.

The patterns in Figure 3 confirm the general findings about the impact of the aggregate results, in particular that in scenarios that do not include a levy, developed economies see the smallest impact on their GDP while LDCs and SIDS experience the largest impact. However, they also show that, for scenarios that include a levy and a GFI requirement (scenarios 26 and, to a more limited extent, 32), relatively smaller impacts on GDP –sometimes even increases in GDP compared to the BAULG– are seen in the case of LDCs, relative to scenarios 24 or 36. The results also show that for both the world and all groups of economies, the impacts on GDP are relatively smaller in the scenario with the higher levy price (scenario 26), even when revenues are allocated only to developing economies.

Impacts on trade

By 2050, the impact on global import volumes ranges between -0.23 per cent and -0.97 per cent compared to the BAULG. The largest impact on import volumes occurs in scenario 26. By 2030, impacts range from -0.05 per cent to -0.51 per cent. Scenarios with levies show more variable patterns; LDCs often see increases in import volumes compared to BAULG, while developed economies and SIDS see reductions compared to BAULG.

A reduction in export volumes is observed across most scenarios by 2050, with reductions reaching up to 36 per cent in the case of LDCs, relative to BAULG. The exceptions were scenarios 26 and 46, in which revenues are disbursed to SIDS and LDCs only. These lead to slightly positive effects (up to 0.08 per cent) on the developed economies' total export volumes. By 2030, scenarios without levies, generally show a reduction in export volumes relative to BAULG, across the various groups of economies, except for SIDS which see small increases ranging from 0.02 per cent to 0.03 per cent. Scenarios with levies show inconsistent patterns, with some leading to increases in SIDS' export volumes.

The impact on the price and the quantity of the agricultural products imported is of relevance for food security. It should be noted that food security entails more than one dimension. These include the availability of food which is determined by factors such as the level of food production, stock levels and trade. Economic and physical access to food is another dimension of food security and is determined by factors such as markets, prices and transportation. Meanwhile, food utilization is related to factors such as energy and nutrient intake by individuals. The stability of these three dimensions over time is also a dimension of food security. In this context, the impact on the quantity of agricultural products imported and their prices simulated in the present assessment report provides some insights into the food availability and access. However, the assessed impact on agricultural product trade volumes and prices provides a partial view as to the potential implications for food security as it does not reflect all the dimensions of food security (e.g., food utilization and stability) nor cover all the food related items and products that contribute to improving food security. This is because while agricultural products are key for food security, other food items and products are also important and are carried in containers (e.g. processed food items, equipment used in agricultural production or food processing) as well as raw material (e.g. fertilisers). These products are not captured by the heading "agricultural products".

Under most policy scenarios, the world mean CIF price of agricultural product imports increase by up to 2.5 per cent by 2050 relative to BAULG in response to the GHG measure in individual economies. In some extreme cases, the rise in import prices of agricultural products in some economies reaches more than 10.0 per cent relative to BAULG when revenues are disbursed to SIDS and LDCs only. The reduction in the quantity of agricultural product imports is simulated to reach up to 6.2 per cent in 2050, relative to BAULG except in a few outlying cases, depending on the policy combination.

Impacts on consumer prices

Nearly all policy scenarios modelled lead to increases in the consumer price index (CPI) relative to the BAULG for the years considered (2030, 2040, and 2050) and across all groups of economies. By 2050, the global CPI is simulated to rise between 0.20 per cent (scenarios 21, 22, 23, 24, 36 and 43) and 0.39 per cent (scenario 26 with revenues disbursed to all economies) compared to the BAULG. In the short run (2030), CPI changes in percentage terms vary across scenarios. Under scenarios that combine a GFI requirement with higher-levy prices with a Strive GHG emissions trajectory (scenario 46), global CPI increases by 0.13 per cent. Under a Base GHG emissions trajectory (scenario 26), the global CPI increases by 0.11 per cent. Scenarios which combine a GFI requirement with a lower GHG price, show a CPI increase of 0.06 per cent under scenario 32 and 0.05 per cent under scenario 31, relative to BAULG.

LDCs experience the largest CPI increases. Revenue disbursement roughly doubles the CPI increase globally compared to scenarios without revenue disbursement. With revenue disbursement, recipient economies have more revenues to spend for consumption thereby increasing demand and driving consumer prices higher. This complements the effect that increased prices also reflect a higher cost environment resulting from the increased maritime logistics costs.

Developed economies see a reduction in their consumer prices resulting from revenue disbursement (even when revenue is not disbursed to developed economies). To some extent, this offsets the effect of the increased maritime logistics costs, unlike developing economies, SIDS, and LDCs, where revenue disbursement adds to the consumer price increase.

Sensitivities to different policy parameters

Sensitivity analysis undertaken by comparing the results of scenarios in which only one parameter is varied, reveals that long-term impacts on world GDP are comparable for both the TtW and WtW scenarios. By 2050, WtW scenarios see relatively larger impacts on GDP. Short-term impacts (by 2030) are also comparable for the TtW and WtW scenarios. Long-term (by 2050) impacts are not consistently larger under the Strive scenarios compared to Base scenarios as both trajectories include the ambition to reach net-zero GHG emissions by or around 2050. Some Strive scenarios show larger impacts on GDP, while others show smaller impacts. Short-term impacts by 2030 are larger under the Strive scenarios.

Introducing flexibility mechanisms leads to similar smaller impacts (-0.16 per cent in scenario 23 and 24) on global GDP in the long-run (2050) compared to comparable no-flexibility scenarios (-0.16 per cent reduction in scenario 21 and 22). However, introducing flexibility mechanisms can lead to relatively larger impacts on the world GDP in the short run (2030) (-0.03 per cent in scenario 24 which includes a flexibility mechanism, compared with -0.04 per cent in comparable scenario 22 which does not include a flexibility mechanism). Including a feebate mechanism leads to a smaller difference in impact in long-run world GDP compared to scenarios without feebate.

Scenarios which include a levy in combination with a GFI requirement have consistently smaller GDP impacts in the long run (2050) compared to scenarios with a GFI requirement but without a levy. In the short run (2030), the impact on the world GDP can be larger under the Strive scenario with higher GHG price (scenario 46). Differences in GDP impacts on States also occur when revenues generated from a levy scenario are distributed to different groups of economies (modelled as three different variations of scenarios 26, 31, 32 and 46). For example, when revenues are distributed to all economies, or developing economies, including SIDS and LDCs, the simulated impacts on the world GDP as well as the GDP of developed and developing economies and SIDS, are comparable. When revenues are distributed only to SIDS and LDCs, the reductions in GDP relative to the BAULG are smaller or the increases in real GDP relative to the BAULG are larger compared to when revenues are distributed to a larger group of economies (all economies or developing economies including SIDS and LDCs).

Results across all scenarios show that LDCs are experiencing larger sensitivity to differences in revenue disbursement specifications. In some scenarios (scenarios 26 and 46, LDCs experience positive impacts, *i.e.* GDP increases relative to the BAULG. In other revenue distribution scenarios (variants of scenarios 31 and 32), LDCs see smaller negative impacts on GDP (-0.1 per cent to -0.32 per cent reductions relative to the BAULG), when compared with scenarios that include a GFI requirement without a levy (scenarios 21, 22, 23, 24, 36 and 43).

In sum, the assessment reveals that GHG reduction measures have an adverse effect on global GDP, import and export volumes, and global CPI. These impacts vary in their magnitude across scenarios and timelines depending on whether levies, flexibility mechanisms, and revenue disbursement schemes are included or not. Results relating to scenarios with a GFI requirement and higher levy prices have shown that some negative impacts on the world GDP could be reduced/offset by revenue distribution schemes to some extent.

1 Introduction

This report sets out the main findings of the modelling work and analytical assessment conducted by UNCTAD in compliance with the terms of reference relating to Task 3 on the Assessment of Impact on States of the IMO Revised Work Plan for the Conduct of the Comprehensive Impact Assessment of the Basket of Candidate Mid-Term Measures.

The present report, together with attached data files, constitute the main deliverable of Task 3 of the Assessment. As indicated under the above-mentioned IMO Revised Work Plan and the Terms of Reference under Task 3, the main output is the undertaking of "an analysis of the impacts on States, including in terms of countries' trade, GDP change and end consumer prices, of various technically possible combinations of a goal-based marine fuel standard and forms of maritime GHG pricing mechanism on the values and ranges for scenario development identified by the Steering Committee".

The report features the main results of the modelling work conducted as part of Step 2 of Task 3.

This report is structured as follows:

- Section 2 presents the underlying modelling work, related main assumptions and limitations.
- Section 3 introduces and describes the scenarios modelled.
- Section 4 explains the applied methodologies.
- Section 5 presents the impacts on maritime transport costs, shipping times and maritime logistics costs.
- Section 6 sets out the main results of the macro-economic assessment and relays the impacts on States' gross domestic product, trade (imports and exports) and consumer prices.
- Section 7 synthesizes and discusses the results.
- Annexes that include 14 tables featuring the simulated impacts on State's GDP.
- Additional tables presenting the simulated impacts on maritime transport, time and logistics costs, imports, exports and prices. The monetary inflows and outflows are provided separately in xls format.

2 Limitations of the analysis

2.1 Main assumptions and limitations

Modelling work under this project involving a range of policy scenarios, a high level of complexity and tight timelines, required making a number of assumptions and decisions about what to include in the model. The main assumptions and limitations are introduced below.

Time trends in the target variables – These are, as implied in the BAULG, affected by a forecasting uncertainty which increases over time. Time trends in target variables have therefore not been displayed in detail in the present report. As the simulations in GTAP follow a static approach, the assessment of the impact is methodologically independent from time trends. Even if the actual value in the future will be different from the forecast, based on the BAULG, the relative impact of the GHG reduction measures will not necessarily be affected by that forecast error. The primary focus of this assessment is on the impacts not on changes over time. For example, the absolute size of an economy's real GDP (including its evolution over time) is not of primary concern for understanding the impacts. Therefore, most tables presented in this report show relative impact with reference to the BAULG, rather than comparing time trends under different scenarios. That said, it is useful to set the impact in perspective to the trend over time, as shown in Figure 2 and Figure 12. Put differently, GDP may be impacted by the GHG reduction measures but still show considerable growth over time.

Modelling maritime logistics costs – Cost and time changes of passenger transport and fishery are not considered.

Uncertainty as to how costs will be felt by an economy – It is not possible to determine precisely which share of the maritime logistics cost increases will fall on the importer or the exporter. Given the significant differences between world economies and taking into account the relevant literature, UNCTAD divided the shock equally between importers and exporters, allocating 50 per cent of the shock from the increase in maritime logistics costs to the variable axs (for exports) and 50 per cent to the variable ams (for imports) (see Section 4.6.1 for the methodology).

In GTAP, policy specifications are represented as shocks, depicted as changes in initial conditions to observe how the model responds and finds a new equilibrium. However, the model outputs are sensitive to the specification of these shocks and how they are applied through the axs and ams variables. The variable axs will have a stronger impact on trade, while ams will have a stronger impact on GDP and consumer prices. The 50/50 modelling approach strikes a balance between these impacts. Therefore, there is a possibility that the impacts have been either overestimated or underestimated. A sensitivity analysis conducted for a scientific conference,[4] indicates the possible magnitude of the impact. Export changes in 2030 varied about 8 per cent

[4] https://www.gtap.agecon.purdue.edu/events/Conferences/2024/index.aspx

from the 50/50 modelling when using only axs or only ams, i.e., a change of -0.23 could be about -0.21 or -0.25. The sensitivity of the GDP change was less pronounced.

Transport costs database used in GTAP 11 – This model uses modal shares estimated by Nuno-Ledesma and Villoria (2019). The modal shares data in GTAP are calculated based on fractional share of the transport margin attributable to air, water, and other shipping modes. This implies that economies which trade data are poor or not available during the estimation process such as SIDS may have inconsistent maritime transport costs and modal share data. One implication of this limitation is that impacts on these economies might be underestimated or overestimated.

Exogenous transport demand – The modelling under Task 2 by DNV incorporates an exogenous projection of maritime transport demand (taken from the 4th IMO GHG Study). In the present assessment of the effects of the GHG reduction measures on maritime logistics costs, the BAULG scenario projects the changes in maritime transport costs based on DNV modelling work and serves as a benchmark in the GTAP model. In the GTAP model, transport costs are determined by the interaction between transport supply and demand, with the demand changing in proportion to commodities being transported from one country to another Therefore, the current facilitates analyses of changes in transport demand and supply at the detailed commodity- and partner-specific levels as well as at the global level. In turn, changes in route-specific and global transport demand and supply affect maritime logistics costs and revenue. The model may however not entirely capture the impact on maritime transport demand, particularly that stemming from changes in technology, which may have repercussions on maritime logistics costs and on revenues. These secondary or second round effects (see Section 4.1 for an explanation) have not been considered in the present assessment.

Assumed fixed structure of economies to 2050 – GTAP works by characterising each economy's structure, all the different sectors within an economy, as well as all the links to other economies. Shocks are then applied to that characterisation. The characterisation of a structure is based on empirical data (e.g. historical data). To project out to 2050, the structure of economies in the most recent year available (in this case 2017) is projected to grow over time (e.g. real GDP increases). The respective strengths of different sectors and the pattern of consumption and production within the economy is assumed to hold constant. This ensures simplicity and transparency, but it also means that many uncertainties will remain about whether the projected economic structure is representative of how any economy might actually evolve. For example, the modelling does not include the impacts of climate change, even though there is good science that indicates that these impacts will increase over the period modelled. The modelling assumes that there are no additional costs or modifications to economic characterisation/structure.

Generally, the assumption of economic structure holding constant is hard to characterize as being either optimistic or conservative. The uncertainty means that economies could grow faster or slower than it is assumed (likely to result in smaller or larger impacts respectively) and modify to structures that could be more or less susceptible to the impacts of increased transport costs. In some cases, with foresight of increases in transport costs, some economies may even choose to pre-empt the impacts of policy on international shipping and diversify or specialize to reduce susceptibility to impacts. This would likely have the consequence of reducing the impacts on those States. Whereas for economies that are more vulnerable to climatic factors irrespective of whether these fall under the developed, developing, SIDS or LDC groups of economies, and assuming no other action is taken to address the underlying vulnerability, the consequence would likely be that the estimates of impacts in this report are optimistic – that a lower growth/development consequent from climate impacts would make them more susceptible to impacts from higher maritime logistics costs.

Assumed instantaneous revenue distribution in scenarios incorporating a levy, administration costs incorporated within revenue disbursement – Four scenarios include a levy, and the modelling of their impacts includes distribution of the remainder of the revenues generated from the levy (after modelling of some of revenue usage under Task 2), and the inclusion of these revenues within the general equilibrium modelling. As GTAP is solved in each time-step as a static model, to find an equilibrium it must disburse all of the revenues to economies within each time step. This therefore assumes that there is instantaneous distribution, and that any benefits from revenue disbursement to economies accrue instantaneously in the time-step.

Lack of revenue in scenarios that generate revenues but do not include a levy – Revenues are generated in several of the scenarios that are modelled in GTAP. However, the GTAP calculation has only included the revenues in scenarios that include a levy (scenarios 26, 31, 32 and 46). In addition to these scenarios, under Task 2 modelling, revenues are also modelled in scenarios 23, 24, and 43. Table 3 includes total remaining revenues, as calculated under Task 2 (after deduction of revenues used for D4 'Reward'), over the period from 2027-2050, for both levy and non-levy scenarios, in order to show their relative orders of magnitude. By only including the remaining revenues in levy scenarios under Task 3, the aim was to keep the number of discrete GTAP runs to a manageable total computational load. It is also justified on the basis that in the non-levy scenarios the remaining revenues are small and, based on results of the different levy scenarios, can be expected to have low impacts (in relative terms) on States on an annual basis. The remaining revenues are also more uncertain in the non-levy scenarios, because they are derived from a flexibility mechanism and therefore are a function of the trading of credits within that mechanism, which is hard to model/simulate. Not including the remaining revenues for non-levy scenarios has the effect of overestimating the negative impacts of these scenarios, as the revenues are, in principle, expected to have a positive impact/benefit.

Table 3. Revenues, absolute and relative

Scenario	Total aggregate revenues, 2027–2050) (Billion $)
23	27
24	22
26	982
31	139
32	244
43	28
46	776

Modelling only the maritime transport mode/not accounting for potential modal shift – The model simulations only consider changes in maritime transport costs, excluding potential modal shifts to alternative modes like air or land transport. Modal shift could occur because increases in maritime logistics costs make it more competitive to move cargo away from shipping to an alternative mode of transport (air, or land modes). Instead, the choices are limited to continuing to use maritime transport (at a higher cost), substituting to a different supply chain, or substituting the good. Not including this potential lower cost option means that economies see higher cost impacts than if modal substitution (assuming it is cheaper) was included and was material. For example, if instead of absorbing the increased maritime logistics costs, it was more cost-effective to substitute to a different mode, the impact on an economy would be lower. It should however be noted that reliable economic estimates of modal shifts are limited, with such estimates typically not significantly different from zero thereby implying very limited scope to substitute against maritime transport services. This limitation therefore has the effect of leading to conservative results – by not including modal shift, if anything, the estimated impacts are likely to be higher than if it had been included.[5]

Not including secondary impacts on emissions from international shipping – Consistent with the assumption of exogenous transport demand, which means there is no feedback loop of results between Task 2 and Task 3, there is also no inclusion/modelling of the estimated reductions in trade volume (imports/exports) on emissions. Generally, the scenarios result in changes in trade volume (consistently the impact is a reduction in trade volume), which would indicate that this is not likely to be material.

In the scenarios where the reduction in volume of merchandise trade is greater, the emissions would likely see a stronger feedback effect, that is be reduced by a greater amount. This means that to achieve the IMO's GHG reduction targets, a less stringent package of policy measures (e.g. lower GFI stringency, or lower GHG price) would probably be needed, which in turn should result in smaller impacts on States. This limitation has the effect of making the results of the

[5] Furthermore, including a modal shift over such a long period is complex because it would require making assumptions about how costs in other transport sectors will change during the analysis period.

analysis in this report conservative – not including these secondary impacts on emissions from international shipping, if anything, the estimated impacts are likely to be higher than if they had been included.

Not including secondary impacts on emissions from the wider economy – The nature of the equilibrium modelling in GTAP is such that the changes in one sector also create changes in other sectors. If household income is not spent on purchasing services from international shipping (indirectly through the prices of imported goods), it will need to be spent in other sectors for the model to be in equilibrium. Conversely, if there is an increase in the cost of international shipping resulting in the household spending more income in this sector, then there will need to be a reduction in consumption from other sectors. Each sector has an energy and carbon intensity, and therefore regardless of the changes in emissions within the international shipping sector, there can be supplementary changes (increases/decreases) from other sectors as a result of responses in the shipping sector.

Whilst it is possible in GTAP to capture the energy/carbon intensity of other sectors and therefore quantify these secondary impacts, in practice, there would be higher uncertainty in any modelled result because of the unknown change in each sector’s carbon intensity over the period to 2050. One reference to guide this model decision is that governments have committed to reducing their GHG emissions by 2050. Bearing this in mind, rather than projecting each sector’s respective rate of carbon intensity reduction, the approach taken is to assume that all sectors will reduce their GHG emissions over the period of this impact analysis. The uncertainty of how different sectors’ carbon intensities might evolve over time makes it hard to categorically assign this as a conservative or optimistic limitation. But with the assumption that all sectors' emissions will be significantly reducing over the period to 2050, the secondary impacts on emissions from the wider economy can also be expected not to be significant.

Aggregating economies and sectors within GTAP – To make solving the GTAP model computationally possible, including for the number of complex scenarios analysed, aggregations are applied both to economies (in total 111 economies and groups of economies are modelled) and to sectors (in total 11 sectors are modelled). Aggregations can introduce bias in the results, potentially inaccurately representing the unique economic characteristics of individual economies. There is also an additional consequence in the reliability of results for certain economies. For the economies that are aggregated, the individual impacts are estimated, but as a disaggregation of the GTAP output. This limitation means that if an economy is well represented by the aggregation, obtaining its results in this way should be reliable. However, if the economy’s circumstances differ significantly, then the disaggregated result is more likely to be unreliable. This is particularly important when interpreting the impacts on SIDS and LDCs, as these economies are more likely to be aggregated.

Aggregating remaining revenues and distributing them to households – Under Task 2 analysis, a portion of revenues is already allocated to in-sector revenue use. This includes the allocation of revenues to ‘reward’ which is labelled revenue use category D4. Any remainder revenues are passed to Task 3 for modelling. To preserve equilibrium in the modelling, any revenues received by an economy in this way, are then distributed as income with no specific sectoral allocation. The effect of the income is to represent an increase in spending, which stimulates and creates positive impacts on the economy. The limitation is that different or specific actual revenue uses may have a different effect than this generalized effect on income. Constraining revenue uses in GTAP, whether to a specific sector or type of stimulus, is likely to produce a lower benefit than unconstrained allocations. Therefore, this limitation is likely to be optimistic, other variants of the assumption/decision would reduce the benefits and therefore result in smaller positive impacts of disbursement of revenues into economies. In practice, however, constraining revenue toward uses specifically related to advancing the decarbonization of international shipping would likely reduce increases in maritime logistics costs, and therefore result in smaller impacts on States of the increased maritime logistics costs.

Not discriminating between in-sector and out-of-sector revenue use – Consistent with the assumption that the impacts of revenue disbursements on an economy can be proxied by increases in household income, there is no distinction or categorisation of income as 'in-sector' or 'out of sector'. The limitation here is that if there are different responses to an economy associated with the choice of either in-sector or out-of-sector revenue use, these cannot be tested for. However, this also means that the modelling does not prejudge or presume any specific revenue uses and leaves specification of revenue use to IMO's further work and decision making. In practice, however, constraining revenue toward uses specifically related to advancing the decarbonization of international shipping would, in principle, likely reduce increases in maritime logistics costs, and therefore result in smaller impacts on States of increased maritime logistics costs.

Uncertainties and limitations related to inputs received from Task 2 – One of the key inputs into Task 3 modelling is DNV's Task 2 cost intensity data that characterizes the impacts on fleets of different scenarios. These are subject to uncertainties in several key assumptions (e.g. relating to future projections of technology, fuel/energy prices, investment decision making, etc) as well as limitations to the extent that different policy mechanisms can be characterized in models (e.g. the characterisation of how a flexibility mechanism might work). Because the variations in the maritime logistics costs between scenarios assessed under Task 3 are significantly driven by these inputs, the limitations and Quality Assurance/Quality Control (QA/QC) associated with Task 2 should also be considered when interpreting the results of Task 3, particularly the comparisons between scenarios.

Interactions with other IMO policies – While such interactions are possible**,** modelling under Task 3 does not consider the implications of any other future national or international GHG reduction or air pollution measure.

Definition of developing economies, SIDS and LDCs – There is no commonly agreed definition of developing economies. For the definition of revenue disbursement schemes to be analysed in this impact assessment, the SC agreed to use the World Banks (2024) definition of developing economies classifying economies by income classes and distinguishing between high-income, middle-income and low-income countries. Throughout this report, in accordance with the World

Bank's practice, middle- and low-income countries are considered as developing economies, and high-income countries as developed economies. For consistency, this definition is applied not only for the definition of revenue disbursement schemes but also for the aggregated presentation of simulation results about potential impacts on States.[6] This definition is intended for statistical convenience and does not necessarily express a judgement about the stage reached by a particular economy in the development process.

LDCs and SIDS have been defined based on the lists maintained by the United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries, and Small Island Developing States (UN-OHRLLS, 2024). The composition of the 2024 classification by the World Bank was maintained throughout the various time horizons analysed in this report.

2.2 Key developments and robustness improvements relative to the modelling carried out to assess short-term measures

The limitations applied in this analysis are in most cases common limitations to any computational general equilibrium modelling. Relative to the 2021 report presenting the main findings of the comprehensive impact assessment of the short-term measure, several advances have been made resulting in the improved robustness of the present approach. These include:

- Public domain and transparent model – the present impact assessment has used GTAP, a CGE with a global user base and large public domain literature, including literature on the limitations of the modelling.
- The application of shocks to represent policy – the present assessment has undertaken extensive additional review (relative to the 2021 assessment) of the way in which policy can be characterized as a shock on an economy. This included reviewing the specific method and assumptions used with the GTAP user base and expert community, to ensure that they had broad scrutiny and validation.
- The inclusion of revenues and their positive impacts in the modelling – unlike the 2021 assessment, which modelled the short-term measure (which did not involve modelling the collection and disbursement of revenues), the present assessment is simulating through modelling work both the impact of the policy measure on States across various scenarios and time horizons, as well as hypothetical revenue disbursement across various schemes in order to incorporate their impacts on States.

[6] For a comparison and discussion of development status classification applied within the United Nations system and by other international organizations, see the UNCTAD Working Paper "Development status as a measure of development" (Hoffmeister, 2020).

2.3 Quality assurance and quality control

The final Task 3 report has benefited from substantive comments provided by members of the SC and Quality Assurance/Quality Control reviewers. The method details were iteratively reviewed and discussed at the SC meetings and have been extensively evaluated by its members. Where requested, meetings were held bilaterally between UNCTAD and member States to clarify and further explain the methodology. Underlying data has been shared to the extent possible, noting the commercial sensitivity and constraints placed on some of the data that has been used.

The final results have been circulated to the SC members, with several iterations of discussions at the SC as well as comments and feedback received in connection with methods used and on key findings. However, and bearing in mind the significant time pressure associated with Task 3 there has only been a short period of time available to examine the results in more detail. Whilst many organisations have access to the GTAP model and could undertake similar studies, so far, efforts made to replicate the results have not been possible in the limited time available.

Specific steps undertaken by UNCTAD and the consulting team to ensure quality assurance include:

- All queries expressed and raised by external reviewers have been carefully considered by the UNCTAD team, and traced back to assumptions, method and data. Responses are shared in a separate file.
- A specific sensitivity GTAP model run was undertaken to test the rigour and consequence of the way the shock has been applied. The method applied to produce all reported results attributes 50 per cent of the shock to exporters (axs variable) and 50 per cent to importers (ams variable). To investigate this assumption's limitation, two additional GTAP scenarios were tested: one applying the entire shock to exporters and the other one applying it to importers. The results of the investigation show that whilst applying the entire shock to importers would result in negative GDP impacts and CPI increases that are slightly larger, applying all the shock to exporters would result in negative GDP impacts and CPI increases that are slightly smaller compared to the model results presented in this report.
- A sensitivity analysis was largely discussed at the annual scientific GTAP conference in June 2024 and has been carried out to support the modelling approach.[7]

[7] The conference webpage and programme are available at: https://www.gtap.agecon.purdue.edu/events/Conferences/2024/index.aspx

3 Scenarios modelled and analysed under Task 3

This chapter outlines the set of scenarios including the implied hypothetical revenue disbursement schemes that have been analysed under Step 2 of Task 3. The scenarios and revenue disbursement schemes were selected by the IMO SC for the purposes of the present analysis.

The selection does not imply a preference on the part of the IMO SC or UNCTAD for the implementation of the policy combinations assumed in these scenarios over those in the scenarios that have not been selected for modelling under Step 2 of Task 3. As regards the ongoing negotiations of the mid-term GHG reduction measures, the selection does not imply any differences in the status of the policy scenarios modelled and non-modelled.

As per the Revised Work Plan for the Conduct of the Comprehensive Impact Assessment of the Basket of Candidate Mid-term Measures, outputs from DNV's assessment of impacts on the fleet under Task 2, have served as input into the assessment of impacts on States under Task 3. Therefore, the policy scenarios analysed in Step 2 of Task 3 are aligned with the scenarios analysed by DNV under Task 2.

As outlined in the "UNCTAD Proposed Assessment Methods and Approach" (UNCTAD, 23 February 2024), around 20 simulation runs can be carried out within the agreed time frame, where a simulation run is specified by a given policy scenario modelled under Task 2 and, if applicable, a specific revenue disbursement method outlined in the document titled 'Working Document on Value Ranges for Scenarios'. As proposed in the UNCTAD submission of 23 February 2024, the selection of the policy scenarios modelled under Task 2 aims to enable comparisons between Base and Strive GHG emission trajectories, between different levels of cost intensities measured under Task 2, and, if applicable, between different levels of revenues generated under Task 2 modelling.[8]

Ahead of the 8th Meeting of the IMO SC (SC8), UNCTAD prepared a proposal, in consultation with the SC Moderator and DNV, setting out the policy scenarios that could be selected and analysed in Step 2 of Task 3 based on the scenarios modelled in Phase 2 of Task 2 as documented in DNV's final report (DNV 2024a). Following some discussion among SC members regarding the 10 policy scenarios featured in Table 1, it was agreed that these should be assessed and analysed by UNCTAD. Four out of the 10 scenarios include three different revenue disbursement options and one option of none-disbursement of revenues. As a result, the overall number of simulation runs was set at 22.

[8] The impact assessment defines two GHG emission trajectories to 2050: Base and Strive. The Base targets a 20 per cent reduction by 2030 and 70 per cent by 2040, compared to 2008 levels. The Strive targets a 30 per cent reduction by 2030 and 80 per cent by 2040.

Table 4. Task 2 policy scenarios selected for analysis under Step 2 of Task 3

Scenario number	Emission trajectory	Seaborne trade growth	Policy code	GFI scope	GFI flexibility		Levy		Feebate (% of gap)	Revenue disbursement modelling
					RU[1] (% of price)	SU[2] (% of price)	Levy ($/tCO₂eq)	Reward (% of gap)		
21	Base	Low	X.1	TtW	No flexibility		No levy		No feebate	-
22	Base	Low	Y.1	WtW	No flexibility		No levy		No feebate	-
23	Base	Low	X.4	TtW	120%	80%	No levy		No feebate	-
24	Base	Low	Y.4	WtW	120%	80%	No levy		No feebate	-
26	Base	Low	Y.2	WtW	No flexibility		150-300	90-65% to 2040	No feebate	Yes
31	Base	Low	X.5	TtW	120%	80%	30-120	105% to 2040	No feebate	Yes
32	Base	Low	Y.5	WtW	120%	80%	30-120	105% to 2040	No feebate	Yes
36	Base	Low	Y.6	WtW	120%	80%	No levy		105% to 2040	-
43	Strive	Low	X.4	TtW	120%	80%	No levy		No feebate	-
46	Strive	Low	Y.2	WtW	No flexibility		150-300	90-65%	No feebate	Yes

[1] Remedial unit, *i.e.* Emission units purchased by ships with negative compliance balance from the Revenue body at a set price under the GHG Fuel Intensity flexibility mechanism.
[2] Surplus unit, *i.e.* Emission units sold by ships with positive compliance balance to the Revenue body at a set price under the GHG Fuel Intensity flexibility mechanism.
Source: DNV (2024a).

All scenarios examined in Step 2 of Task 3 assume a low seaborne trade growth, thus referring to the 'business-as-usual low growth' (BAULG) scenario developed by DNV (2024a) as the baseline 'business-as-usual' (BAU) scenario. Impacts arising from the various policy scenarios are therefore compared to the BAULG scenario. However, all 10 scenarios differ with regards to the individual policy parameters:

- With regards to the basis for the GHG Fuel Intensity (GFI) requirement, four scenarios (scenarios 21, 23, 31 and 43) have a GFI requirement based on annual tank-to-wake (TtW) GHG emissions with sustainability criteria, whereas six scenarios (22, 24, 26, 32, 36 and 46) have a GFI requirement based on annual well-to-wake (WtW) GHG emissions.
- With regards to the GFI flexibility mechanism, six scenarios (scenarios 23, 24, 31, 32, 36 and 43) assume such a mechanism, whereas four scenarios (scenarios 21, 22, 26 and 43) assume no GFI flexibility mechanism. For scenarios with a GFI flexibility mechanism, the first option is for ships, with attained GFI below required GFI (positive compliance balance), to sell excess emission units. The second option is for ships with positive compliance balance to sell excess emission units (termed as Surplus Units (SU)) to a Revenue body at

a set SU price and for ships with negative compliance balance to buy deficit units (termed Remedial Units (RU)) from a Revenue Body at a set RU price.

- With regards to the adoption of a measure with a levy, two scenarios (scenarios 26 and 46) foresee a relatively higher levy, of 150 to 300 $/tCO_2eq, two (scenarios 31 and 32) a relatively lower levy, of 30 to 120 $/tCO_2eq, and the other six do not foresee any levy.
- With regards to the emissions trajectory, two scenarios (scenarios 43 and 46) are based on the Strive GHG emissions trajectory developed by DNV under Task 2. The remaining eight scenarios relate to the Base GHG emissions trajectory which was also developed by DNV.
- With regards to the feebate, one scenario (scenario 36) assumes a feebate, of 105 per cent of the cost gap until 2040, the remaining nine scenarios do not.

Comparing results from two or more scenarios can help elucidate the isolated impacts caused by changes in specific policy parameters. For example:

- Comparing outputs of scenarios 26 and 46, and outputs of scenarios 23 and 43, provides insight into the impact of Base compared to the impact of Strive GHG emissions trajectories.
- Comparing outputs of scenarios 21 and 22, scenarios 23 and 24, and scenarios 31 and 32, provides insight into the impact of using TtW or WtW for a constant GFI scope.
- Comparing outputs of scenarios 21 and 23 and outputs of scenarios 22 and 24, provides insight into the impact of allowing or not for a GFI flexibility.
- Comparing the outputs of scenarios 22 and 26, scenarios 23 and 31, and scenarios 24 and 32, provides insight into the effects of setting a levy, with each comparison maintaining a constant levy price.
- Comparing outputs of scenarios 24 and 36, provides insight into the impacts of allowing or not for a feebate mechanism.

Modelling work under Task 3 includes the modelling of impacts on States caused by both the changes in maritime logistics costs and the disbursement of hypothetical collected revenues. In the document titled “Working Document on Value Ranges for Scenarios”, the SC identified seven categories of revenue disbursement schemes differentiating between beneficiary targets. As some of the seven categories identified have, as their main or ultimate beneficiary target, the States, these five categories have been selected for related modelling work under Step 2 of Task 3.

The five categories are the following: “capacity building and negative impact mitigation” (D2), “address disproportionately negative impacts as appropriate” (D3), “general GHG mitigation and adaptation” (D5), “equitable transition” (D6) and “administration” (D7). The remaining two categories, namely “research, development and deployment (RD&D)” (D1) and “reward for eligible fuels” (D4) imply direct disbursement to the shipping sector and, therefore, a direct impact on the fleet. The effects of D1 and D4 disbursements are therefore modelled by DNV under Task 2, jointly with the modelling of the revenue generation. However, the effect of RD&D (D1) is set to zero in that modelling, due to limited knowledge available abouts its possible impact.

Scenarios 26, 31, 32 and 46 include a levy and are, therefore, expected to generate revenues to be disbursed. These scenarios have been selected at SC8 for assessing the impact of a hypothetical revenue disbursement on imports, exports, GDP and consumer prices. The SC decided that a set of three revenue disbursement schemes were to be applied. These three schemes differ on how they define the targeted beneficiary countries (Level-1 criterion) but apply equal criteria to define the amounts disbursed to individual countries (Level-2 criteria). At Level 2, population size and the percentage change of GDP caused by the policy measures have been agreed as the criteria for defining the shares disbursed to individual countries. At Level 1, the following groups of beneficiary countries have been agreed by the SC:

- All countries
- Countries classified as developing countries, SIDS or LDCs[9]
- Countries classified as SIDS or LDCs

Consequently, three simulations were run for each of the scenarios 26, 31, 32, and 46, assuming revenue disbursements as outlined in Table 5 and keeping the other parameters constant. A fourth simulation was run on an intermediate scenario in which no revenue is disbursed. The aim was to assess the pure effect caused by the increase in the maritime logistics costs in response to the candidate mid-term GHG reduction measure and to determine the revenues to be disbursed to individual countries based on Level 2 criteria. This additional scenario also enables an indicative assessment of the effect of revenue disbursement independently from the increase in maritime logistics costs in response to the GHG emission reduction measure.

Table 5. Hypothetical revenue disbursement schemes analyzed

Level-1 criterion	Level-2 criteria
All countries	Percentage change in real GDP, population size
Developing countries	Percentage change in real GDP, population size
SIDS and LDCs	Percentage change in real GDP, population size

[9] See section 2.1 for the definition of these groups.

4 Methods applied

The impacts of the policy measures on GDP, imports, exports and consumer prices, were modelled in accordance with Circ.885/Rev.1, specifically paragraph 18 "the assessment of impacts on States consists in translating the impacts on fleet to impacts on States (e.g. trade and GDP changes)". The modelling incorporates both a computational general equilibrium model, and transport/logistics modelling.

4.1 Measuring impact

In the present report, the impact of the candidate mid-term GHG reduction measures, is measured by comparing, on the one hand, the expected outcomes under a given *policy scenario*, with, on the other hand, the expected outcome under the *business-as-usual* (BAU) scenario, describing the situation where the assessed policy combination *is not* applied. The *policy scenario* describes the situation where the policy combination is applied. As mentioned above (Section 3.1), the BAU for all policy scenarios assessed under Step 2 of Task 3 is the BAULG scenario. Throughout the report, calculations are made to assess the percentage difference in the variables of interest, namely maritime transport costs, shipping time costs, maritime logistics costs, imports, exports, GDP, consumer prices, and this, between the *policy scenario* and *BAU* in 2030, 2040 and 2050.

In this analysis, the term 'impact' is used to compare outcomes under different scenarios at the same point in time. The term 'change' is used to compare outcomes under the same scenario but at different points in time. Algebraically, the relative impact on a variable (*y*) is defined as its difference between the policy scenario (*s*) and the BAU scenarios (*s*="BAU"), both in the actual year (*t*), in proportion to its value under the BAU scenario:

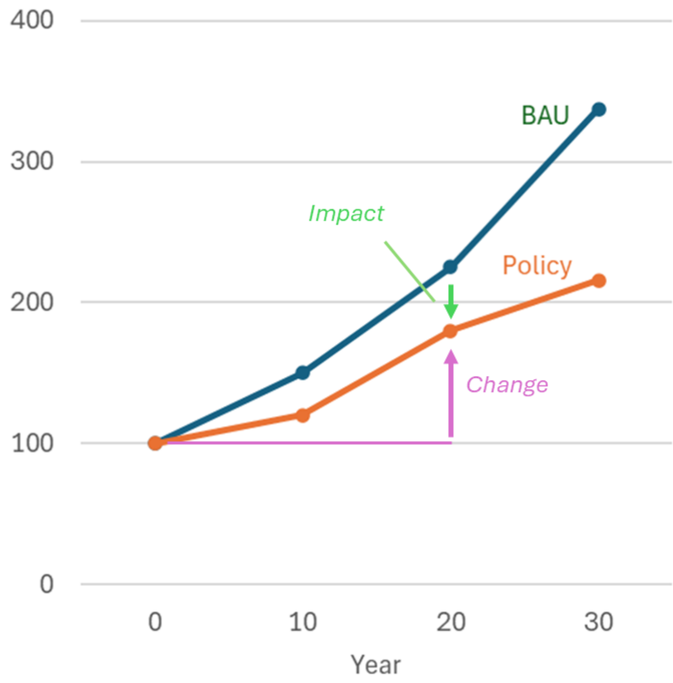
(1) $$\dot{y}_{s,t} = \frac{y_{s,t} - y_{"BAU",t}}{y_{,"BAU",t}} = \frac{y_{s,t}}{y_{"BAU",t}} - 1$$

The relative change of a variable is defined as its difference between its value in the actual year (*t*) and its value in a reference year (t_0), in proportion to the value in the reference year:

(2) $$y'_{s,t} = \frac{y_{s,t} - y_{s,t_0}}{y_{s,t_0}} = \frac{y_{s,t}}{y_{s,t_0}} - 1$$

To better illustrate these two terms, Figure 4 presents a hypothetical example in which, under the *BAU scenario*, GDP increases by 50 per cent every ten years over a period of 30 years. Under the *policy scenario,* the increase is only 20 per cent during the first and the third ten-year periods as a result of the policy measures.

Figure 4. Hypothetical example illustrating both the relative 'change' and 'impact' on GDP of a policy measure



In the example, after the first 10 years, GDP *changes* by +50 per cent under the *BAU scenario* and by only +20 per cent under the *policy scenario* due to the implemented GHG reduction measures. This results in a relative difference of 20 per cent (= (1+0.2) / (1+0.5) - 1). In this context, the relative *impact* amounts to 0.2.

After 20 years, the candidate mid-term GHG reduction measures lead to a change of 125 per cent in GDP (= (1 + 0.5) (1 + 0.5) - 1) *under the BAU* and of 80 per cent (= (1 + 0.2) (1 + 0.5) - 1) under *the policy scenario*; the relative *impact* remains 20 per cent (= (1 + 0.80) / (1 + 1.25) - 1).

While the GHG reduction measures under the *policy scenario* have an impact on real GDP after 30 years (-20 per cent in our example), it does not mean that real GDP will have decreased; rather, it will have grown (+80 per cent over the first 20 years in our example), but to a lower level than it would have under the *BAU scenario* (+125 per cent over the first 20 years). Throughout this assessment, it is the *impact* that will be reported.

4.2 Simulation strategy and framework

The first action in assessing the impact of the candidate mid-term GHG reduction measures on maritime logistics costs, is to simulate the transport cost and shipping time associated with a constant transport work performed by ships under the *BAU* and the *policy scenarios, i.e.* the scenarios where a candidate mid-term GHG reduction measure are assumed to be implemented. The transport costs and shipping times are differentiated by ship type and age as simulated by DNV under Task 2. In its analysis, UNCTAD assigns these maritime transport costs and shipping times to individual ship voyages and identifies the segment of international trade served by these ship voyages. Transport costs and shipping times are aggregated up to the level of bilateral trade flows and to the level of the commodity groups associated with the 11 economic sectors used in the GTAP simulation (see below, Section 4.6).

The second action involves converting shipping time into its cost-equivalent and adding this cost-equivalent to the maritime transport costs to obtain total maritime logistics costs. These actions are carried out within the *Cost Workstream* of the modelling framework (see figure 2).

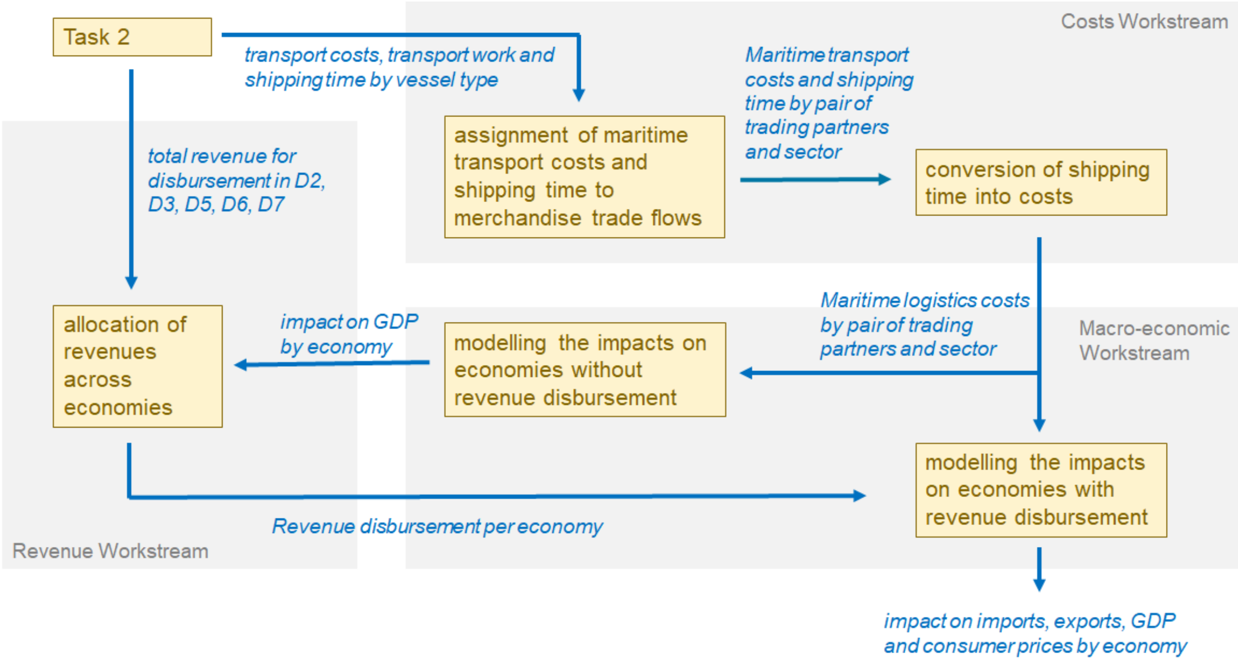
To assess the impact of the changes in maritime logistics costs on States' import and export quantities, real GDP and consumer prices, UNCTAD modifies the maritime trade costs recorded in GTAP for each bilateral trade flow by commodity group under the *baseline scenario*. The modification entails inflating the maritime trade costs with the percentage difference reflecting the impact of the policy scenario on maritime logistics costs calculated under the *Cost Workstream* mentioned above. The GTAP algorithm then compiles the imports, exports, GDP, and consumer prices of each GTAP economy in the new equilibrium, expressed as a proportion of their value under *BAULG*.

To assess the impact of revenue disbursement on imports, exports, GDP and consumer prices, UNCTAD calculates the disbursements to be allocated to the individual GTAP economies in accordance with the hypothetical revenue disbursements schemes described in Section 3.2 of this report.

As mentioned above, transport work is kept constant across scenarios in the present assessment. Therefore, the modelled impacts on maritime logistics costs and generated revenues – and likewise the impacts on emissions, modelled under Task 2 – represent the direct impacts we expect from the implementation of the different policy combinations (first-round effects), abstracting from any attempts by market actors to adjust their transport demand to the new cost structure and macro-economic environment. In theory, such adjustments can take place and in that case cause repercussions on maritime logistics costs, revenues generated, GHG emission levels as well as impact on States, thereby adding another layer of impacts (second-round effects). The measurement of these second-round or secondary effects would require a more extended modelling framework, including a re-run of Task 2 with adjusted transport demand.

Figure 5 provides an overview of the modelling framework developed to carry out the above actions which are described in further detail in the remainder of this section. In contrast to the assessment of short-term GHG reduction measures conduced in 2021, the present assessment requires two additional workstreams to generate the input data required for modelling and simulating the macro-economic impacts (Macro-economic Workstream). The *Costs Workstream* is aimed at simulating impacts on maritime logistics costs while the *Revenue Workstream* focuses on simulating the revenue disbursement. Output data generated under DNV's Task 2 are fed as input into the Costs and the Revenue workstreams. In turn, data generated under these two workstreams are fed into the *Macro-economic Workstream*.

Figure 5. Main modelling steps and data flows



The *Costs Workstream* uses the data on maritime transport costs, shipping time and transport work compiled under Task 2 and combines them with Marine Benchmark data on individual ship voyages and MDS Transmodal data on bilateral merchandise trade. The aim was to compile mean maritime transport costs and shipping time per ton of traded goods, differentiated by commodity group and pair of trading partners.

Changes in shipping time are subsequently converted into their cost equivalents and added to the changes in maritime transport costs. Maritime transport costs and the cost equivalent of shipping time are then combined to generate one single variable measuring the change in maritime logistics costs. This variable is fed into the *Macro-economic Workstream* to simulate impacts on economies' total imports and exports, GDP and consumer prices.

For scenarios that lead to the accumulation of revenues, the *Revenue Workstream* needs to be run. This workstream uses, as one input, the total revenues simulated under Task 2, after deduction of any disbursements for RD&D (D1) (for this assessment set to zero) and reward for eligible fuels (D4). This workstream also uses the results of simulation of the impact on GDP *without* revenue disbursement which was previously generated under the *Macro-economic Workstream*. The use of these results was required to determine how revenues will be allocated across targeted beneficiary economy groupings taking into account Level 1 and 2 revenue disbursement criteria outlined in Section 3.2 of this report and using as input, data on the total accumulated revenues generated under Task 2 as well as data relaying the impact on GDP without revenue disbursement. Together these elements are used to calculate revenue disbursement per country. These calculations are carried out outside of GTAP and its results are transferred to the *Macro-economic Workstream* so that the effects on economies after disbursement of revenues can be modelled in GTAP.

The above actions are executed for every selected policy scenario (Table 1), where applicable with the different revenue disbursement schemes for each of 2030, 2040 and 2050. Throughout the analysis and in line with Task 2, monetary values are measured in constant prices.

For the workstream on shipping costs and time, available data allowed UNCTAD to present results for 175 economies. For the GTAP modelling, available data required UNCTAD to group some economies into aggregates, mostly regional groupings, reporting results for 111 economies and groups of economies.

The following sections describe the various modelling stages in more detail.

4.3 Assign maritime transport costs and shipping time to merchandise trade flows

Data on transport costs per distance (in nautical miles), time (in hours) and by ship type are generated by DNV under Task 2. These data are combined with data on ship traffic as well as data on volume and value of international merchandise trade to simulate both average maritime transport costs measured in dollars per unit of cargo carried and average shipping times measured in mean time in hours at sea. To this end, Task 2 data received from DNV are combined with the following data sources:

- MDS Transmodal's World Cargo Database (WCD) that records all international trade in volume (tons) and value ($) broken down by product group – based on the Standard International Trade Classification (SITC) at 5-digit level – and estimated by mode of appearance (i.e., dry bulk, liquid bulk, gas tankers, vehicle carriers, containerized). The data used is for the reference year 2022. WCD provides a comprehensive origin-destination matrix in which commodities are classified according to their characteristics and the volumes moved between countries. These estimates have been calibrated against independent sources providing data on container movements. It is worth noting that the UN Comtrade does not provide the same level of detail compared to the WCD.
- MDS Transmodal's Global Containership Database (GCD) records the deployment of all container ships, operators, port calls, distances covered and ship parameters. This database has the advantage of linking together the different individual legs of complex liner 'strings', so that for shipping lines offering liner service calling at various maritime regions (e.g. from Europe and the Mediterranean over the Arabian Gulf and the Indian Subcontinent and the Far East, up to North America), the database provides information for each leg of the journey.
- Data on ship voyage from Marine Benchmark provides a record of all voyages of the relevant non-container ships for 2022, identified by IMO vessel numbers, the distances travelled, time and speed, as well as ports of departure and arrival and whether they were laden or in ballast.

In the case of bulk cargo, traffic designated as non-containerized within WCD on a country-by-country basis is linked to all those non-unit-load ships transporting merchandise between the same countries. Goods are allocated to different size classes of ships proportionally to their overall capacity. Traffic between landlocked economies is assigned to ships sailing from adjacent seaboard locations. In this way, a hypothetical cargo can be associated with each ship movement and thereby costed out.

In the case of unitized traffic, given that traffic is often loaded onto ships in other and adjacent countries (e.g. from the United States of America to Switzerland through ports in the Kingdom of the Netherlands, Belgium, France or Germany), cargo is consolidated into 'sub-regions' and liner services modelled based on the capacity supplied in twenty-foot equivalent unit (TEU) between each sub-region. The cost of each individual service is modelled and containerized cargo allocated proportionally to the capacity available.

Data generated under Task 2 include for each scenario and in each snapshot year, 2023, 2030, 2040 and 2050, the total values of different cost components, the total distances travelled and the total travel time by ship type and ship age. With regards to ship type, only ships associated with the transport of merchandise for international trade are considered relevant for the purposes of the present analysis. Therefore, records for the ship types "cruise", "ferry-pax", "ferry ro-pax"[10], "miscellaneous fishing", "offshore", "other service", "service tug" and "yacht" have been excluded from the data set.

Assigning maritime transport costs and shipping times to the merchandise trade flows is done according to the following sequence:

Firstly, maritime transport costs and shipping time by ship type, as recorded in the datasets from DNV, are allocated to pairs of trading partners. To determine maritime transport costs on a route and for a given year, a distinction is made between costs that are primarily dependent on time and costs that are primarily dependent on distance. Capital (C^{CAPEX}) and operational expenditure (C^{OPEX}) are primarily dependent on time; fuel costs (C^{fuel}), captured deposit expenditure[11] (C^{CDE}), and carbon regulatory expenses (C^{REI}) are primarily dependent on distance.

The average costs per hour of the time-dependent components within the ship type *i* is calculated by dividing the sum of annualized capital and annual operational expenditure in that ship type category by the number of ships (*N*) and by the number of hours in a year:

[10] Ro-pax ferries cause a challenge for our analysis, as these ferries, mostly used on short crossings, such as between Sweden and Denmark and the United Kingdom and France, transport not only passengers but also cargo. We have dealt with this complication by assuming all ro-ro freight is carried in ro-ro freight only ships, so that the cost attributed to this cargo (recorded by the matrix of trade between countries) as though all cargo was carried in freight vessels. This will lead to a slight imprecision in the calculation of costs and travel time for a specific segment of trade. Due to the limited volume per sailing, their small proportion in the fleet and the short distances they travel on average, ro-pax ferries account for only a small fraction of total ship miles globally, as the DNV data show.

[11] Carbon deposit expenditure correspond to the costs associated with permanently sequestering (storing e.g. underground) carbon or carbon dioxide captured in the exhaust.

(3) $$c_i^{Time} = \frac{c_i^{CAPEX} + c_i^{OPEX}}{365 \cdot 24 \cdot N_i}$$

The average costs per nautical mile of the distance-dependent components in fleet type *i* is calculated *by* dividing the sum of fuel costs, captured deposit expenditure and carbon regulatory expenses by the total transport distance (*A*) of ships in the fleet type *i* according to the DNV data.

(4) $$c_i^{Distance} = \frac{c_i^{fuel} + c_i^{CDE} + c_i^{REI}}{A_i}$$

c_i^{Time} is measured in dollars per hour, $c_i^{Distance}$ is measured in dollars per mile.

These two cost components are linked to the observed ship movements from the exporting economy (*o*) to the importing economy (*d*), specifically to the total shipping time (*T*) and the total transport distance. They are added up to obtain the total annual cost of maritime transport costs from *o* to *d* per ship type:

(5) $$C_{o,d,i}^{MTC} = C_i^{Time} T_{i,o,d} + C_i^{Distance} A_{i,o,d}$$

Secondly, as international merchandise trade recorded in WCD is subdivided by mode of appearance (MoA), depending on cargo type, differentiating between containers, dry bulk, liquid bulk, gas tankers and vehicle carriers, each MoA can be linked with certain ship types identified in the DNV dataset. Furthermore, the countries in WCD are grouped into 19 subregions to address the specific conditions of landlocked economies and the fact that neighbouring economies often use each other's ports. The product groups that were initially coded according to SITC, are converted into 11 commodity groups associated with the 11 sectors used in the model for the simulation in the *Macro-economic Workstream*[12], maintaining their differentiation by MoA, to allow for the fact that a given good/commodity can travel by different MoA. Correction factors are applied to adjust the data for the fact that not all container ships are represented in the MDST database as maritime transport is imperfectly covered and not all international trade is maritime.

Using the GCD, the total container shipping capacity in TEU is estimated for any inter-regional trade and differentiated by the proportion provided by each separate service.[13] It is assumed in

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[12] These sectors have been adopted from the classification of sector used in Eora (KGM and Associates, 2024), an online global supply-chain database. They comprise agriculture; fishing; mining and quarrying; food and beverages; textiles and wearing apparel; wood and paper; petroleum, chemical and non-metallic mineral products; metal products; electrical and machinery; transport equipment; and other manufacturing.

[13] A service refers to a ships deployed to any given port rotation.

this calculation that, for each rotation, capacity is used once in each direction. All liner services are modelled based on their total rotations (e.g. China to Northern Western Europe and returning to China including typically around 10 port calls). For example, for a container shipped from Shanghai to Colombo and further from Colombo to Genova, costs will effectively be attributed once.

The mean cost for container services in each region-to-region movement can therefore be established by summing up the cost of each relevant service. The so derived shipping capacity is contrasted with shipping demand, in terms of cargo volume, as sourced from WCD, for each service, with a ship size category attached, in the relevant market. By matching the DNV dataset, the cost of each service deployed through its ship size and sea miles can be simulated.

A similar approach is adopted in the case of bulk traffic, using the ship-voyage data from Marine Benchmark as the basis. Cargo sourced from the WCD and identified by MoA is allocated to the relevant ship type – for example dry bulk cargo to dry bulkers and cars to vehicle carriers – and matched with the DNV data. This allows complementing the DNV data with detailed information on port calls, arrival and departure times, port distances and whether a ship was laden or in ballast.[14] The Marine Benchmark ship movement data are analysed to determine all laden voyages between ports as well as (1) hours at sea, (2) distances covered over the total distance sailed, (3) total time required, and (4) distances covered between the discharge ports at which a ship departed and arrived laden. This ensures that the total cost in terms of both sailing time and distance travelled associated with both the ballast and laden legs as well as the time spent in port to load and discharge cargo, are all taken into account in the calculation. The time cargo has actually spent at sea is also taken into account. The cost intensities derived from the DNV data are applied to each voyage by ship type and size category. The costs in 2022 are calibrated to match DNV costs by ship type reported for 2023.

Lastly, and to establish the correct weighting by ship type and tonnage for each combination, data is summed up to the level of combinations of origin and destination economies and commodity group, as defined by the 11 sectors used in the model and while taking account of the tonnages in each of these combinations according to WCD. The final output is the cost per ton ($/ton) and the shipping time in hours per ton (hour/ton) for each bilateral trade by commodity group.

To determine the impact of the different future scenarios resulting from the application of the mid-term GHG reduction measures, as simulated by DNV under Task 2, the actions described above are repeated substituting the maritime transport costs and shipping time under the *baseline scenario*, by ship type and size group, with the ones falling under the *policy scenarios*.

Note that in this repeated process the number of ships required to carry a given volume of cargo is not separately recalculated. Instead, as previously mentioned, the additional shipping

[14] Marine Benchmark defines laden and ballast on the basis of the Intake calculated from draft. Marine Benchmark then compares Intake with its calculated ship individual maximum cargo capacity in tons and considers the ship to be loaded if exceeding 77 per cent.

capacity required is computed in the case of ships operating more slowly at sea, and the fixed operating and capital costs associated with a given voyage[15] are raised accordingly. This ensures consistency with data from DNV's Task 2.

4.4 Calculate maritime logistics costs

The work described in Section 4.3 generates estimates of maritime transport costs in $ and average shipping time at sea in hours, alongside the value in $ and volume in metric tons of trade, for each pair of trading partners and sector, under 11 scenarios (BAULG and 10 policy scenarios) at four points in time (2023, 2030, 2040, 2050).

These are used as inputs for the calculation of maritime logistics costs which, in turn, will form the input for modelling and assessing the economic impact on States of the candidate mid-term GHG reduction measures. Maritime logistics costs are defined as the total monetary costs paid by shippers to have their goods transported from origin to destination across the multimodal transport chain for international freight transport. Maritime logistics costs take into account both time costs and transport costs, which vary due to geographical and geopolitical factors, types of shipped products, market-specific factors, port- and hinterland infrastructure, and inventory requirements.

Consequently, and to calculate the maritime logistics costs, the first step required UNCTAD to calculate shipping time costs which represent the monetary value paid by shippers related to the time spent to transport goods from origin to destination. Shipping time costs are calculated by multiplying the shipping time in hours of a given commodity from origin to destination by the sector-level value-of-time (VoT) coefficients measured in $ per ton-hour under the different policy scenarios. VoT is commonly expressed as the monetary value of a unit transport time for each unit of goods transported. It can be defined as shippers' or carriers' willingness-to-pay for each reduction in time by one unit (de Jong, 2014; Zamparini & Reggiani, 2007). In other words, it is the marginal benefit that can be obtained from reducing a unit of time from the total amount of time needed to transport goods from origin to destination.

Shippers' considerations regarding transport time include:[16]

- The interest costs of the capital goods during transport.
- Potential depreciation of the value of the goods during transit.
- Potential loss of opportunities due to shortage of supply for the market.
- Disruption in the production process due to delayed arrival of raw materials.

[15] A voyage means a journey of a ship from one port to another irrespective of whether it carried cargo or not.
[16] Shippers refers to cargo interests. Carriers are the shipping service and ship carrying capacity providers including operators and shipowners. Ship brokers are specialist intermediaries/negotiators between shipowners and charterers who use ships to transport cargo, or between buyers and sellers of ships.

- Opportunities to minimize inventory costs by adjusting their distribution structure.

In this study, we used the Value of Time coefficients that were estimated in the Comprehensive Impact Assessment of the Short-term measures. These values were derived from the estimation of Multinomial-logit discrete choice models for 11 EORA sectors (de Jong, 2014). The model is typically used to predict the choices of shippers given a set of alternative modes of transport and their determinants. Where the shipper's utility function is specified as follows:

(6) $$ut_{o,d,p,m} = \mu_m \cdot asc_m + TC_{o,d,m} \cdot TD_{o,d,m} + VoT_p \cdot TT_{o,d,m} + Ct^m \cdot contig_{o,d} + Rt \cdot RTA_{o,d} + lg \cdot lang_{o,d} + A_o + A_d$$

(7) $$\pi_{o,d,p,m} = \frac{e^{u_{o,d,p,m}}}{\sum_{m=1}^{M} e^{u_{o,d,p,m}}}$$

Where π designates the choice probability of mode m for the transport of commodity p from the economy of origin o to the economy of destination d. $u_{t,o,d,p,m}$ designates the corresponding choice utility. asc_m is a mode/specific constant. Cp designates the transport cost coefficient for commodity p, $TD_{o,d,m}$ the transport distance (in km), $TC_{o,d,m}$ transport costs intensity in (in \$ per ton-km), VoT_p the value of time (\$/ton-hour) for commodity p, and $TT_{o,d,m}$ transport time. Ct_m is a contiguity coefficient for mode m, and $contig_{o,d}$ is a binary variable for the contiguity (i.e. a situation in which the economy of origin shares a border with the economy of destination). Rt is a trade agreement coefficient, and $RTA_{o,d}$ is a binary trade agreement variable. lg is a language coefficient, and $lang_{o,d}$ is a dummy variable that is 1 if the same language is spoken in the economy of origin and the economy of destination. A_o and A_d are origin- and destination-specific fixed effects, respectively. μ scaling factor to map unto utility space.

Due to the aggregate nature of the UN Comtrade dataset that records annual bilateral trade values in CIF (Costs, Insurance and Freight) and FOB (Freight on Board) terms across HS-6 commodity groups, broken down by five modes of transport (air, sea, road, and rail, and non-standard transport mode), the estimation method uses a non-linear optimisation method based on a multi-objective evolutionary algorithm called 'non-dominated sorting genetics algorithms II (NSGAII)'. The goal of this method is to find a set of model parameter values that minimize the root mean square error (RMSE) between the observed and modelled modal shares across all modes and to maximize the coefficient of determination (R-squared). We use observations of trade values at EORA commodity level to estimate the coefficient of the model. The value of time for each commodity is the estimated coefficient in the model in equations 6 and 7, explaining the utility of the shippers.

The estimation of VoTs is a resource intensive process, which requires an iterative experimentation process to determine the most suitable utility functions and to verify the estimated coefficients. UNCTAD has taken a number of steps to verify and validate the estimated VoTs. First, the estimated VoTs were compared with literature from freight transport modelling domain. A comparison with a study which collects and compares different estimated VoTs for maritime transport confirms that the estimated values of time in the present report are well within the range for VoTs of maritime transport as reported in Binsuwadan et al. (2022). Specifically, VoT for sea mode is estimated to be, on average, and on a global level, 0.13 US$/ton.hour which is similar to the global average of 0.15 US$/ton.hour, which is computed across all commodities, using a simple average. Another literature from De Jong et al. (2011) also provides a breakdown of value of time by commodities for the Dutch freight transport systems where similar levels of VoT values for different commodities are observed. Second, UNCTAD consulted an expert in freight transport modelling to further evaluate the methodology and its results. Both processes have verified the resulting estimations.

Shipping time costs per unit expressed in dollars per metric ton are calculated by multiplying the average shipping time by the VoT coefficients set out in Figure 6. The sum of shipping time costs and maritime transport costs is referred to as the ‘maritime logistics costs’ throughout this report. As mentioned above, shipping time costs and maritime transport costs are measured in constant prices. The specification of per-unit maritime logistics costs is provided by the following formula:

(8) $$c_{o,d,p}^{MLC} = c_{o,d,p}^{MTC} + \beta_p t_{o,d,p}$$

Where c^{MLC} designates per-unit maritime logistics cost (in $ per ton), c^{MTC} per-unit maritime transport costs (in $ per ton), t average time spent at sea, and β the VoT coefficient from Table 6. As above, o denotes the origin economy, d the destination economy and p the group of commodities. In this way, maritime logistics costs differ for each origin, destination, and commodity.

Table 6 provides an overview of the components of maritime logistics costs across the 11 groups of commodities in the base year (2023), including the VoT coefficients estimated based on the method above. We calculated the weighted average maritime transport costs, shipping time, and time costs across all bilateral trades of the commodity groups. The volume of the trade in metric tons is used as the weighting factor of the calculation.

Table 6. Components of maritime logistics costs in the base year, 2023, by type of commodity

Commodity	Per-unit maritime transport costs ($/ton)	Average travel time (hours)	VoT coefficient ($ / ton-hour)	Average time cost ($/ton)	Per-unit maritime logistics costs ($/ton)
Agriculture	89.07	920.06	0.01	7.36	96.43
Electrical and machinery	101.59	738.78	0.38	280.74	382.33
Fishing	91.91	707.40	0.10	68.62	160.53
Food and beverages	102.52	762.94	0.31	232.70	335.22
Metal products	89.66	763.05	0.39	299.88	389.54
Mining and quarrying	50.97	1,274.19	0.04	50.97	101.94
Other manufacturing	96.70	733.76	0.18	129.88	226.58
Petroleum, chemical, min. products	86.45	894.15	0.07	63.48	149.93
Textiles and wearing apparel	87.47	762.32	0.09	70.51	157.99
Transport equipment	113.55	691.62	0.10	70.55	184.09
Wood and paper	78.37	862.01	0.03	23.71	102.07

As can be seen, metal products, electrical and machinery, and food and beverages have relatively high time costs per ton, mainly due to a relatively high VoT coefficient, meaning that long travel times cause relatively high logistics costs. By contrast, agricultural products, products from mining and quarrying, and wood and paper products, show relatively low time costs, despite long average travel times, as the VoT is relatively low for those products. As a consequence, for these former groups of products, shipping time represents a relatively important cost factor, accounting for more than two thirds of the maritime logistics costs in 2023, the start year of the present impact assessment, whereas for agricultural products and products from wood and paper, the share of time costs in total maritime logistics costs amounts to less than one quarter. The strong discrepancy in the VoT between agricultural products and food and beverages, can be explained by the fact that items such as cereals and seeds are recorded under the former group, whereas meat and dairy products, which can more easily spoil, are recorded in the latter group.

In Table 7, the components of maritime logistics costs are further differentiated by group of economies.

Table 7. Components of maritime logistics costs in the base year, 2023, by type of commodity and group of economies

Commodity	Group of economies	Per-unit maritime transport costs ($/ton)	Average travel time (hours)	VoT coefficient ($ / ton-hour)	Average time cost ($/ton)	Per-unit maritime logistics costs ($/ton)
Agriculture	Developed economies	71.68	878.91	0.01	7.03	78.71
	Developing economies	70.34	964.60	0.01	7.72	78.05
	LDCs	147.91	775.77	0.01	6.21	154.12
	SIDS	109.35	633.37	0.01	5.07	114.41
Electrical and Machinery	Developed economies	82.28	633.40	0.38	242.59	324.87
	Developing economies	73.06	787.99	0.38	301.80	374.86
	LDCs	120.93	803.24	0.38	307.64	428.57
	SIDS	170.54	767.06	0.38	293.79	464.33
Fishing	Developed economies	73.97	641.81	0.10	62.26	136.23
	Developing economies	68.59	803.57	0.10	77.95	146.53
	LDCs	144.27	399.17	0.10	38.72	182.99
	SIDS	147.41	595.05	0.10	57.72	205.13
Food and Beverage	Developed economies	85.26	664.21	0.31	202.58	287.84
	Developing economies	74.85	831.42	0.31	253.58	328.44
	LDCs	138.77	736.97	0.31	224.78	363.55
	SIDS	145.11	747.59	0.31	228.02	373.12
Metal Products	Developed economies	81.01	844.73	0.39	331.98	412.99
	Developing economies	63.39	728.57	0.39	286.33	349.72
	LDCs	114.33	888.89	0.39	349.33	463.66
	SIDS	138.56	721.77	0.39	283.66	422.21
Mining and Quarrying	Developed economies	61.24	1,326.82	0.04	53.07	114.31
	Developing economies	49.68	1,176.43	0.04	47.06	96.73
	LDCs	83.93	1,429.61	0.04	57.18	141.11
	SIDS	96.19	788.18	0.04	31.53	127.72
Other Manufacturing	Developed economies	79.33	631.08	0.18	111.70	191.03
	Developing economies	70.52	776.33	0.18	137.41	207.93
	LDCs	110.05	697.27	0.18	123.42	233.47
	SIDS	169.33	655.26	0.18	115.98	285.31
Petroleum Chemical and	Developed economies	74.62	925.76	0.07	65.73	140.34
	Developing economies	68.85	863.45	0.07	61.31	130.15

Commodity	Group of economies	Per-unit maritime transport costs ($/ton)	Average travel time (hours)	VoT coefficient ($ / ton-hour)	Average time cost ($/ton)	Per-unit maritime logistics costs ($/ton)
Non-Metallic Mineral Products	LDCs	99.73	763.43	0.07	54.20	153.94
	SIDS	136.28	884.02	0.07	62.77	199.04
Textiles and Wearing Apparel	Developed economies	78.09	644.63	0.09	59.63	137.72
	Developing economies	63.91	788.90	0.09	72.97	136.89
	LDCs	107.80	845.41	0.09	78.20	186.00
	SIDS	135.22	677.58	0.09	62.68	197.90
Transport Equipment	Developed economies	127.73	656.32	0.10	66.95	194.68
	Developing economies	91.89	729.00	0.10	74.36	166.24
	LDCs	95.25	583.71	0.10	59.54	154.79
	SIDS	115.09	909.55	0.10	92.77	207.87
Wood and Paper	Developed economies	65.98	882.12	0.03	24.26	90.23
	Developing economies	69.45	838.10	0.03	23.05	92.50
	LDCs	102.81	797.47	0.03	21.93	124.74
	SIDS	104.38	793.88	0.03	21.83	126.21

For assessing the impacts of the candidate mid-term GHG reduction measures, maritime logistics costs for the year 2030, 2040, and 2050 are calculated based on the cost intensity calculations under different scenarios provided by DNV and calculated by MDST. GTAP takes these values as inputs to simulate the macro-economic impacts in 2030, 2040, and 2050.

4.5 Simulation of scenarios with revenue disbursement

As outlined above, the revenue *generation* and the use of revenues for D1 and D4 were modelled by DNV under Task 2, where the amount of D1 disbursement was set to zero. The effects of the disbursement of the remaining revenues (D2, D3, D5, D6 and D7) are assessed under Task 3.

Among the 10 policy scenarios analysed, the SC requested that the effects of hypothetical revenue *disbursement* be assessed under scenarios 26, 31, 32 and 46, as these scenarios generate the highest revenues. We assume that revenues collected in the period up to a snapshot year (i.e., 2030, 2040, 2050) are disbursed in equal proportions each year over the periods from 2027 to 2030, from 2031 to 2040 and from 2041 to 2050.

The first step in simulating the revenue disbursements was to identify the set of beneficiary economies by applying Level 1 criterion (Table 5). For the applied definitions of developing economies, SIDS and LDCs, see Section 2.1.

Secondly, the disbursements to each individual beneficiary country need to be calculated by applying Level-2 criteria which comprise ‘change of GDP’ and ‘population size’ (*p*). ‘Change’ of GDP (*y*) is understood as the percentage impact on GDP ($\acute{y}$) calculated using formula (1) above. To consider the criterion population size, the revenue disbursement scheme is defined in a way that disbursements (*r*) per capita are proportional to the percentage change in GDP, thus

(9) $$\frac{r_i}{p_i} = a\acute{y}_i$$

where *i* is the identifier of the country. *a* is constant for all *i*. Considering that total revenue ($\underline{R}$) should be disbursed across the complete set (Φ) of the *n* beneficiary countries defined in Level 1, thus

(10) $$R = \sum_{i=1}^{n} r_i \text{ , with } i\epsilon\Phi,$$

revenues need to be distributed across countries based on the formula below

(11) $$r_i = \frac{p_i\acute{y}_i}{\sum_{j=1}^{n} p_j\acute{y}_j} R,$$

with $i\epsilon\Phi$ and $j\epsilon\Phi$, to achieve an allocation per capita proportional to $\acute{y}$, where *j* is the index of the countries included in the sum. Accordingly, the revenue disbursement in year *t* under a given policy scenario *s* is calculated as

(10) $$r_{i,s,t} = \frac{p_{i,t}\acute{y}_{i,s,t}}{\sum_{j=1}^{n} p_{j,t}\acute{y}_{j,s,t}} R_{s,t}$$

These simulations are run for three points in time, choosing *t*=2030, *t*=2040, and *t*=2050, where $R_{s,t}$ is calculated as an average over the preceding years, as proposed by DNV.

4.6 Modelling of impacts on States

Analysing the impacts of trade cost changes, for example due to GHG reduction measures in shipping requires a framework that can account for economic feedback effects across economic sectors and countries. Thus, this analysis employs a computable general equilibrium (CGE) model of the global economy with production, consumption and bilateral trade data detailed at the level of individual economies. CGE models capture the intersectoral relationships inherent in input-output tables, particularly whether products are used as either intermediate inputs for further production in other sectors or for final consumption. Global CGE models are well-suited for analysing trade-related policy issues since countries are interlinked through bilateral trade in goods and services. Moreover, these types of economic models facilitate the analyses of economy-wide effects arising from changes in transport costs or other exogenous shocks.

4.6.1 Assess the impact of changes in maritime logistics costs using GTAP

The CGE model used in the *Macro-economic Workstream* of Task 3 is the Global Trade Analysis Project (GTAP) model, a widely used multi-economy and multi-sectoral model, fully documented in Corong et al. (2017), based on the latest GTAP Data Base version 11c (Aguiar et al. 2022). In the present context, the GTAP model is used to assess the impact on economies, in terms of GDP, imports, exports and consumer prices, in response to effects of policy measures on maritime logistics costs simulated in the *Costs Workstream* (see Sections 4.3 and 4.4).

In GTAP, domestically produced goods and services are destined for sale to the domestic market as well as to external destinations, leading to bilateral trade. Export prices are obtained by adding to the domestic supply price a potential export tax (*txs*), and this converts the initial domestic supply price to the free-on-board (FOB) price of exports, denoting the price before costs for international freight and insurance are added. The FOB price undergoes two further transformations *en route* to its final destination. A transportation margin (known as PTRANS) is added to the FOB price to generate the CIF (cost, insurance and freight) price of imports. Then, a bilateral tariff (*tms*) is added to the latter to generate the basic price of imports in the domestic market of the importing country. In GTAP, commodity-specific imports are aggregated from all bilateral flows to create an aggregate import bundle for each commodity. Aggregate imports allow for a shift in importer or consumer preferences through iceberg trade costs. These iceberg costs (ams) are equivalent to an import-diminishing “technological change” variable and can be applied to trade cost and time changes.[17][18] Similarly, a corresponding trade cost variable (*axs*) exists on the export side. The latter two variables are similar to a productivity shock and standard variables used to simulate regulatory changes.

GHG emission reduction measures can be of two broad natures: price mechanisms such as a GHG emissions pricing measures and regulatory measures such as a mandatory limit on emissions or a ban on fossil fuels. Applied to maritime transport, both mechanisms increase the maritime logistics costs, which in turn increase trade costs. A large proportion of global trade is shipped by sea. Higher trade costs generally lead to an increasing demand for domestic goods and a reduction of imports. This has been empirically verified and is widely accepted (Frankel and Romer, 1999; World Bank 2021; Moïsé and Le Bris, 2013). Most economies are expected to be negatively affected because prices for imports, both consumption goods and intermediate

[17] When the variable ams(i,r,s) is shocked by -5 per cent, then 5 per cent less of the product becomes available to importers. In the iceberg transport cost model, costs are extracted from the arriving volume linear to the distance.

[18] Modeling trade costs via the iceberg method was introduced by Samuelson (1954) based on the idea that the value melts away during transit. The iceberg method results in lower effective volume of goods arriving in the destination country relative to those sent by the exporting country.

goods, rise, and export costs also increase. Since higher maritime logistics costs disproportionately affect trade over longer distances, higher volume and lower value products, and highly trading nations, the cost changes affect economies differently. This is all reflected in GTAP where maritime logistics costs vary between two trading partners and products, and thus also the share of these costs in terms of their share in the CIF price. The effect of higher trade costs is generally negative for producers, consumers, investors and the government which also consumes and receives revenue that is linked to domestic economic activities. However, some economies or economic actors may benefit, for example economies that are closer to large markets than their competitors or non-exporting producers.

The impacts of changes in maritime logistics costs are simulated using an approach similar to that used for assessing the effects of non-tariff measures (NTMs). Walsmley and Strutt (2021) discuss all four variables introduced above in detail. NTM changes that have no revenue impact, *i.e.*, stemming from a regulatory change, are often reflected as productivity shocks using the variables ams and axs in GTAP and changes of measures that generate revenue, such as quotas and taxes use txs or tms. Where maritime logistics costs changes originate from a regulatory change, we use the two variables ams and axs in equal proportion, since it is unclear whether the importer or the exporter bears the cost change. Where the costs change originate from a revenue generating levy, we use tms and txs in equal proportions for the same reason.[19]

The magnitude of the shocks is calculated from the share of the maritime logistics costs in the CIF price in GTAP and the change of these costs for each bilateral economy pair and product group. For example, a levy that increases maritime logistics costs by 2 per cent, when the share of maritime logistics costs for a particular economy pair and product is 10 per cent, would be simulated by a shock of txs and tms by 0.1 per cent respectively. With this approach, we effectively shock the maritime cost component of the CIF-FOB margin. An extensive sensitivity analysis, largely discussed at the annual scientific GTAP conference in June 2024, has been carried out to support this approach.

In this application, the underlying database is aggregated to 15 sectors[20] and 112 GTAP economies. Most SIDS and LDCs are unfortunately not represented as single economies in GTAP but are part of a composite one.[21] The aggregation to a lower number of theoretically available sectors and economies is a standard practice in global general equilibrium modelling to respond to limits in computer processing capability and to ensure that the model converges to an equilibrium. Preference was given to the highest possible number of economies where the calibration (see below) of the interim baseline still converges. The aggregation can lead to a potential aggregation bias (Britz and v.d. Mensbrugghe, 2016). However, since the number of

[19] Other GTAP variables such as PTRANS were also considered but found less appropriate for the assessment of maritime logistics costs changes. Specifically, exogenising PTRANS and endogenising shipping productivity is unsuitable for long-term analysis because it implies technological regress in shipping, contrary to the assumption of technological advancements in the sector.
[20] These comprise the 11 goods sectors above, water, land and other transport as well as other services.
[21] An aggregation from the 160 standard GTAP economies to 112 economies was technically required, due to the complexity of the policy simulation and the high number of dimensions involved.

economies is kept high and the goods sectors have been chosen according to similar trade costs, the potential aggregation bias is expected to be low, likely a few per cent (not percentage points).

The GTAP data are first updated, starting from a base year of 2017 (GTAP version 11) to the year 2023 using the GTAP recursive dynamic model (Aguiar *et al.*, 2017) with capital accumulation mechanism. This step entails imposing economic projections to a future year based on actual GDP, labour force and population growth. Moreover, from 2023 to 2030, 2040 and 2050, an interim baseline is created based on the Shared Socioeconomic Pathways (SSP) 'Middle of the Road' scenario with specific assumptions on the development of labour force, GDP and population.[22][23] In this baseline, the trade costs move in proportion to trade and are also driven by the interaction between the global supply and demand for transport services. Starting from this baseline, the trade costs in the GTAP model are shocked based on the maritime logistics costs effects caused by the GHG emission from ships reduction measure under the various scenarios for each of 2023–2030, 2030–2040 and 2040–2050. The trajectory between the three periods is not assessed; information is only provided for the final point of each period, not for every year within these periods. The results from these scenarios are then compared relative to the BAULG scenario based on changes in maritime logistics costs derived based on Task 2 results.

A recursive dynamic approach has been chosen. Except for the interim baseline, where the dynamic GTAP model has been used, the shocks of the BAULG and the change in maritime logistics costs are applied to the interim baseline equilibria for each of the three periods using the standard GTAP model with a closure that assumes perfect competition and constant returns to scale.[24] A sensitivity analysis has also been conducted for this assumption using inter alia the dynamic model for cost changes to support the choice of the selected approach. Results, unless stated explicitly otherwise, show the difference between the change in maritime logistics costs and BAULG, i.e., the impact of the policy change.

4.6.2 Impact assessment of scenarios with the revenue disbursement

To simulate the effects of revenue disbursements, scenarios 26, 31, 32 and 46, in accordance with the specified hypothetical revenue disbursement schemes (see Section 3.2), the revenue, calculated as described in Section 4.5, is generated in GTAP by using export levies (txs) and import tariff (tms) as outlined above, collected from the economies by a newly-introduced revenue collection mechanism "timo", and transferred to GTAP's 'regional household' (see

[22]International Institute for Applied Systems Analysis (IIASA), January 2024 release: https://data.ece.iiasa.ac.at/ssp/#/workspaces.
[23]The interim baseline run uses the latest SSP2 database which accounts for actual economic growth from 2017 to 2023, thereby reflecting economic disruptions caused by the COVID-19 pandemic all the way to 2050.
[24] The modelling employs an endogenous trade balance closure to facilitate analyses of economic adjustments associated with increased shipping cost. A fixed ratio of trade balance to world income closure for each country is not specified as this not only constrains economic adjustments but also limits cross-border investment flows.

below on regional household income allocation) in each eligible economy.[25] The shocks for tms and txs are calculated endogenously to match the global revenue disbursement and with equal rate changes for each economy. To ensure the same maritime logistics costs change as in the non-revenue scenario, axs and ams are adjusted accordingly to account for changes in “timo”. This keeps the total shock from the change in maritime logistics costs and the levy constant, preventing any overestimation. However, when comparing the no-revenue and with-revenue scenarios, caution is required, since the shocks are not identical. The no-revenue simulations represent a regulatory change while the revenue simulations constitute a mix of regulatory and levy change. Strictly speaking, the *same* scenario with and without revenue distribution could only be compared if two scenarios, one with and another without levy, would have exactly the same maritime logistics costs changes. Either a levy generates revenue that is to be distributed or not. However, scenarios that generate revenue in the simulations with revenue distribution, can still be compared with other scenarios that have no revenue. The results for the scenarios with revenue without distribution of revenue are shown because they are needed to assess how States are affected by changes in maritime logistics costs.

The regional household collects all factor incomes and levy revenues generated within an economy, then allocates all income across three types of expenditure, private consumption, government consumption and savings, to maximize the welfare for each country or region. The international maritime transport sector including shipping is not modelled in high detail in GTAP, as in any other global CGE model, so it is not possible to model a precise and targeted distribution of revenue to the maritime transport sector inside the GTAP model.

[25] “Timo” is a proxy variable created for this impact assessment. It collects funds through txs and tms and redistributes them according to the criteria described in Section 4.5.”

5 Impacts on maritime transport costs, shipping times and maritime logistics costs

In this and the following sections, we document the results of the impact assessment obtained by applying the methods laid out in Section 4. The present section documents the impacts of the analysed policy scenarios on maritime logistics costs, representing the sum of maritime transport costs and time costs, i.e. the costs associated with shipping time (see above, for details about their calculation). Consistent with the analysis under Task 2, maritime logistics costs, maritime transport costs and shipping time costs are measured in constant prices. In this report, maritime logistics costs are calculated using the weighted average of maritime transport costs, and time costs across all bilateral trades of the commodity groups. The volume of the trade in metric tons is used as the weighting factor of the calculation. Compared to the previous version of the report which uses a simple average across all the economies, this approach results in higher average weight for time costs and smaller increase in maritime logistics costs. The primary focus of the present assessment is on the analysis of the impact on States' imports, exports, GDP and CPI, as revealed by the percentage difference between the outcomes under 22 policy scenarios considered and the baseline scenario BAULG (see Section 4.1 above for the definition of impact).

Results of simulations conducted by UNCTAD at economy group levels are set out in tables 5 to 24 below. The results for individual IMO member States and territories are presented in the Annex at the end of this report.

5.1 Global impacts

As Table 8 shows, the candidate mid-term GHG emission measures have a stronger impact on maritime transport costs than on time costs, under all policy scenarios. Thus, the percentage impact on time costs has a moderating effect on the percentage impact on maritime transport costs in the calculation of maritime logistics costs. The larger the proportion of maritime transport costs, the higher the increase in maritime logistics costs for a given increase in maritime transport costs.

Table 8. Relative impact on global maritime logistics costs and their two components

(Percentage difference compared to BAULG)

Scenario	Year	Maritime transport costs	Shipping time costs	Maritime logistics costs
21	2030	22.51	2.36	8.22
	2040	40.46	11.94	27.93
	2050	83.08	16.71	36.28
22	2030	19.75	2.09	7.26

Scenario	Year	Maritime transport costs	Shipping time costs	Maritime logistics costs
	2040	64.75	12.35	27.83
	2050	84.64	16.76	36.79
23	2030	16.78	1.72	6.32
	2040	63.21	12.88	27.61
	2050	80.87	16.59	35.56
24	2030	14.91	1.69	5.78
	2040	61.54	11.11	26.06
	2050	81.20	16.38	35.52
26	2030	38.10	6.15	15.82
	2040	68.40	13.70	29.74
	2050	77.60	16.85	34.82
31	2030	18.20	1.07	6.38
	2040	55.37	9.91	23.50
	2050	79.00	16.44	34.93
32	2030	19.72	1.64	7.26
	2040	56.21	10.32	24.01
	2050	78.80	16.41	34.85
36	2030	22.03	1.09	7.46
	2040	59.73	11.13	25.46
	2050	82.36	16.71	36.11
43	2030	25.99	4.58	10.83
	2040	74.05	14.06	31.62
	2050	78.57	16.24	34.65
46	2030	44.86	8.03	19.09
	2040	74.03	14.58	31.98
	2050	76.60	17.06	34.68

In 2050, increases in percentage terms in the maritime logistics costs are estimated to be within the same order of magnitude across all scenarios analysed (Table 8), regardless of whether they are Base or Strive, with or without levy and regardless of other differences between the analysed policy scenarios. By 2050, maritime logistics costs are simulated to be more elevated than under BAULG: 34.7 per cent more elevated under the Strive GHG emissions trajectory scenarios 43 and 46; 34.8 per cent more elevated under the higher GHG price base scenario 26; 34.9 per cent more elevated under the low GHG price base scenarios 31 and 32; 35.5-35.6 per cent more elevated under the flexibility scenarios 23 and 24; 36.1 per cent more elevated under the feebate scenario 36; and 36.3-36.8 per cent more elevated under the no flexibility/feebate/levy scenarios 21 and 22. This outcome is consistent with Task 2 results which show little variation in the 2050 cost intensity (i.e. 71-85 per cent increase in maritime transport costs) regardless of the scenario. This also implies that DNV's simulated cost intensity for 2050 is primarily driven by the 2050 net zero objective, rather than the policy parameters through the transition. Whilst some of the variations in maritime logistics costs come from variations in shipping time, maritime transport costs (a product of the capital and operating/energy costs of the ships/fleet) are the main drivers of variations in total maritime logistics costs.

However, there are some differences between the policy scenarios' long run impacts detectable both in small differences in maritime transport costs and shipping time. In 2050, scenarios with a levy (26/31/32/46) lead to relatively smaller increases in maritime transport costs than scenarios without a levy (21/22/23/24/36/43). Scenarios with a levy result in relatively more elevated shipping time costs (e.g. indicating that the levy induces small decreases in operating speeds) compared to the no levy scenarios. These two effects counter each other when the two components are combined to calculate changes in maritime logistics costs. This leads to a relatively low difference in costs between levy and no-levy scenarios.

Among scenarios with a levy such as 26/46 and 31/32, the level of the levy determines impacts on ship speed. Scenario with higher levy levels (26/46) cause ships to have a relatively larger reduction in their speed in order to reduce their GHG emissions and the additional costs from the levy. In turn, relatively larger speed reduction also results in more elevated shipping time costs in scenarios with higher levy levels compared to scenarios with lower levy levels (31/32).

In 2030, there are more significant differences in maritime transport costs, shipping time costs, and maritime logistics costs between different scenarios. This pattern is also consistent with DNV's cost intensity calculations which show high variation in the 2030 cost intensity (i.e. 16 to 40 per cent increase). The higher levy scenarios (26/46) see relatively larger increases in maritime logistics costs when compared to levy scenarios with low levy levels (31/32) as well as to scenarios with no levy (21/22/23/24/36/43). This is because their maritime transport and shipping time cost components are both more elevated indicating lower average speeds. In 2030, increases in maritime logistics costs are relatively the smallest under the scenarios that include a flexibility mechanism (smallest increase under scenario 24) but are generally comparable (5.8 per cent to 8.2 per cent more elevated) across scenarios that have a low levy price and a flexibility mechanism as well as scenarios with no levy but including a flexibility mechanism or scenarios that have no levy and do not include a flexibility mechanism.

Impacts on maritime logistics costs by commodity, presented in Table 9, generally follow similar trends over time as the corresponding totals, presented in Table 8. Not surprisingly, the maritime logistics costs of relatively time-sensitive types of commodities, which are featured by a high weight of time costs in maritime logistics costs, such as metal products, electrical and machinery, and food and beverages (see above, Table 6), are less affected by the policy measures than less time intensive products, for which maritime logistics costs consist to a large extent of maritime transport costs, independent from shipping time, such as agricultural products and wood and paper products. The relatively larger increase in the maritime logistics costs of agricultural products is worth being recognized in the context of food security analysis.

Increases in maritime logistics costs in 2050 range from 24 per cent for metal products to 82 per cent for agriculture. In 2050. scenarios with a levy (scenarios 26, 31, 32, 43 and 46) generally have lower commodity-specific maritime logistics costs than equivalent scenarios that do not have a levy (scenarios 21, 22, 23, 24 and 36).

Table 9. Relative impact on maritime logistics costs, by commodity, in 2050

(Percentage difference compared to BAULG)

	Scenario									
Group of commodities	21	22	23	24	26	31	32	36	43	46
Agriculture	80.3	81.8	77.2	78.3	73.2	77.6	77.6	79.9	73.4	70.7
Electrical and Machinery	26.2	26.6	25.9	26.1	25.9	25.8	25.8	26.6	25.7	25.8
Fishing	54.9	56.5	53.6	54.4	51.8	52.6	52.3	55.7	52.9	51.0
Food & Beverages	27.6	28.1	27.1	27.2	26.8	26.9	26.8	27.8	26.7	26.8
Metal Products	24.8	25.0	24.4	24.5	24.6	24.6	24.6	24.9	23.9	24.5
Mining and Quarrying	44.8	45.5	43.7	44.0	41.9	44.1	43.9	44.7	41.7	40.8
Other Manufacturing	31.2	31.7	30.6	30.8	30.3	30.5	30.6	31.4	30.0	30.0
Petroleum Chemical, ...	35.5	36.0	34.9	34.5	34.5	33.4	33.3	35.0	34.4	35.0
Textiles and Wearing Apparel	43.9	45.0	42.9	43.5	41.7	42.1	42.0	44.4	42.6	41.2
Transport Equipment	42.4	42.9	41.9	42.2	38.6	41.6	41.5	43.8	39.5	37.3
Wood and Paper	62.4	63.6	60.3	61.2	57.7	60.3	60.2	62.5	57.7	56.0

5.2 Impact on maritime logistics costs of imports

The effects of changes in maritime logistics costs on imports under the different scenarios show patterns and magnitudes that are similar to the overall changes in maritime logistics costs (Table 10). In 2050, there is little variation in results between scenarios, but in 2030, there is greater variation, with scenarios that feature a higher levy price, and Strive scenarios seeing consistently larger increases in maritime logistics costs across different groups of economies (developed/ developing/ SIDS/ LDCs).

The increase in the relative maritime logistics costs is smaller for developed economies and SIDS compared to the other groups of economies (world, developing economies and LDCs) irrespective of the scenario. The developing economies and LDCs show similar increases in maritime logistics costs across scenarios. This may indicate that both economy groups, in general, import similar commodity types which see a comparable impact on maritime logistics costs due to the measures. However, inspection of results across individual economies shows that these aggregated values by group of economies can mask significant variations between individual economies. Economies that experience the relatively largest increases in the maritime logistics costs of their imports include many SIDS, LDCs and landlocked developing economies.

Table 10. Relative impact on maritime logistics costs of imports

(Percentage difference compared to BAULG)

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
21	2030	8.2	7.3	9.0	7.6	9.3
	2040	27.9	26.0	29.5	26.0	30.2
	2050	36.3	33.5	38.7	33.3	38.5
22	2030	7.3	6.4	7.9	6.7	8.6
	2040	27.8	25.9	29.4	26.1	29.9
	2050	36.8	33.9	39.2	34.0	39.2
23	2030	6.3	5.4	7.1	5.3	7.3
	2040	27.6	25.9	29.0	25.6	29.7
	2050	35.6	32.9	37.8	32.9	37.7
24	2030	5.8	5.2	6.2	5.1	6.9
	2040	26.1	24.1	27.6	24.0	28.8
	2050	35.5	32.7	37.9	32.8	38.0
26	2030	15.8	14.7	16.7	15.0	17.3
	2040	29.7	27.9	31.3	27.5	31.6
	2050	34.8	32.5	36.7	32.3	36.6
31	2030	6.4	5.6	7.0	5.8	7.4
	2040	23.5	21.7	25.0	21.5	25.1
	2050	34.9	32.0	37.4	31.6	37.2
32	2030	7.3	6.5	7.9	6.6	8.4
	2040	24.0	22.1	25.6	21.8	25.7
	2050	34.9	31.9	37.4	31.5	37.1
36	2030	7.5	6.9	7.9	6.6	8.4
	2040	25.5	23.6	27.0	23.5	27.4
	2050	36.1	33.2	38.5	33.3	38.6
43	2030	10.8	9.8	11.7	9.6	11.6
	2040	31.6	29.4	33.4	29.3	34.5
	2050	34.7	32.4	36.5	32.6	37.1
46	2030	19.1	17.8	20.1	18.3	20.7
	2040	32.0	30.0	33.6	29.7	34.1
	2050	34.7	32.7	36.3	32.8	36.4

5.3 Impact on maritime logistics costs of exports

The variations in the maritime logistics costs of exports across scenarios are similar to the variations observed at the global level (world) as well as the variations across scenarios seen in the case of the maritime logistics costs of imports (Table 11). Specifically, some scenarios with a levy show relatively smaller increases in maritime logistics costs of exports in 2050 but larger increases in 2030.

However, the pattern varies when comparing different groups of economies. LDCs experience consistently larger increases in the maritime logistics costs of their exports compared with the remaining groups of economies (developed, developing, SIDS, and world). Developed and developing economies together with SIDS experience increases in the maritime logistics costs of their exports that are of comparable magnitudes.

Compared to the impact on the import side, the increase in the maritime logistics costs of exports is relatively larger for LDCs. Furthermore, comparable increases across developed economies, developing and SIDS indicate that the impact of the measures on the maritime logistics costs of exports is more uniform on a global level compared to the impact on the import side. Values reported for the various groups of economies mask significant variations between individual countries with the exports of many SIDS and LDCs experiencing relatively some of the largest increases in the maritime logistics costs.

Table 11. Relative impact on maritime logistics costs of exports

(Percentage difference compared to BAULG)

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
21	2030	8.2	8.0	8.3	7.9	11.1
	2040	27.9	28.1	27.5	28.1	34.8
	2050	36.3	36.1	36.1	35.9	44.5
22	2030	7.3	7.1	7.3	7.0	9.9
	2040	27.8	27.9	27.4	27.9	34.5
	2050	36.8	36.5	36.6	36.4	45.5
23	2030	6.3	6.1	6.4	6.5	7.8
	2040	27.6	27.7	27.2	27.8	33.2
	2050	35.6	35.3	35.3	35.3	43.8
24	2030	5.8	5.6	5.9	5.9	6.7
	2040	26.1	26.1	25.7	26.0	32.5
	2050	35.5	35.1	35.4	35.0	43.9
26	2030	15.8	15.6	15.8	16.2	19.2
	2040	29.7	30.0	29.1	29.8	36.3
	2050	34.8	34.8	34.4	34.9	42.2
31	2030	6.4	6.0	6.6	6.2	8.2
	2040	23.5	23.4	23.3	23.0	28.6
	2050	34.9	34.5	35.0	33.6	43.0
32	2030	7.3	7.0	7.4	7.2	9.0
	2040	24.0	23.9	23.9	23.3	29.1
	2050	34.9	34.4	34.9	33.4	42.8
36	2030	7.5	7.6	7.2	7.9	9.3
	2040	25.5	25.6	25.0	25.2	31.6
	2050	36.1	35.7	36.0	35.4	44.6
43	2030	10.8	10.8	10.7	11.5	12.9
	2040	31.6	31.7	31.2	32.0	38.9

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
	2050	34.7	34.6	34.3	35.5	42.4
46	2030	19.1	19.0	18.9	19.5	23.1
	2040	32.0	32.3	31.3	32.2	39.2
	2050	34.7	34.9	34.1	35.3	41.9

6 Impacts on States

This section documents the impacts of the analysed policy scenarios on States, in particular on imports and exports, GDP and consumer prices. The primary focus is on analysing the impact, as revealed by the percentage difference between the outcomes under the *policy scenarios* and the situation under the baseline BAULG (see Section 4.1 above for details about the calculation). Throughout this section, the reported impacts are in quantity (volume) for imports and exports, real GDP for GDP, and the CPI[26] for consumer prices.

Results for the various groups of economies are featured in the tables. The results for individual economies are presented in the Annex.

6.1 Importance of maritime logistics costs within overall trade costs

The degree to which changes in maritime logistics costs are reflected in changes in the prices of imports and exports is dependent on their share of the value of exports and imports. As shown in Table 12, this share varies considerably across global commodity groupings. In agriculture, the maritime CIF-FOB margin, the variable used in GTAP as a measure of maritime transport costs, is relatively high when measures as a proportion of goods import value, amounting to 5.3 per cent. The next highest CIF-FOB margin relates to electrical products and machinery followed by the CIF-FOB margins of products from mining and quarrying (4.1 per cent) and fishery products (4.6 per cent) as well as food and beverages (2.9 per cent). By contrast, the maritime CIF-FOB margins for transport equipment and textile and wearing apparel are around less than 1 per cent of the value of trade. This means that for the same percentage increase in maritime logistics costs, economies that rely strongly on trade in agricultural products, will, on average, face a stronger percentage increase in the CIF price of their trade compared to economies whose trade relies more on manufactured goods.

[26] The CPI used in this report measures household expenditures on both goods and services.

Table 12. Proportion of the maritime transport margin in the CIF price of internationally traded goods, by commodity group (GTAP base year 2017)

(Percentage)

Commodity group	World	Minimum[1]	Maximum[1]
Agriculture	5.32	0.19	15.96
Electrical and machinery	2.18	0.03	3.55
Fishing	4.62	0.01	16.91
Food and beverages	2.85	0.65	8.10
Metal products	2.24	0.13	6.74
Mining and quarrying	4.07	0.11	18.05
Other manufacturing	2.21	0.20	5.08
Petroleum chemical, non-metallic mineral products	1.94	0.22	9.85
Textiles and wearing apparel	0.98	0.06	4.61
Transport equipment	0.97	0.10	3.58
Wood and paper	1.76	0.42	13.81

[1]Minimum and maximum refer to the highest and lowest values across the 112 GTAP regions.

As Table 13 reveals, and whether for imports or exports, the ratio of the maritime CIF-FOB margin to the value of imports and exports of developing economies is almost twice as high as the CIF-FOB margin to the value of imports and exports of developed economies. The equivalent ratios for LDCs and SIDS range in between while ratios for LDCs are closer to those of developing economies whether in terms of imports or exports.

Table 13. Proportion of the maritime transport margin in the CIF price of exports and imports (GTAP base year 2017)

(Percentage)

Group of economies	Imports	Exports
World	1.60	1.64
Developed economies	1.25	1.27
Developing economies	2.28	2.36
SIDS	1.42	1.45
LDCs	1.94	2.00

Note: Imports and exports include goods and services. For services, maritime transport costs are zero.

6.2 Policy scenarios modelled without revenue disbursements

UNCTAD is modelling a wide range of scenarios in GTAP. This section discusses the scenarios modelled with a GFI with no flexibility only (21 and 22), a GFI with flexibility only (23, 24 and 43), and a GFI with flexibility and a feebate (36). Two scenarios raise no revenues (21 and 22). Under the other scenarios discussed in this section, the vast majority of revenues are allocated in

DNV's modelling to D4 under Task 2 (23, 24, 36 and 43). Therefore, UNCTAD is not modelling revenue disbursements in GTAP for these scenarios under Task 3.

6.2.1 Exports and imports

The six policy scenarios discussed in this section are estimated to lead to a reduction in export quantities (hereafter exports) compared to BAULG in all compared groups of economies, except for SIDS (Table 14). The impact becomes larger between 2030 and 2040. At the global level, the magnitude of the reduction in exports goes from -0.05 and -0.08 per cent in 2030 to -0.18 and -0.22 per cent in 2040 relative to BAULG, depending on the policy scenario. The magnitude of the reduction in exports during the subsequent ten-year period i.e. between 2040 and 2050 is less pronounced. By 2050, the decrease in exports caused by the policy measures is estimated to range between -0.23 and -0.24 per cent relative to BAULG. Under policy scenario 43, the size of the impact remains almost constant over the 2040–2050 period.

Table 14. Impact on export quantity

(Percentage difference compared to BAULG)

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
21	2030	-0.06	-0.03	-0.12	0.03	-0.15
	2040	-0.20	-0.08	-0.37	0.07	-0.42
	2050	-0.24	-0.09	-0.45	0.07	-0.49
22	2030	-0.06	-0.03	-0.11	0.03	-0.14
	2040	-0.20	-0.08	-0.36	0.07	-0.42
	2050	-0.24	-0.09	-0.45	0.08	-0.50
23	2030	-0.05	-0.02	-0.10	0.02	-0.12
	2040	-0.20	-0.08	-0.36	0.06	-0.40
	2050	-0.23	-0.09	-0.43	0.07	-0.48
24	2030	-0.05	-0.02	-0.10	0.02	-0.11
	2040	-0.19	-0.08	-0.36	0.06	-0.41
	2050	-0.24	-0.09	-0.44	0.07	-0.49
36	2030	-0.06	-0.03	-0.12	0.02	-0.14
	2040	-0.18	-0.07	-0.34	0.06	-0.38
	2050	-0.24	-0.09	-0.44	0.07	-0.49
43	2030	-0.08	-0.04	-0.15	0.03	-0.17
	2040	-0.22	-0.09	-0.40	0.07	-0.46
	2050	-0.23	-0.09	-0.43	0.07	-0.48

On average, the impact on exports caused by the policy measures is relatively larger for LDCs, followed by developing economies and developed economies. In developed economies, the difference compared to BAULG amounts to around -0.02 and -0.04 per cent in 2030. By 2050, it is a larger impact of around -0.09 per cent. Developing economies experience an average reduction of exports ranging between -0.10 to -0.15 per cent in 2030, and -0.43 to -0.45 per cent in 2050. LDCs see a relatively larger reduction in their exports ranging from -0.11 to -0.17 per cent in 2030, and -0.48 to -0.50 per cent in 2050, depending on the policy scenario.

SIDS stand out by experiencing a slight increase in exports compared to the BAULG. Increases range from +0.02 to +0.03 per cent in 2030 and +0.07 to +0.08 per cent in 2050. As shown in Table 11, this probably reflects SIDS' export prices increasing at a relatively lower rate than the export prices of other economies in specific market segments, making their exports more competitive globally.

Results for the individual SIDS economies show some variations. While exports increase by +0.47 to +0.50 per cent in the "rest of the Caribbean", they decrease in the Dominican Republic (-0.15 to -0.17 per cent) and Mauritius (-0.29 to -0.30 per cent). Depending on the scenario, there are around 20 economies globally that experience an increase in exports compared to BAULG.[27]

As to the impact on imports, the simulations reveal that, overall, all four groups of economies experience a reduction in their import quantities (hereafter imports) compared to BAULG (Table 15). Developing economies experience the largest reduction in imports, followed by LDCs, SIDS, and developed economies. In the developing economies, the import reduction ranges between -
-0.08 and -0.13 per cent in 2030, depending on the policy scenario. By 2050, the decline ranges between -0.36 and -0.37 per cent. Reduction in developed economies' imports ranges from -0.03 to -0.04 per cent in 2030 and from -0.13 to -0.14 per cent in 2050. While slightly varying depending on the year and the scenario, there are around 30 economies that see a positive impact, that is an increase in imports compared to BAULG.

Table 15. Impact on import quantity

(Percentage difference compared to BAULG)

Scenario	Year	Developed economies	Developing economies	SIDS	LDCs
21	2030	-0.03	-0.11	-0.08	-0.11
	2040	-0.11	-0.30	-0.23	-0.30
	2050	-0.14	-0.37	-0.27	-0.34
22	2030	-0.03	-0.10	-0.08	-0.11
	2040	-0.11	-0.30	-0.23	-0.30
	2050	-0.14	-0.37	-0.28	-0.35
23	2030	-0.03	-0.09	-0.06	-0.09
	2040	-0.11	-0.30	-0.23	-0.29
	2050	-0.13	-0.36	-0.27	-0.33
24	2030	-0.03	-0.08	-0.06	-0.09

[27] The "rest of the Caribbean" economies benefit from a positive impact on their services exports, which compensates for the negative impact on agriculture and mining sector exports. Conversely, the increase in services exports in Mauritius and the Dominican Republic does not offset the negative impact on food and beverage, textile, and agriculture exports.

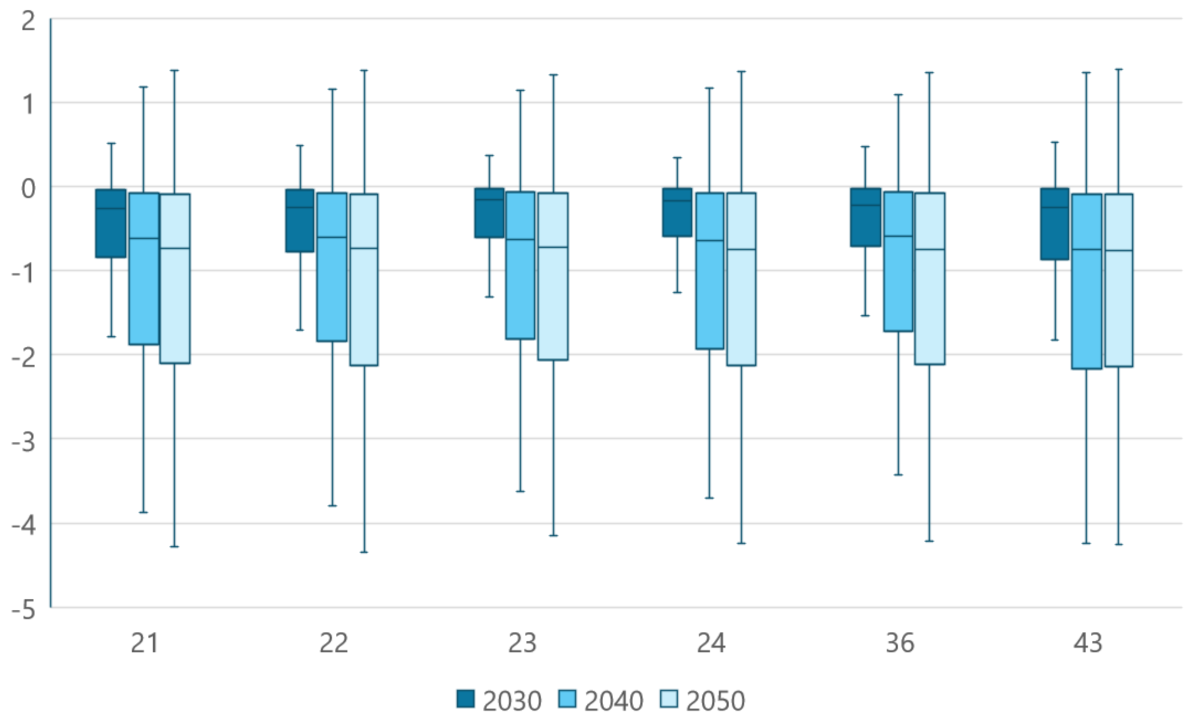
Scenario	Year	Developed economies	Developing economies	SIDS	LDCs
	2040	-0.11	-0.30	-0.23	-0.30
	2050	-0.13	-0.36	-0.28	-0.34
36	2030	-0.03	-0.10	-0.07	-0.11
	2040	-0.10	-0.28	-0.21	-0.27
	2050	-0.13	-0.36	-0.27	-0.34
43	2030	-0.04	-0.13	-0.10	-0.13
	2040	-0.12	-0.34	-0.26	-0.33
	2050	-0.13	-0.36	-0.28	-0.35

Note: “World” is the same total as for exports (Table 14).

The policy measures could raise some food security risks especially as regards food availability and access to food, if they lead to significant reductions in agricultural product imports or cause food import prices to increase. Figure 6 shows that three quarters of the GTAP economies are simulated to experience a reduction in their agricultural product imports compared to BAULG, with growing average intensity over time, under all six policy scenarios without levy. In 2030, this reduction remains in all economies below 1.9 per cent. In 2050, it reaches in some economies up to 4.3 per cent. The statistical annex in xls format presents the simulated impact of the policy combinations without a levy on the quantity of food imports by GTAP economy.

Figure 6. Impact on quantity of imports of agricultural products by scenario, and impact distribution across economies

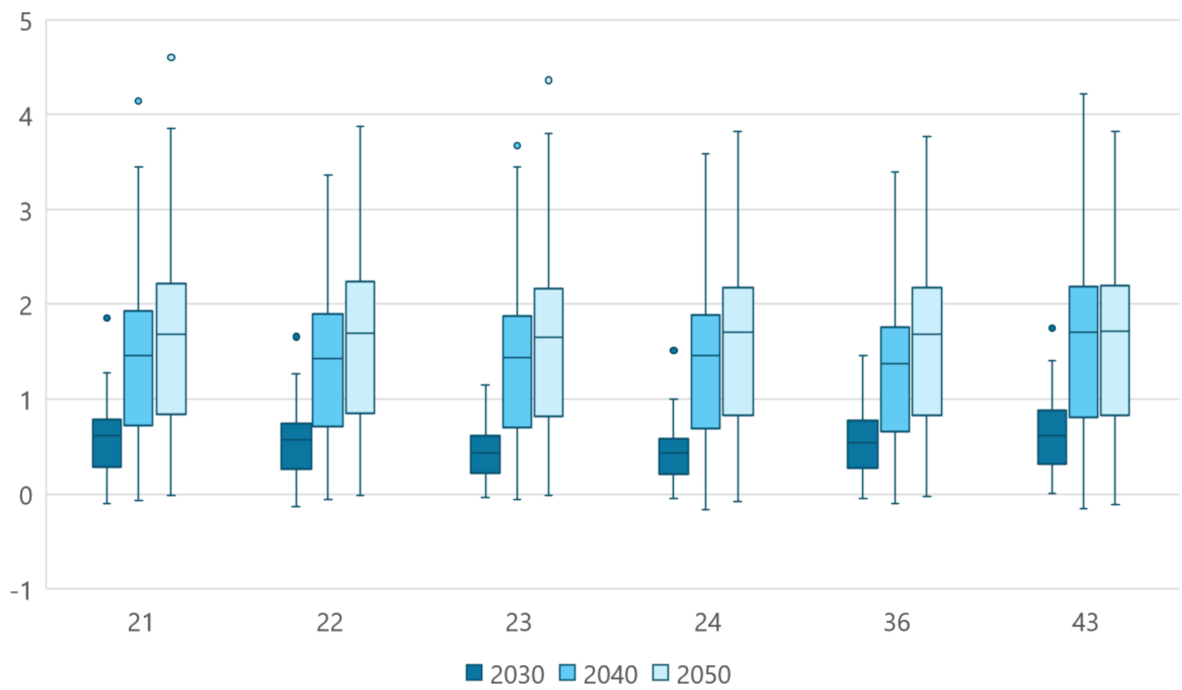
(Percentage difference compared to BAULG)



The prices of agricultural product imports are simulated in GTAP to increase in almost all economies in response to the policy measures, where the strength of the impact will grow over time. In 2030, the increase relative to BAULG remains in all economies below 1.9 per cent. In 2050 and for some economies, the increase reaches up to 4.6 per cent, according to the results of the simulation (see Figure 7). The statistical annex in xls format presents the simulated impact of the policy combinations without a levy on the prices of agricultural product imports by GTAP economy.

Figure 7. Impact on the CIF price of imports of agricultural products, by scenario, and its distribution across economies

(Percentage difference compared to BAULG)



Reductions in agricultural imports and increases in their prices has implications for food security with the precise impact on individual economies depending on several factors. The implications will be more heightened for economies that are high food importers and show a relatively higher agricultural product import dependency (*i.e.* the ratio of agricultural imports to domestic demand for agriculture), have a low initial level of per-capita supply in agriculture, including stocks, and where domestic producers have limited capacity to react to fluctuations in demand.

6.2.2 Real gross domestic product

As shown in Table 16, the six scenarios discussed in this section lead to a reduction in GDP in 2030 and 2050, compared to the baseline BAULG, for the four groups of economies analysed and at the global level. Across all scenarios, developed economies experience the smallest reduction in GDP relative to BAULG, while LDCs see the largest reduction in their GDP.

Table 16. Impact on real GDP

(Percentage difference compared to BAULG)

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
21	2030	-0.04	-0.03	-0.06	-0.10	-0.11
	2040	-0.13	-0.10	-0.18	-0.29	-0.33
	2050	-0.16	-0.12	-0.22	-0.34	-0.39
22	2030	-0.04	-0.03	-0.06	-0.09	-0.10
	2040	-0.13	-0.10	-0.18	-0.29	-0.32
	2050	-0.16	-0.12	-0.22	-0.34	-0.40
23	2030	-0.04	-0.03	-0.05	-0.08	-0.08
	2040	-0.13	-0.10	-0.18	-0.28	-0.32
	2050	-0.16	-0.12	-0.22	-0.34	-0.38
24	2030	-0.03	-0.03	-0.05	-0.07	-0.08
	2040	-0.13	-0.10	-0.18	-0.28	-0.32
	2050	-0.16	-0.12	-0.22	-0.34	-0.39
36	2030	-0.04	-0.03	-0.06	-0.09	-0.11
	2040	-0.12	-0.09	-0.17	-0.27	-0.30
	2050	-0.16	-0.12	-0.22	-0.34	-0.39
43	2030	-0.05	-0.04	-0.07	-0.12	-0.13
	2040	-0.15	-0.11	-0.20	-0.32	-0.37
	2050	-0.16	-0.12	-0.21	-0.34	-0.38

In 2030, the largest impact on GDP globally (-0.05 per cent) is observed for scenario 43 (Strive, TtW, flex, no levy, no feebate). In 2050, scenarios 21 and 22 (Base, WtW, no flex, no levy, no feebate), which do not include a flexibility mechanism, and scenarios 23 and 24 that do include a flexibility mechanism all lead to a -0.16 per cent impact on global GDP relative to the baseline BAULG.

Developed economies experience a relatively smaller impact on their GDP compared to developing economies, SIDS and LDCs. In 2030, the GDP impact for developed economies is around -0.03 per cent across most scenarios, relative to BAULG. Their GDP reduction reaches approximately -0.12 per cent by 2050.

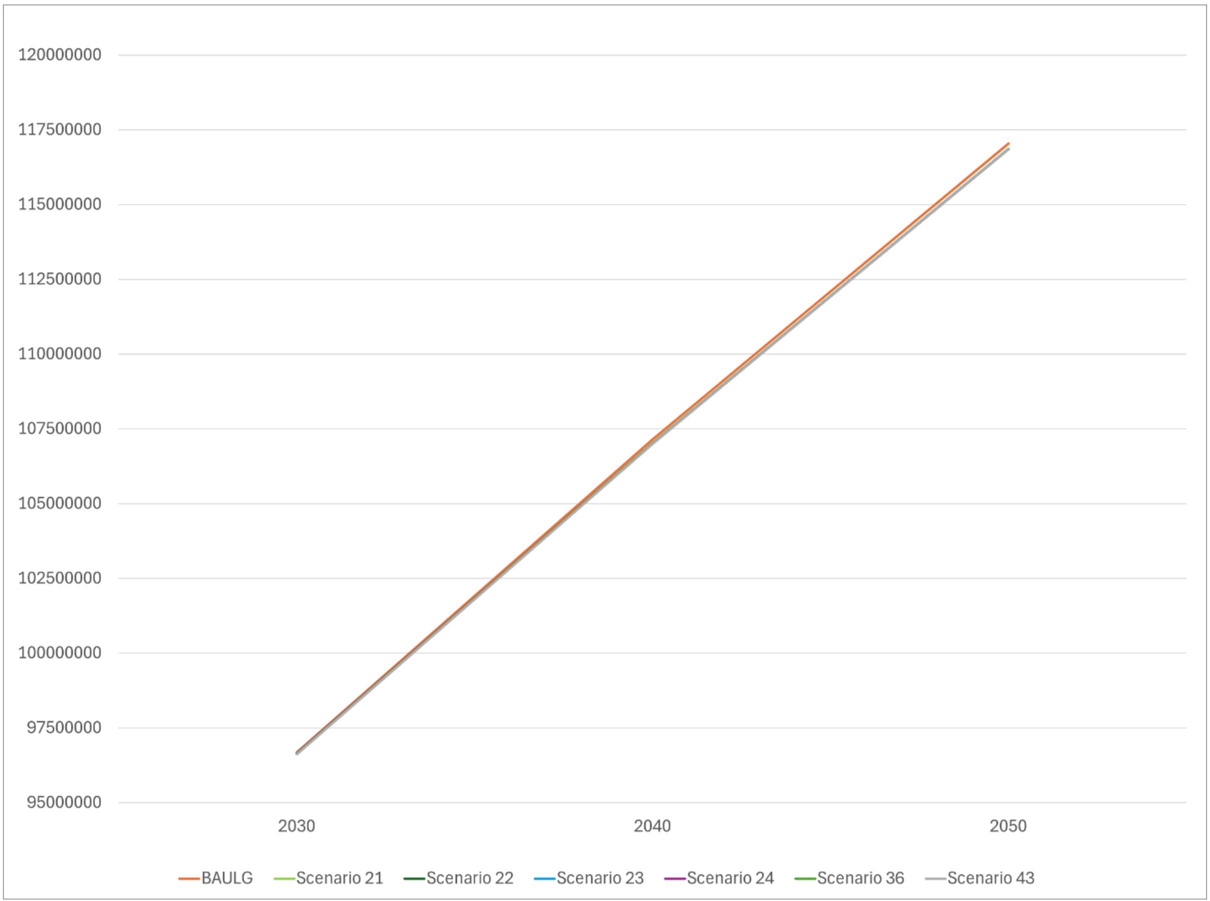
Developing economies experience an impact on their real GDP as well. The impact ranges from -0.05 to -0.07 per cent in 2030, and by 2050, it reaches -0.21 per cent in scenario 43 and -0.22 per cent in the remaining five scenarios. SIDS experience an impact on their GDP that is relatively larger than the world average. In 2030, the impact on their GDP ranges from -0.07 per cent in scenario 24 to -0.12 per cent in scenario 43. By 2050, it varies between -0.27 and -0.34 per cent. Of all groups of economies being considered, LDCs see the largest impact on their GDP ranging from -0.08 to -0.13 per cent in 2030 and -0.38 to -0.40 per cent by 2050.

Scenario 43 leads to the largest reductions in real GDP across all groups of economies in 2030. For instance, in 2030, the global real GDP reduction is -0.05 per cent, with the real GDP of SIDS and LDCs experiencing declines of -0.12 and -0.13 per cent, respectively. However, by 2040 and 2050, other scenarios lead to larger reductions in real GDP with scenario 43 no longer consistently showing the largest reduction.

Figure 8 shows the impact of the six policy scenarios on GDP relative BAULG for the snapshot years 2030, 2040 and 2050. The difference between BAULG and the scenarios varies between $95.9 billion (of 2017) for Scenario 26 SIDS and LDCs, and $188.6 billion (of 2017) for Scenario 22.[28]

Figure 8. World real GDP values in different scenarios

(Millions of dollars in 2017 prices)



Note: The real GDP values are based on GTAP data base and are on constant 2017 US$. The growth assumptions follow forecasts by the International Institute for Applied Systems Analysis (IIASA), SSP2, released in January 2024. These values do not represent an economic projection by UNCTAD and were used solely to model the impact in GTAP.

[28] According to the United States Bureau of Labor Statistics, US$ 1 in 2017 is equivalent to US$ 1.28 in 2024 (US Bureau of Labor Statistics, 2024). Therefore, extrapolating to 2024 $, the net impact would range between US$ 122.7 billion and US$ 241.4 billion.

6.2.3 *Consumer prices*

The six policy scenarios lead to an increase in consumer prices compared to the baseline BAULG at the global level and in the four groups of economies, with one exception, where for scenario 22 (Base, WtW, no flex, no levy, no feebate) consumer prices for SIDS in 2030 remain constant relative to BAULG prices (Table 17). The simulations reveal that LDCs experience the largest increase in consumer prices, followed by developed economies, developing economies, and SIDS.

Table 17. Impact on the consumer price index

(Percentage difference compared to BAULG)

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
21	2030	0.06	0.06	0.05	0.00	0.09
	2040	0.17	0.17	0.16	0.02	0.28
	2050	0.20	0.21	0.19	0.03	0.37
22	2030	0.05	0.06	0.05	0.00	0.08
	2040	0.17	0.17	0.16	0.02	0.28
	2050	0.20	0.21	0.19	0.03	0.37
23	2030	0.05	0.05	0.04	0.00	0.08
	2040	0.17	0.17	0.16	0.02	0.29
	2050	0.20	0.21	0.19	0.03	0.36
24	2030	0.04	0.05	0.04	0.00	0.06
	2040	0.16	0.17	0.15	0.01	0.27
	2050	0.20	0.21	0.18	0.03	0.36
36	2030	0.06	0.06	0.06	0.00	0.08
	2040	0.15	0.16	0.14	0.02	0.27
	2050	0.20	0.21	0.19	0.03	0.37
43	2030	0.07	0.07	0.07	0.01	0.13
	2040	0.19	0.19	0.17	0.01	0.32
	2050	0.20	0.20	0.18	0.02	0.35

For LDCs, the increase in consumer prices ranges between 0.06 to 0.13 per cent in 2030 and between 0.35 to 0.37 per cent in 2050. In developing economies, consumer prices are simulated to increase by 0.04 to 0.07 per cent in 2030 and by 0.18 to 0.19 per cent in 2050. Developed economies are simulated to experience increases in their consumer prices ranging from 0.05 to 0.07 per cent in 2030 and from 0.20 to 0.21 per cent in 2050. SIDS will experience the relatively, the smallest increase in consumer prices, ranging between no impact at all in 2030 to a marginal increase of 0.02 to 0.03 per cent in 2050.

6.3 Policy scenarios modelled with revenue disbursement

UNCTAD is modelling a wide range of scenarios in GTAP. This section discusses the scenarios modelled with a levy and a GFI with flexibility (scenarios 31, 32 and 46) and a levy and a GFI with no flexibility (scenario 26). As these hypothetical scenarios raise revenues, UNCTAD is modelling revenue disbursements in GTAP for these scenarios under Task 3.

6.3.1 Results before revenue disbursement in GTAP

The outcomes before revenue disbursement, presented in the following, have been generated solely to determine the allocation of revenues across countries, in accordance with the defined revenue disbursement schemes (see Section 3.2) and the policy scenarios allowing for parts of the generated revenues to be disbursed to pre-determined target countries. A consistent and coherent analysis requires comparing the results of scenarios after revenue disbursement with BAULG. The comparison of modelling results after revenue disbursement scenarios with modelling results under BAULG is provided in Section 5.3.2.

6.3.1.1 Exports and imports

Policy scenarios that include a levy and a GFI (scenarios 26, 31, 32 and 46) are simulated to lead to a reduction of global international trade[29] of goods and services, in constant prices (Table 18 and Table 19). The size of this reduction gradually increases over the period from 2030 to 2050, as the effects on maritime logistics costs increase. As a result, under all four policy scenarios with a levy, international trade in 2050 is simulated to be 0.23 per cent less than under the BAULG. Within scenarios, variation across 2030, 2040 and 2050 are less pronounced than variations within scenarios and across the three timelines relating the maritime logistics costs.

Table 18. Impact on export quantity before disbursement of revenues
(Percentage difference compared to BAULG)

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
26	2030	-0.12	-0.05	-0.23	0.04	-0.26
	2040	-0.20	-0.09	-0.38	0.07	-0.43
	2050	-0.23	-0.09	-0.42	0.07	-0.47
31	2030	-0.05	-0.02	-0.10	0.02	-0.12
	2040	-0.17	-0.07	-0.32	0.06	-0.36
	2050	-0.23	-0.09	-0.43	0.07	-0.47
32	2030	-0.06	-0.03	-0.12	0.02	-0.14
	2040	-0.17	-0.07	-0.32	0.06	-0.36
	2050	-0.23	-0.09	-0.43	0.07	-0.47
46	2030	-0.15	-0.06	-0.27	0.05	-0.31

[29] Global international trade is the same as world exports, which are equal to world imports.

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
	2040	-0.22	-0.09	-0.41	0.08	-0.46
	2050	-0.23	-0.10	-0.42	0.07	-0.47

In 2050, developing economies are simulated to experience larger reductions in their exports caused by the policy measures (-0.42 to -0.43 per cent in 2050) compared to reductions in the exports of developed economies (-0.09 to -0.10 per cent). The reduction in the exports of LDCs is larger than the reduction in the exports of the remaining groups of economies. Across scenarios and target years, SIDS are simulated to experience a marginal increase in their exports (0.07 per cent). Section 6.2.1 briefly details the potential explanatory factors driving the export increase in SIDS.

Similar to their exports and compared to BAULG, the imports of developing economies in 2050 experience relatively larger reductions due to increased maritime logistics costs (between -0.35 and -0.36 per cent). Imports of developed economies see a reduction of -0.13 per cent. SIDS and LDCs' imports experience reductions of -0.26 to 0.27 per cent and -0.32 and -0.35, respectively.

Table 19. Impact on import quantity before disbursement of revenues

(Percentage difference compared to BAULG)

Scenario	Year	Developed economies	Developing economies	SIDS	LDCs
26	2030	-0.07	-0.20	-0.15	-0.21
	2040	-0.11	-0.32	-0.24	-0.32
	2050	-0.13	-0.36	-0.27	-0.34
31	2030	-0.03	-0.09	-0.07	-0.09
	2040	-0.10	-0.26	-0.20	-0.25
	2050	-0.13	-0.35	-0.26	-0.32
32	2030	-0.03	-0.10	-0.07	-0.11
	2040	-0.10	-0.27	-0.20	-0.25
	2050	-0.13	-0.35	-0.26	-0.32
46	2030	-0.08	-0.24	-0.18	-0.24
	2040	-0.12	-0.34	-0.26	-0.34
	2050	-0.13	-0.36	-0.27	-0.35

Note: "World" is the same total as for exports (Table 18).

6.3.1.2 Gross domestic product

The four policy scenarios that include a levy and a GFI (26, 31, 32 and 46) lead to a reduction in real GDP (Table 20). At a global level, the impact on real GDP is amplified over time. In 2050, under all four scenarios, global real GDP is simulated to be 0.15 per cent smaller than under BAULG.

Table 20. Impact on real GDP before disbursement of revenues

(Percentage difference compared to BAULG)

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
26	2030	-0.08	-0.07	-0.11	-0.19	-0.20
	2040	-0.14	-0.11	-0.19	-0.30	-0.33
	2050	-0.15	-0.12	-0.21	-0.33	-0.36
31	2030	-0.04	-0.03	-0.05	-0.08	-0.09
	2040	-0.11	-0.09	-0.16	-0.24	-0.28
	2050	-0.15	-0.12	-0.21	-0.32	-0.37
32	2030	-0.04	-0.03	-0.06	-0.09	-0.10
	2040	-0.12	-0.09	-0.16	-0.25	-0.28
	2050	-0.15	-0.12	-0.21	-0.32	-0.37
46	2030	-0.10	-0.08	-0.13	-0.22	-0.23
	2040	-0.15	-0.11	-0.20	-0.32	-0.35
	2050	-0.15	-0.12	-0.21	-0.34	-0.37

Similar to what has been observed in the case of maritime logistics costs (see Section 5) and international trade volume, under the higher-levy no-flexibility scenarios (scenarios 26 and 46), the largest reduction in GDP caused by the GHG reduction measures occurs in 2030 and 2040 compared to the reduction in GDP simulated under scenarios 31 and 32 which are characterized by a lower-levy and flexibility.

Simulations for 2030 show that the largest impact on global GDP (-0.10 per cent) occurs under the high-levy scenario 46 that assumes a Strive GHG emissions trajectory. Meanwhile, the smallest impact on GDP in 2030 (-0.04 per cent) occurs under scenario 31 that is the low levy scenario with TtW GFI scope with sustainability criteria as well as under scenario 32, targeting a WtW GFI scope. Comparing the impact of the policy measure on GDP across groups of economies shows a larger reduction in the GDP of economies that do not fall within the group of developed economies. On average, developing economies experience a relatively larger reduction in GDP in 2050 (-0.21 per cent) compared to developed economies (-0.12 per cent). On average, the reductions in the GDP of SIDS (-0.32 to -0.34 per cent) and LDCs (-0.36 to -0.37 per cent) are larger compared to equivalent reductions in developing economies.

6.3.1.3 Consumer prices

Compared to BAULG, all four policy scenarios with a levy (26, 21, 32 and 46) are simulated to cause an increase in the global CPI in 2030, 2040 and 2050, and across all groups of economies (Table 21). While all four policy scenarios are simulated to drive up global consumer prices by 0.19 to 0.20 per cent in 2050, the effects are more differentiated for 2030. In 2030, the largest global increases in consumer prices occur under scenario 46 characterized by a high-levy with a Strive GHG emissions trajectory without GFI flexibility (0.13 per cent) and scenario 26 featuring a high-levy with a Base GHG emissions trajectory without GFI flexibility (0.11 per cent). In 2030, the increase in global consumer prices is expected to moderate to 0.05 per cent under the low-levy scenarios with GFI flexibility, namely scenario 32 (with a WtW GFI scope) and scenario 31 (with a TtW GFI scope with sustainability criteria).

Table 21. Impact on the consumer price index before disbursement of revenues
(Percentage difference compared to BAULG)

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
26	2030	0.11	0.11	0.10	0.01	0.17
	2040	0.18	0.18	0.16	0.02	0.30
	2050	0.19	0.20	0.18	0.02	0.34
31	2030	0.05	0.05	0.04	0.00	0.08
	2040	0.14	0.15	0.14	0.02	0.25
	2050	0.19	0.20	0.18	0.03	0.36
32	2030	0.05	0.06	0.05	0.00	0.08
	2040	0.15	0.15	0.14	0.02	0.26
	2050	0.19	0.20	0.18	0.04	0.36
46	2030	0.13	0.13	0.12	0.00	0.20
	2040	0.19	0.20	0.18	0.02	0.32
	2050	0.20	0.20	0.18	0.02	0.34

While, in general, the average size of the simulated increases in consumer prices is comparable in developed and developing economies, consumer price increases are relatively larger for LDCs and smaller for SIDS.

6.3.2 *Simulated impacts after revenue disbursement*

6.3.2.1 Revenues generated and disbursed

Table 22 provides an overview of the average annual revenue streams that are available for disbursement as reward to the shipping sector for eligible fuels (D4) and for, other purposes. to the States ('other') under each of the examined scenarios. Disbursement for 'other' is determined as a remainder of the total revenue after D4 has been distributed to the fleet according to DNV modelling under Task 2. Under Task 3 modelling, 'other' is distributed to the beneficiary economies in accordance with the method outlined in Section 4.5. We assume that revenues collected in the period up to a snapshot year, from 2027 to 2030, from 2031 to 2040 and from 2041 to 2050, are disbursed in equal proportions each year over that period. The costs are presented as average values in billion US$ per year over the respective periods, rather than as snapshots of specific target years.

Table 22. Revenue streams (annual)

(Billion US$. Source: (DNV, 2024a))

Scenario	Period	Collected	Disbursed	
			D4	States
26	2027-2030	127.2	5.8	121.4
	2031-2040	102.8	14.5	88.3
	2041-2050	35.7	-	35.7
31	2027-2030	29.5	10.1	21.8
	2031-2040	33.6	32.5	6.4
	2041-2050	5.7	1.6	6.5
32	2027-2030	36.0	20.2	18.0
	2031-2040	47.0	24.6	26.8
	2041-2050	15.4	1.5	16.2
46	2027-2030	117.5	16.8	100.7
	2031-2040	81.7	26.6	55.2
	2041-2050	23.7	-	23.7

Table 23 provides an overview of the 'Other' revenues disbursed, in total and per capita to the different groups of economies under each of the examined scenarios for all revenue disbursement schemes in 2030, 2040 and 2050.

Table 23. Revenue disbursement, total and per capita, under all schemes

Scenario	Year	In total (billion US$)					Per capita (US$)				
		World	Dev'ed	Dev'ing	SIDS	LDCs	World	Dev'ed	Dev'ing	SIDS	LDCs
Revenues disbursed to all economies											
26	2030	121.4	11.30	110.10	1.57	28.39	16.86	14.59	18.35	25.42	27.82
	2040	88.3	7.37	80.93	1.07	22.92	11.41	9.67	12.55	16.44	19.49
	2050	35.7	2.92	32.78	0.23	7.27	3.45	2.98	3.76	2.50	5.53
31	2030	21.8	2.03	19.77	0.28	5.10	2.67	2.60	2.71	3.75	1.87
	2040	6.4	0.53	5.87	0.08	1.66	0.73	0.70	0.75	0.95	0.53
	2050	6.5	0.53	5.97	0.04	1.32	0.56	0.54	0.57	0.40	0.19
32	2030	18	1.68	16.32	0.23	4.21	2.50	2.16	2.72	3.77	4.12
	2040	26.8	2.24	24.56	0.33	6.96	3.46	2.94	3.81	4.99	5.91
	2050	16.2	1.32	14.88	0.10	3.30	1.57	1.35	1.71	1.13	2.51
46	2030	100.7	9.37	91.33	1.30	23.55	13.99	12.10	15.23	21.09	23.07
	2040	55.2	4.60	50.60	0.67	14.33	7.13	6.05	7.85	10.27	12.18
	2050	23.7	1.94	21.76	0.15	4.83	2.29	1.98	2.50	1.66	3.67
Revenues disbursed to developing economies, LDCs and SIDS											
26	2030	121.4	0.20	121.20	1.73	31.25	12.73	1.35	20.21	27.99	30.62
	2040	88.3	0.11	88.19	1.17	24.98	8.56	0.77	13.68	17.91	21.23

Scenario	Year	In total (billion US$)					Per capita (US$)				
		World	Dev'ed	Dev'ing	SIDS	LDCs	World	Dev'ed	Dev'ing	SIDS	LDCs
	2050	35.7	0.02	35.68	0.25	7.91	2.52	0.11	4.09	2.72	6.02
31	2030	21.8	0.04	21.76	0.31	5.61	2.29	0.24	3.63	5.03	5.50
	2040	6.4	0.01	6.39	0.08	1.81	0.62	0.06	0.99	1.30	1.54
	2050	6.5	0.00	6.50	0.04	1.44	0.46	0.02	0.74	0.50	1.10
32	2030	18	0.03	17.97	0.26	4.63	1.89	0.20	3.00	4.15	4.54
	2040	26.8	0.03	26.77	0.35	7.58	2.60	0.23	4.15	5.44	6.44
	2050	16.2	0.01	16.19	0.11	3.59	1.14	0.05	1.86	1.23	2.73
46	2030	100.7	0.16	100.54	1.43	25.92	10.56	1.12	16.76	23.21	25.40
	2040	55.2	0.07	55.13	0.73	15.61	5.35	0.48	8.55	11.20	13.27
	2050	23.7	0.02	23.68	0.16	5.25	1.67	0.08	2.72	1.80	4.00
Revenues disbursed to LDCs and SIDS											
26	2030	121.4	0.72	120.68	6.36	115.04	13.60	4.97	19.27	103.01	112.72
	2040	88.3	0.38	87.92	3.94	84.36	8.34	2.61	12.10	60.48	71.72
	2050	35.7	0.10	35.60	1.08	34.62	2.41	0.50	3.66	11.90	26.34
31	2030	21.8	0.13	21.67	1.14	20.66	2.44	0.89	3.46	18.50	20.24
	2040	6.4	0.03	6.37	0.29	6.11	0.60	0.19	0.88	4.38	5.20
	2050	6.5	0.02	6.48	0.20	6.30	0.44	0.09	0.67	2.17	4.80
32	2030	18	0.11	17.89	0.94	17.06	2.02	0.74	2.86	15.27	16.71
	2040	26.8	0.11	26.69	1.20	25.60	2.53	0.79	3.67	18.36	21.77
	2050	16.2	0.05	16.15	0.49	15.71	1.09	0.23	1.66	5.40	11.95
46	2030	100.7	0.60	100.10	5.27	95.43	11.28	4.13	15.99	85.45	93.50
	2040	55.2	0.24	54.96	2.46	52.74	5.21	1.63	7.56	37.81	44.83
	2050	23.7	0.07	23.63	0.71	22.99	1.60	0.33	2.43	7.90	17.49

Note: The world total is the sum of the figures for developing and developed economies. LDCs and SIDS are included in developing or developed economies.

6.3.2.2 Exports and imports

When not receiving revenue disbursements, developed economies, experience a positive, albeit moderate, impact (*i.e.* an increase in exports with reference to BAULG) of the policy combinations (Table 18). LDCs, as a group, experience a relatively large reduction in their exports as result of the policy measures after disbursement (Table 24).

Under the scheme in which revenues are disbursed to SIDS and LDCs only, LDCs' exports are reduced by up to one-third, under the scenario with high-levy no-flexibility scenario and with Base emissions trajectory (scenario 26), in the years 2040–2050. It should be noted that under this revenue disbursement scheme, LDCs, and to a lesser extent, SIDS, experience an appreciation of their currency (the real exchange rate) making their exports relatively more expensive on the global marketplace and leading to higher export prices. Conversely, it makes imports cheaper, resulting in lower import prices.

Table 24. Impact on export quantity after disbursement of revenues

(Percentage difference compared to BAULG)

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
Revenues disbursed to all economies						
26	2030	-0.51	-0.06	-1.20	-0.23	-6.50
	2040	-0.85	-0.11	-1.93	-0.36	-9.79
	2050	-0.97	-0.14	-2.18	-0.39	-10.55
31	2030	-0.12	-0.03	-0.28	-0.03	-1.27
	2040	-0.26	-0.07	-0.54	-0.01	-1.74
	2050	-0.34	-0.09	-0.68	0.01	-2.00
32	2030	-0.12	-0.03	-0.26	-0.02	-1.08
	2040	-0.31	-0.08	-0.65	-0.03	-2.32
	2050	-0.41	-0.10	-0.84	-0.03	-2.78
46	2030	-0.46	-0.07	-1.07	-0.17	-5.49
	2040	-0.70	-0.11	-1.57	-0.25	-7.63
	2050	-0.78	-0.13	-1.73	-0.27	-8.13
Revenues disbursed to developing economies, SIDS and LDCs						
26	2030	-0.50	0.00	-1.30	-0.27	-7.12
	2040	-0.85	-0.01	-2.08	-0.42	-10.68
	2050	-0.97	-0.02	-2.35	-0.45	-11.49
31	2030	-0.12	-0.01	-0.30	-0.04	-1.38
	2040	-0.26	-0.06	-0.56	-0.01	-1.88
	2050	-0.34	-0.08	-0.71	0.00	-2.15
32	2030	-0.12	-0.02	-0.28	-0.02	-1.18
	2040	-0.31	-0.05	-0.68	-0.04	-2.51
	2050	-0.41	-0.07	-0.88	-0.04	-3.00
46	2030	-0.46	-0.02	-1.16	-0.21	-6.01
	2040	-0.70	-0.03	-1.69	-0.29	-8.32
	2050	-0.78	-0.04	-1.85	-0.32	-8.86
Revenues disbursed to SIDS and LDCs						
26	2030	-0.47	0.06	-1.29	-1.34	-23.89
	2040	-0.80	0.07	-2.08	-2.06	-33.20
	2050	-0.91	0.08	-2.35	-2.25	-35.77
31	2030	-0.12	0.00	-0.30	-0.23	-4.73
	2040	-0.25	-0.04	-0.57	-0.25	-5.82
	2050	-0.33	-0.06	-0.72	-0.27	-6.59
32	2030	-0.12	-0.01	-0.28	-0.18	-3.95
	2040	-0.31	-0.04	-0.69	-0.38	-7.79
	2050	-0.40	-0.05	-0.90	-0.45	-9.50
46	2030	-0.43	0.03	-1.16	-1.10	-20.22
	2040	-0.66	0.03	-1.69	-1.54	-26.46

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
	2050	-0.74	0.04	-1.87	-1.67	-28.34

On average, the impact of the policy measure on *imports* after the disbursement of revenue is negative (*i.e.* import reduction) for both developed and developing economies, with relatively reductions occurring in the group of developed economies (Table 25).

By contrast, on average, after the revenue disbursement, the policy measure leads to increases in LDCs' imports by almost 19 per cent under scenario 26 when revenues are disbursed to SIDS and LDCs only. This suggests that disbursing revenues to LDCs generates effects that outweigh the negative effects caused by a reduction in imports that follows an increase in maritime logistics costs. On average, SIDS experience an overall import reduction, except under the two scenarios with a higher GHG price (scenarios 26 and 46) and when revenues are disbursed to SIDS and LDCs only.

Table 25. Impact on import quantity after disbursement of revenues

(Percentage difference compared to BAULG)

Scenario	Year	Developed economies	Developing economies	SIDS	LDCs
Revenues disbursed to all economies					
26	2030	-0.60	-0.31	-0.49	1.91
	2040	-0.99	-0.55	-0.81	2.88
	2050	-1.13	-0.65	-0.93	3.12
31	2030	-0.12	-0.11	-0.13	0.28
	2040	-0.22	-0.29	-0.27	0.20
	2050	-0.27	-0.39	-0.36	0.17
32	2030	-0.11	-0.12	-0.12	0.20
	2040	-0.28	-0.32	-0.32	0.38
	2050	-0.37	-0.43	-0.43	0.42
46	2030	-0.52	-0.33	-0.46	1.50
	2040	-0.78	-0.51	-0.68	2.08
	2050	-0.87	-0.57	-0.76	2.24
Revenues disbursed to developing economies, SIDS and LDCs					
26	2030	-0.62	-0.27	-0.47	2.17
	2040	-1.03	-0.48	-0.77	3.28
	2050	-1.17	-0.57	-0.90	3.54
31	2030	-0.13	-0.10	-0.12	0.33
	2040	-0.22	-0.28	-0.27	0.25
	2050	-0.28	-0.38	-0.35	0.23
32	2030	-0.12	-0.11	-0.12	0.24
	2040	-0.29	-0.31	-0.31	0.45
	2050	-0.38	-0.42	-0.42	0.51

Scenario	Year	Developed economies	Developing economies	SIDS	LDCs
46	2030	-0.54	-0.29	-0.44	1.72
	2040	-0.80	-0.46	-0.66	2.37
	2050	-0.90	-0.51	-0.74	2.56
Revenues disbursed to SIDS and LDCs					
26	2030	-0.65	-0.11	0.12	11.02
	2040	-1.07	-0.27	0.12	16.63
	2050	-1.23	-0.33	0.08	18.61
31	2030	-0.14	-0.08	-0.02	1.78
	2040	-0.23	-0.26	-0.14	1.99
	2050	-0.29	-0.35	-0.21	2.24
32	2030	-0.12	-0.09	-0.04	1.44
	2040	-0.30	-0.28	-0.13	2.84
	2050	-0.40	-0.37	-0.20	3.57
46	2030	-0.57	-0.17	0.04	8.92
	2040	-0.84	-0.30	0.02	12.27
	2050	-0.94	-0.34	0.00	13.55

Note: “World” is the same total as for exports (Table 24).

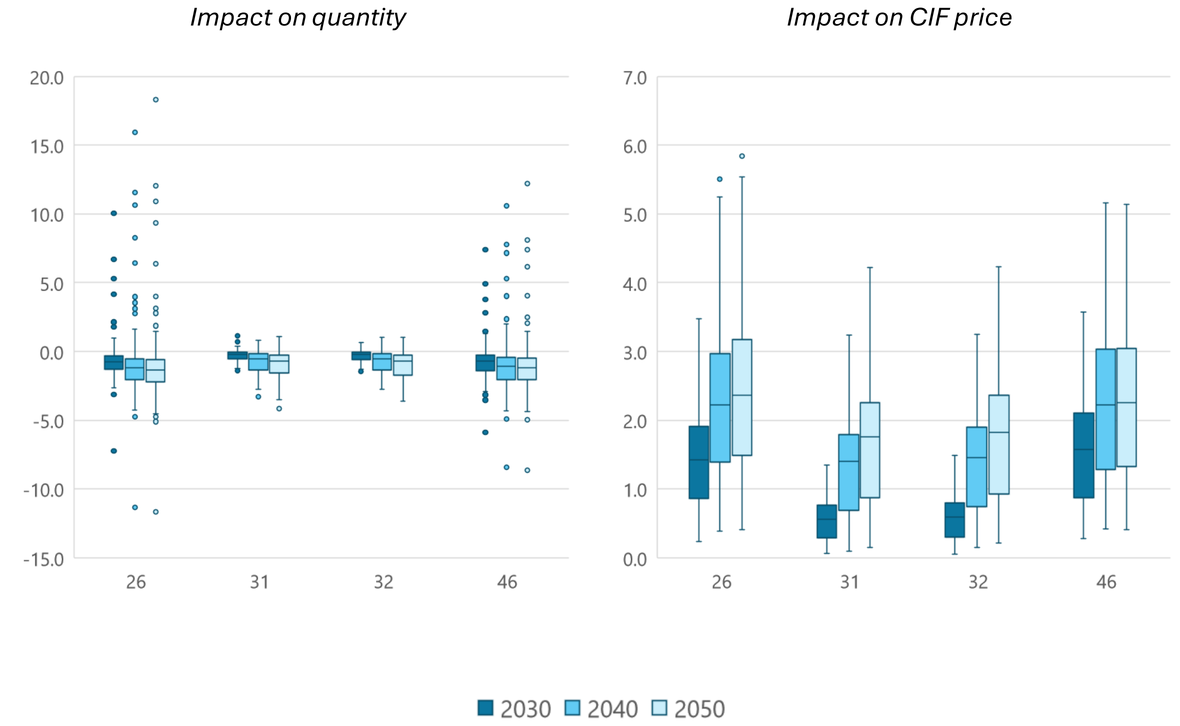
Figure 9 shows the simulated effect on the quantity and price of agricultural product imports, under a disbursement scheme in which all countries are considered eligible for receipt of the disbursed revenues.

Under all scenarios and in all years, the simulations show a certain reduction of the quantity of agricultural product imports, which could potentially constrain food supply, in around three quarters of the economies. The simulations also show a certain increase in the import of agricultural products in around one quarter of the economies. In almost all cases, the prices of agricultural product imports are simulated to increase in response to the policy measure. However, the average size and spread of the percentage increase in these prices vary considerably between scenarios 26 and 46, on the one hand, in which a higher levy is assumed, and scenarios 31 and 32 on the other, under which the amount of the levy is lower. In the first case, the magnitude and distribution of the reduction in agricultural product imports and the increased prices of agricultural commodities imported, are relatively larger in 2030 and 2040, but monotonically decrease over time.

The quantity of agricultural product imports is simulated to reduce by up to 2.9 per cent on the back of the policy measure in 2030, with the exception of a few outlying cases. By 2050, this threshold will rise to 4.5 percent, according to the simulations. The prices of food imports are simulated to increase by up to 3.6 per cent compared to BAULG in 2030, 5.3 per cent in 2040, and 5.5 per cent in 2050. In another case, under scenarios 31 and 32, the reduction of the quantity of agricultural imports remains below -2.0 per cent in all years compared, with the reduction, on average, measured by the median, from 2030 to 2040, amplifying to some extent. The reduction in imports moderates, on average, from 2040 to 2050. The increase in the price of agricultural product imports remains in all economies below 1.9 per cent under scenarios 31 and 32 and follows a similar trend over time as the reduction in quantities.

Figure 9. Impacts on the quantity and the CIF price of imports of agricultural products, and their spread across economies, when revenues are disbursed among all countries

(Percentage difference compared to BAULG)



To examine the impact of the applied revenue disbursement scheme, Figure 10 compares the percentage reduction (compared to BAULG) in the quantity of agricultural product imports under scenarios 26 and 32, two scenarios that are derived from a Base emissions trajectory and apply a WtW GFI scope but differ in the amount of the levy. The graphs show a relatively stable distribution of the percentage reduction in agricultural product imports under the three revenue disbursement schemes compared. However, disbursement of revenues to SIDS and LDCs only, leads to increases in the agricultural product imports of few countries.

Similar trends are observed when considering the increase in agricultural product import prices, as shown on Figure 11. The electronic annex in xls format presents the simulated impact of the policy combinations with a levy, under the different revenue disbursement schemes, on the quantity and prices of food imports by GTAP economy.

Figure 10. Impact of the policy combinations under scenarios 26 and 32 on the quantity of imports of agricultural products, across economies and by countries receiving the revenues disbursed

(Percentage difference compared to BAULG)

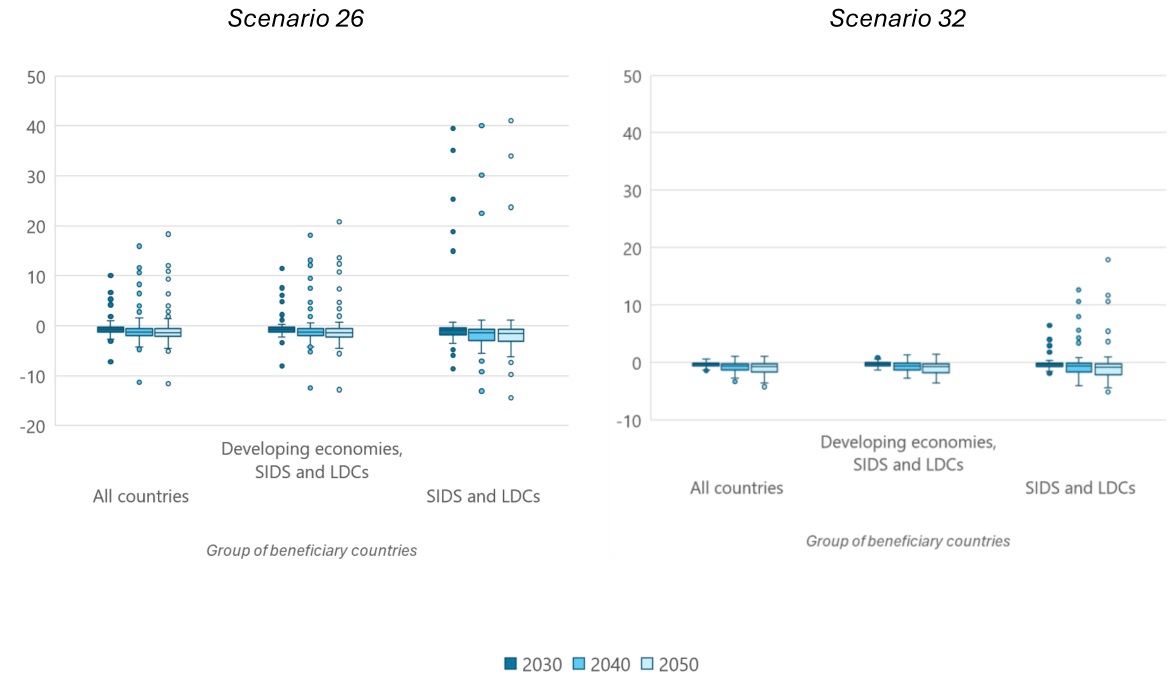
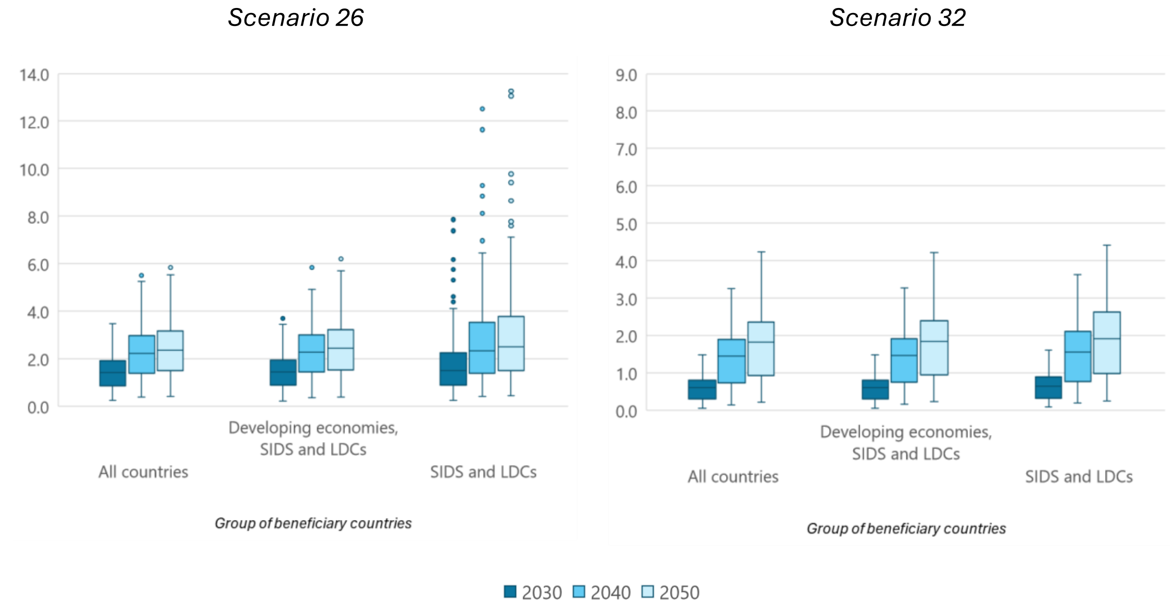


Figure 11. Impact of the policy combinations under scenarios 26 and 32 on the CIF price of imports of agricultural products, across economies and countries receiving the revenues disbursed

(Percentage difference compared to BAULG)



6.3.2.3 Gross domestic product

When revenues are disbursed to all economies, scenario 46 in for 2030 results in the largest impact on global GDP (-0.07 per cent) while scenario 31 results in the smallest impact (-0.03 per cent).

By 2050, scenario 31 leads to the largest impact with a global GDP reduction of -0.14 per cent. Developing economies' GDP experiences a negative impact of -0.20 per cent and that of LDCs faces an impact of -0.32 per cent. In 2050, scenario 26 results in the smallest impact on global GDP (-0.09 per cent) while GPD of LDCs shows a smaller impact (-0.01 per cent).

When revenues are disbursed to developing economies, SIDS, and LDCs, scenario 26 shows a marginal increase of 0.02 per cent in the real GDP of LDCs in 2050 compared to BAULG. The GDP of SIDS sees a reduction of -0.18 per cent. In 2050, scenario 31 results in a reduction in the world GDP (-0.14 per cent). LDCs experience a relatively larger reduction in their GDP (-0.32 per cent).

Under the scheme where revenues are disbursed specifically to SIDS and LDCs, global GDP increases by 0.79 per cent under scenario 26 in 2050 compared to BAULG. For comparison and during the same timeframe, SIDS face a smaller impact on their GDP (-0.04 per cent). Scenario 26 specification with revenues disbursed only to SIDS and LDCs, leads to the relatively smallest reduction in the world GDP as well as in the GDP of developing economies, that is notwithstanding the fact that the revenue is only disbursed to a subset of developing economies. This is because all economies are connected through trade (in practice and in the modelling), so an increase in consumption in SIDS and LDCs due to revenue distribution, can also lead to an increase in trade, which can stimulate economic development in the trading partners of those countries receiving revenues.

Scenario 31 continues to show the largest impact on the world GDP (-0.14 per cent) in 2050. SIDS experience the largest GDP reduction (-0.28 per cent) while LDCs see their GDP reduced by -0.20 relative to the BAU scenario. Under scenario 46, LDCs experience a 0.5 per cent increase in real GDP in 2050.

Overall, the reduction in the GDP of developed economies after revenue disbursement caused by the policy measure, does not vary much across the four scenarios and distribution schemes. In contrast, the reduction in the GDP of developing economies is lessened when revenues are disbursed to SIDS and LDCs only. Generally, for scenarios which include a levy, the reduction in GDP is relatively smaller in all analysed years, once the effects of revenue distribution are taken into account.

The smaller reduction in GDP occurs not only in the economies that directly receive the revenues disbursed, but also in the ones that do not receive the disbursement, reflecting a stimulated demand for their exports in response to the increased income abroad.

When comparing the effects across groups of economies, in 2050, revenue disbursement has the effect to lessen the reduction in GDP (relative to BAULG) caused by the increase in maritime logistics costs driven by the candidate mid-term GHG reduction measures. This is more pronounced in the case of the developing economies compared to the developed ones. This is especially the case for LDCs. Meanwhile, the impact on the GDP of developed economies, as a group, remains negative (i.e. reduction in GDP) in all four scenarios, especially when disbursements are limited to SIDS and LDCs only. All in all, the impact on the GDP of developing economies is relatively larger than the impact on the GDP of developed economies.

Table 26. Impact on real GDP after disbursement of revenues

(Percentage difference to BAULG)

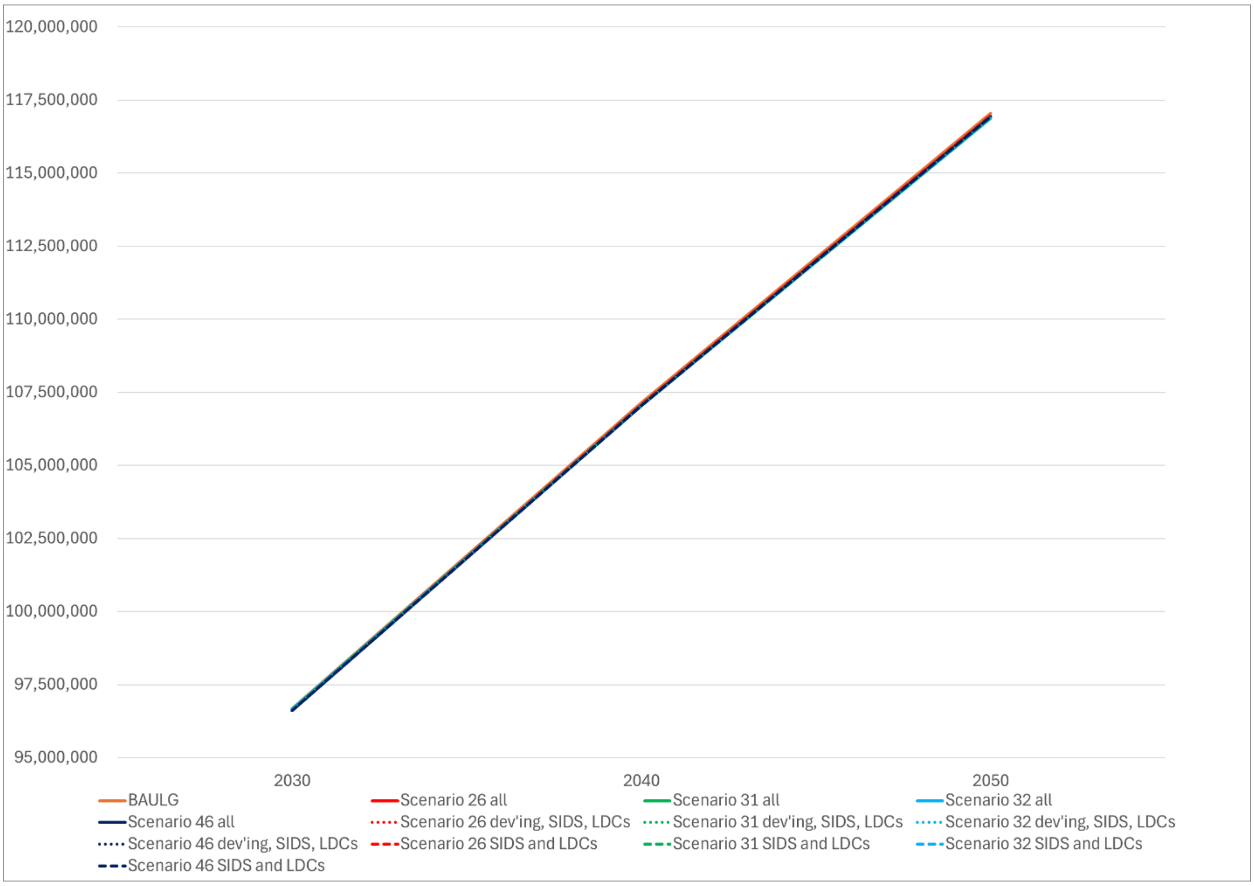
Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
Revenues disbursed to all economies						
26	2030	-0.05	-0.04	-0.06	-0.11	0.00
	2040	-0.08	-0.07	-0.11	-0.17	-0.01
	2050	-0.09	-0.07	-0.11	-0.19	-0.01
31	2030	-0.03	-0.02	-0.04	-0.07	-0.05
	2040	-0.11	-0.08	-0.14	-0.23	-0.23
	2050	-0.14	-0.11	-0.20	-0.30	-0.32
32	2030	-0.04	-0.03	-0.05	-0.08	-0.07
	2040	-0.10	-0.08	-0.14	-0.22	-0.21
	2050	-0.14	-0.10	-0.19	-0.29	-0.29
46	2030	-0.07	-0.06	-0.09	-0.16	-0.07
	2040	-0.11	-0.08	-0.14	-0.23	-0.11
	2050	-0.11	-0.09	-0.14	-0.23	-0.10
Revenues disbursed to developing economies, SIDS and LDCs						
26	2030	-0.05	-0.04	-0.06	-0.10	0.02
	2040	-0.08	-0.07	-0.10	-0.17	0.01
	2050	-0.09	-0.07	-0.11	-0.18	0.02
31	2030	-0.03	-0.03	-0.04	-0.06	-0.05
	2040	-0.11	-0.08	-0.14	-0.23	-0.23
	2050	-0.14	-0.11	-0.20	-0.30	-0.32
32	2030	-0.04	-0.03	-0.05	-0.08	-0.07
	2040	-0.10	-0.08	-0.14	-0.22	-0.21
	2050	-0.14	-0.11	-0.19	-0.29	-0.28
46	2030	-0.07	-0.06	-0.09	-0.15	-0.06
	2040	-0.11	-0.09	-0.14	-0.22	-0.10
	2050	-0.11	-0.09	-0.14	-0.23	-0.08
Revenues disbursed to SIDS and LDCs						
26	2030	-0.05	-0.04	-0.05	-0.02	0.47
	2040	-0.08	-0.07	-0.09	-0.04	0.69
	2050	-0.08	-0.08	-0.09	-0.04	0.79
31	2030	-0.03	-0.03	-0.04	-0.05	0.03
	2040	-0.11	-0.08	-0.14	-0.21	-0.13
	2050	-0.14	-0.11	-0.20	-0.28	-0.20

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
32	2030	-0.04	-0.03	-0.05	-0.07	0.00
	2040	-0.10	-0.08	-0.14	-0.19	-0.07
	2050	-0.14	-0.11	-0.18	-0.26	-0.10
46	2030	-0.07	-0.06	-0.08	-0.08	0.32
	2040	-0.10	-0.09	-0.12	-0.13	0.42
	2050	-0.10	-0.09	-0.12	-0.12	0.50

Figure 12 shows the impact of the examined policy scenarios with revenue disbursements, on the world GDP relative to BAULG for the snapshot years 2030, 2040 and 2050. The policy scenarios are simulated to have only a minimal impact on GDP relative to BAULG, suggesting that the economic growth trajectory remains largely stable with the implementation of the GHG emission reduction mid-term measure.

Figure 12. World real GDP in scenarios with revenue distribution

(Millions of dollars in 2017 prices)



Note: The real GDP values are based on GTAP data base and are on constant 2017 US$. The growth assumptions follow forecasts by the International Institute for Applied Systems Analysis (IIASA), SSP2, released in January 2024. These values do not represent an economic projection by UNCTAD or any of the authors and were used solely to model the impact in GTAP.

6.3.2.4 Consumer prices

When revenues are disbursed to all economies, the largest increase in the CPI caused by the policy measures that drive up maritime transport costs, occurs under scenario 26 with the global CPI increasing by 0.39 per cent in 2050 (Table 27). Under the same scenarios, developing economies experience a rise of 1.18 per cent in their CPI. LDCs' CPI sees an increase of 5.15 per cent. In contrast, developed economies experience a reduction in their CPI (-0.06 per cent). In 2050, scenario 31 leads to the smallest increase in the global CPI (0.22 per cent). In 2050, scenario 31 lead to the relatively smallest increase in LDCs' CPI (1.04 per cent).

When revenues are disbursed to developing economies, SIDS, and LDCs, scenario 26 again leads to the largest impact on the global CPI with an increase of 0.38 per cent in 2050. Developing economies experience an increase of 1.30 per cent in their CPI while the CPI for LDCs increases by 5.66 per cent. In contrast, under this same scenario and in 2050, developed economies see a reduction of -0.13 per cent in their CPI. In 2050, scenario 31 leads to the smallest increases in the global CPI (0.22 per cent) and that of LDCs (1.12 per cent).

When revenues are disbursed to SIDS and LDCs only, in 2050, LDCS experience the largest increase in their CPI (21.42 per cent) under scenario 26. In 2050, the global CPI increases by 0.38 per cent while that of developing economies increases by 1.38 per cent. The CPI of developed economies sees a reduction of -0.18 per cent in 2050. Scenario 31 leads to the smallest increase in the global CPI (0.22 per cent) while the CPI of LDCs goes up by 3.16 per cent.

The increase in the global CPI, is roughly twice as high, when a revenue disbursement scheme is implemented, compared to instances where there is no such scheme (see Section 6.3.1.3). This holds true for all three revenue disbursement schemes considered (i.e. with disbursements directed to all economies; developing economies, SIDS and LDCs; and SIDS and LDCs only). This difference, in percentage terms, is larger under the higher levy price (scenarios 26 and 46) than the lower levy scenarios (scenarios 31 and 32).

Table 27. Impact on the consumer price index after disbursement of revenues
(Percentage difference compared to BAULG)

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
Revenues disbursed to all economies						
26	2030	0.21	-0.05	0.68	0.12	3.08
	2040	0.34	-0.06	1.07	0.21	4.76
	2050	0.39	-0.06	1.18	0.22	5.15
31	2030	0.07	0.02	0.15	0.03	0.59
	2040	0.17	0.11	0.26	0.05	0.87
	2050	0.22	0.16	0.32	0.06	1.04
32	2030	0.07	0.03	0.14	0.02	0.50
	2040	0.18	0.10	0.32	0.06	1.14
	2050	0.24	0.14	0.41	0.08	1.39
46	2030	0.21	0.00	0.59	0.10	2.60

Scenario	Year	World	Developed economies	Developing economies	SIDS	LDCs
	2040	0.31	0.01	0.86	0.16	3.68
	2050	0.34	0.01	0.93	0.16	3.93
Revenues disbursed to developing economies, SIDS and LDCs						
26	2030	0.21	-0.09	0.75	0.15	3.39
	2040	0.34	-0.12	1.18	0.24	5.23
	2050	0.38	-0.13	1.30	0.26	5.66
31	2030	0.07	0.01	0.16	0.03	0.64
	2040	0.17	0.11	0.28	0.05	0.94
	2050	0.22	0.15	0.34	0.07	1.12
32	2030	0.07	0.03	0.15	0.03	0.55
	2040	0.18	0.09	0.34	0.07	1.23
	2050	0.24	0.13	0.43	0.08	1.50
46	2030	0.21	-0.04	0.65	0.12	2.86
	2040	0.31	-0.04	0.94	0.19	4.04
	2050	0.34	-0.04	1.01	0.19	4.31
Revenues disbursed to SIDS and LDCs						
26	2030	0.20	-0.13	0.81	1.08	12.85
	2040	0.34	-0.17	1.24	1.66	19.43
	2050	0.38	-0.18	1.38	1.79	21.42
31	2030	0.06	0.01	0.16	0.20	2.16
	2040	0.17	0.10	0.28	0.25	2.75
	2050	0.22	0.15	0.34	0.29	3.16
32	2030	0.07	0.02	0.15	0.16	1.80
	2040	0.18	0.09	0.34	0.35	3.69
	2050	0.24	0.13	0.44	0.42	4.55
46	2030	0.21	-0.07	0.70	0.90	10.52
	2040	0.31	-0.07	0.98	1.26	14.53
	2050	0.33	-0.08	1.06	1.35	15.78

6.4 Variability of impact within groups of economies

Results in Sections 6.1 to 6.3 are presented and discussed as aggregated results for groups of economies. However, within those groups there can be significant variability due to differences in individual economies' geographical and economic circumstances, among other features. For example, SIDS include both developed and developing economies, showing a broad range of per-capita income levels and featuring varying shipping connectivity levels and trade structures.

While SIDS and LDCs, as groups, experience some of the largest impacts under the different policy scenarios, there remains some variability as regards impacts at the individual economy level. Understanding this variability can help to further clarify similarities and differences between SIDS and LDC groups of economies. It can also improve understanding of the relative impact on SIDS, LDCs, developing and developed economies as discrete populations of economies – as opposed to a group of economies with a single aggregate impact.

Results at the individual economy level provide some basis to explore this variability (see Annex). However, with 112 economies being modelled, it is difficult to identify patterns and trends. Discerning these patterns across the results for 22 scenarios is also a complex endeavour. Consequently, this section focuses on a subset of four scenarios, that are relatively comparable while holding constant two of the parameters Base/Strive and TtW/WtW, but containing systematic permutations of the other parameters used, namely flexibility mechanism, levy and feebate:

- Scenario 24 – GFS with a flexibility mechanism, no levy or feebate
- Scenario 26 – GFS without flexibility mechanism, levy ($150-300) no feebate
- Scenario 32 – GFS with a flexibility mechanism, levy ($30-120) no feebate
- Scenario 36 – GFS with a flexibility mechanism, no levy and a feebate

For comparability, under scenarios 26 and 32 the focus is on the revenue disbursement scheme that envisages revenue disbursement to developing economies, SIDS and LDCs, while being conscious that different revenue distribution options may cause significant differences at the level of individual economies.

As mentioned above, due to limitations in the input data and in computation, GTAP runs do not produce simulations for many economies from SIDS and LDCs at the level of individual States. In total, only three LDCs and four individual SIDS are represented in the model outputs as individual GTAP economies. The others are included in regional aggregations, such as the “Rest of Caribbean” and “the Rest of Western Africa”. The presentation of results below therefore only partially captures some of the variability within SIDS and LDCs.

The variability of the percentage change in real GDP in the short run (2030) resulting from the four policy scenarios above is set out in Figure 13. Equivalent information for 2050 is presented in Figure 14.

Figure 13. Variability in GDP impact in 2030 for each group of economies, sample of four scenarios

(Percentage difference to BAULG)

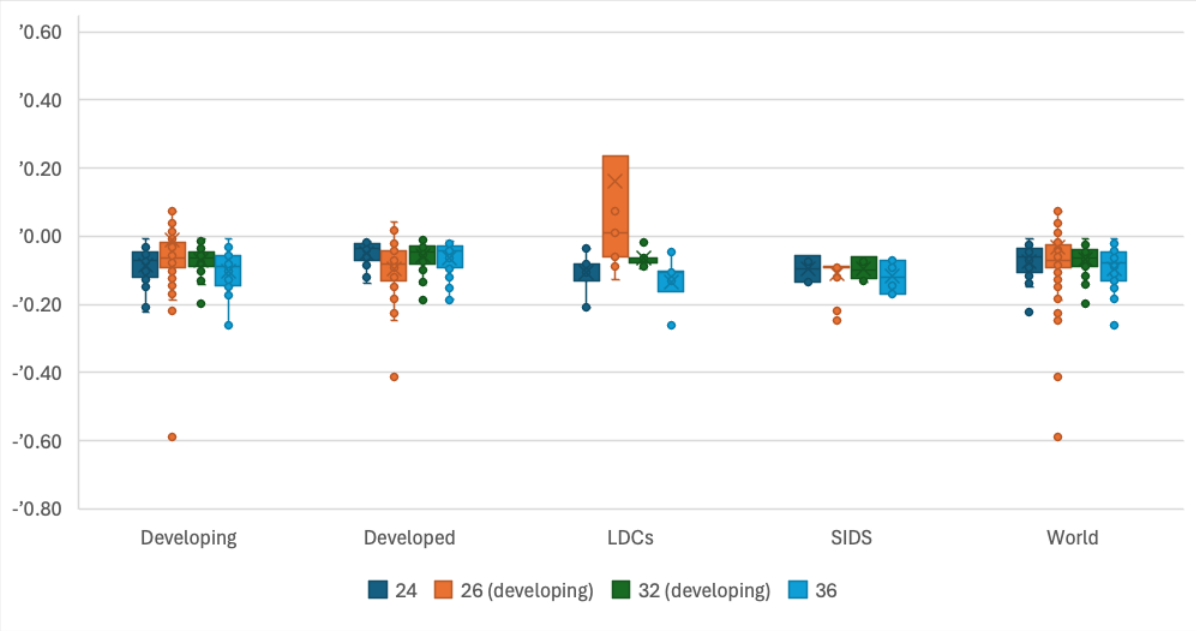
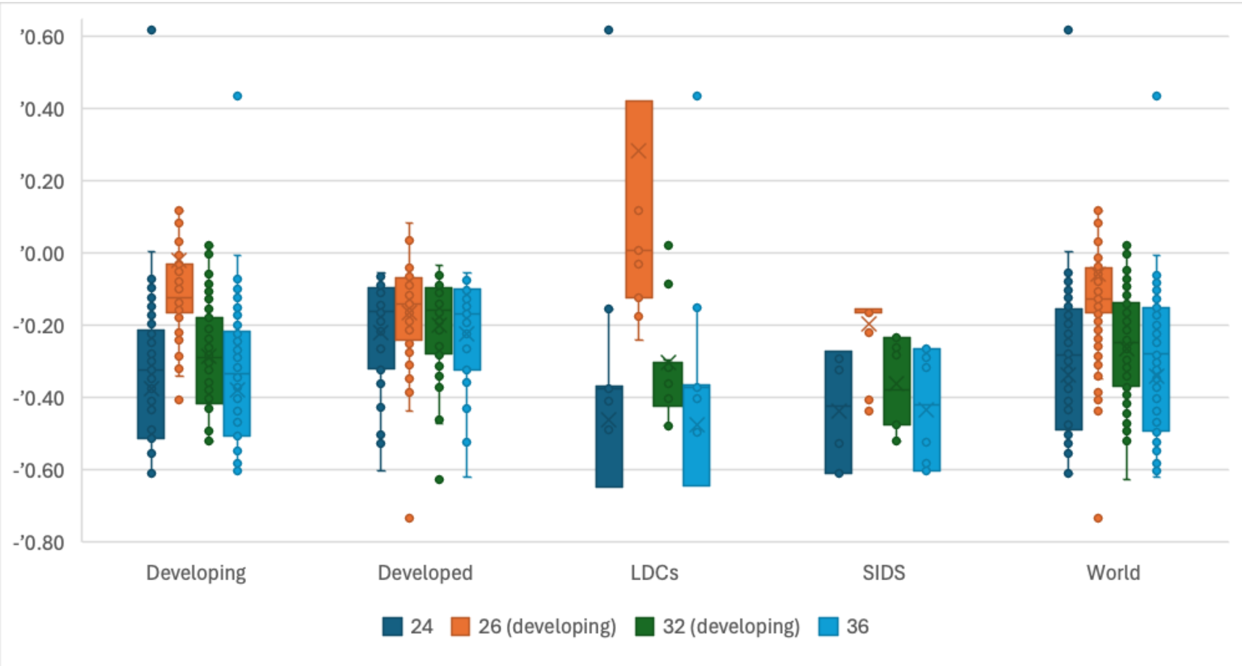


Figure 14. Variability in GDP impact in 2050 for each group of economies, sample of four scenarios

(Percentage difference to BAULG)



7 Synthesis and discussion of results

7.1 Key findings from across all scenarios

The impacts assessed in this report result from the following two effects: 1) the effects arising from the specifications of particular policy combination and related consequences in terms of changes in maritime logistics costs; and where appropriate 2) the effects arising from the revenue disbursement of a particular policy after in-sector disbursement of revenues D4 (see Section 3.2), and from how the total revenues are disbursed to different countries.

Changes in maritime logistics costs are derived from the outputs from Task 2. These outputs incorporate changes to a number of maritime transport cost components (related to efficiency, fuel/energy specification, capital costs, other operating costs and regulatory expenses which includes the cost of any levy as well as regional carbon pricing regulation, as well as changes to the operating speed, both of which create differences in maritime logistics costs between scenarios. Many of these effects can interact and evolve over time – a change in investment decision making has consequences both for the time-step that this occurs in but also in future time-steps. So, in this example, a levy can increase the immediate financial burden, but it changes the technology specification providing long term benefits in the form of a fleet with lower energy use, and a different fuel/energy mix and cost. This is all incorporated within the change in maritime logistics costs, and before any distribution of remaining hypothetical revenue (after in-sector use for reward, D4), and including the effects of any remaining revenues further modifies the impacts on States

The findings of this report are therefore consistent with and explained by the differences in maritime logistics costs between scenarios, which are in turn consistent with and explained by the results of Task 2. The key findings of this report can be further explained and understood by considering the results and the reporting under Task 2.

The findings are also novel and may at first seem to differ from other literature. For example, key references in the existing literature (e.g. Sheng et al (2018), Pereda et al. (2023)) have focused on understanding GDP impacts that occur due to carbon pricing relative to a BAU scenario, but have not considered the relative impacts of carbon pricing compared to a fuel standard or any other measures achieving an equivalent GHG reduction trajectory as is studied in this report. Their findings are consistent with this report in that they all conclude that regulating GHG emissions leads to a reduction in GDP growth at the world aggregate level and creates changes in trade patterns. The magnitude of changes is consistent with those estimated in this report (see Table 28). Different literature applies different specifications of carbon/levy price, and the present report's cases of scenarios 31 and 32 also include a fuel standard.

Table 28. Impacts on world GDP of different references using broadly similar shocks and comparison to this report

Reference	Carbon/GHG price modelled ($)	World GDP impact
Lee et al. (2013)	90/tCO2	-0.02% (only for China)
Sheng et al. (2018)	10-25/tCO2	-0.02% to -0.06%
Pereda et al. (2023)	50/tCO2	-0.04%
This report, scenario 31 (no revenue), for the year 2030	30/tCO2	-0.04%

Pereda et al. (2023) does not incorporate any revenue use or disbursement within the modelling, even though it models a levy which generates revenues. However, Sheng et al. (2018) does include revenue disbursement with three different revenue distribution options. Broadly consistent with the findings in this report, Sheng et al. concludes with respect to a global bunker charge that:

> *"...The net economic impact, though negative on average, is modest compared to the benefits obtained from the emissions reduction. If revenues from a bunker emissions charge are properly distributed among countries and regions, the losses to disadvantaged countries are likely to be offset by the benefits to advantaged countries..."*

With respect to the complex interactions of investment and operating decisions on a ship that are captured in Task 2 and therefore the inputs to this report's modelling, neither Sheng et al. (2018) nor Pereda et al. (2023) include this, instead representing change in emissions and costs of fleet through an elasticity. These studies have also not considered the interactions between policies and investment decision making, operating costs, fuel costs and regulatory costs. Furthermore, they have not examined the detailed impacts on fleets obtained under Task 2 to explain many of the differences in the costs of different policy scenarios and therefore their different impacts.

The findings presented are based on outputs from the quantitative modelling. The values from modelling are reported in the discussion of impacts while taking into account the underlying limitations. Many of those limitations are common to all scenarios, and so should have a minimal consequence on the comparative analysis of scenarios, but some are specific to how a given scenario has been modelled – particularly in relation to how scenarios with hypothetical revenues are modelled. These limitations should be borne in mind when interpreting the results of the impact analysis contained in this report.

7.1.1 Impact on real GDP: main findings

In 2030, at the global (all economies) level, the total impact on GDP relative to BAULG:

- Is mostly negative – the policy scenarios result in reduced GDP relative to BAULG at the global aggregate level. This is consistent with the findings in Task 2, which show that achieving a reduction in GHG emissions is associated with an increase in shipping's cost intensity and is predominantly the result of changes in technologies and energy required to achieve the GHG emission reduction.

- Is smaller than the global impact in 2050 – the relative reduction in the world GDP becomes larger over time in all scenarios.
- Reduction in the world GDP ranges from a maximum of -0.07 per cent to a minimum of -0.03 per cent.
- Is highest in scenario 46, the Strive trajectory scenario, assuming a levy of 150 to 300 $/CO_2$eq in combination with a WtW GFI requirement, with all revenue disbursement schemes but no flexibility mechanism and no feebate, and lowest in scenario 31, which assumes a Base trajectory, TtW GFI scope, a flexibility mechanism, and a levy of 30 to 120 $/CO_2$eq, but no feebate, when revenues are disbursed to SIDS and LDCs only.
- Is dependent on the specifics if a levy is included. For example, the reduction in the world's GDP in 2030 is larger for some of the scenarios that include a levy as well as a GFI requirement (26), than the comparable scenarios that include a GFI requirement but do not include a levy (22/24). However, the reductions in GDP are similar (for TtW, the levy scenario has comparatively smaller impact, for WtW the levy scenario has comparatively larger impact) for other scenarios that include a levy as well as a GFI requirement (31/32) to the comparable scenarios that include a GFI requirement but do not include a levy (23/24).

Changes between 2030 and 2050

- For most economies, including SIDS, the impact on GDP increases/amplifies over the period between 2030 and 2050.
- For a number of LDCs, and only in scenarios with a levy, the reduction in real GDP can become smaller or become more strongly positive i.e. real GDP increases over this period, which can be explained by the effects of revenue disbursement

By 2050, at the global (all economies) level, the total impact on GDP, relative to BAULG:

- Is consistently negative – at an aggregate level, the policy scenarios all result in reduced world GDP relative to BAULG.
- Reduction in world real GDP ranges from a maximum of -0.16 per cent, to a minimum of -0.08 per cent, depending on the policy combination.
- Is highest in scenario 22, -0.16 per cent relative to BAU (though when rounded to two significant figures, 2050 reductions in the world GDP are the same across scenarios 21, 22, 23, 24, 36 and 43), which assumes a Base emissions trajectory, a WtW GFI scope, without flexibility mechanism, levy nor feebate, and lowest in scenario 26, –0.08 per cent relative to BAU, the corresponding scenario with both GFI requirement and a levy of 150-300 $/CO_2$eq, where revenues are disbursed to SIDS and LDCs only.

- Is consistently smaller impact (lessened reduction in GDP) for scenarios that include a GFI requirement as well as a levy (scenarios 26, 31, 32 and 46) than scenarios that include a GFI requirement but no levy. The scenarios with a higher levy price have the lowest (smallest reduction in GDP) global impact (both relative to lower GHG price scenarios, and relative to all other scenarios). Distributing the revenues only to LDCs and SIDS results in the smallest reduction in GDP in percentage terms (both relative to other distribution approaches, and to all other scenarios)

7.1.2 Variation in impacts between economies

- Looking at impacts across different aggregations of economies (developing/ developed/ LDCs/ SIDS), the following findings are observed: In scenarios with a GFI requirement but without a levy (21/22/23/24/36/43), for any point in time 2030-2050, the impact on GDP, relative to the corresponding BAULG, is greatest for LDCs and SIDS, and smallest for developed economies. That is, LDCs and SIDs see the largest reductions in their respective GDP while the developed economies experience the smallest reduction in their GDP. The developing economies including developing SIDS and LDCs, as a group, are consistently impacted more (i.e., see the largest reduction in their GDP) than developed economies but less than SIDS and LDCs who both experience the relatively largest reductions in their respective GDP.
- In scenarios with a GFI requirement but without a levy, there is little variation in the magnitude of impacts for different groups of economies (e.g. the impacts on developed, developing, SIDS and LDCs have a similar distribution across the component economies). This includes that across scenarios which do not include a levy (variations relating to flexibility mechanism, feebate mechanism, and in scenarios varying between TtW and WtW), there are limited changes in the size of GDP reductions experienced across different groups of economies.
- In scenarios with a levy (26/31/32/46), the pattern of GDP reductions varies significantly between the groups of economies, depending on the GHG price and the revenue distribution.
- For low levy price scenarios which include a GFI requirement (31/32), with revenues disbursed to all countries or all developing economies, the pattern is the same as in scenarios with a GFI requirement but without a levy. That is LDCs and SIDS see the largest impact on their GDP while developed economies experience the smallest impact. However, the spread/range of GDP reductions between LDC and developed countries is reduced relative to the no-levy scenarios.
- For low levy price scenario (31/32), with revenues disbursed only to SIDS and LDCs, there are periods when LDCs are positively impacted (increased real GDP), or negatively impacted (reduced real GDP) but less than developed economies. But the pattern is not consistent over time and is different depending on whether looking at TtW (31) or WtW (32)

scenarios. For higher levy price scenarios which include a GFI requirement, LDCs are consistently either positively impacted (increase in real GDP), or least negatively impacted (the smallest reduction in real GDP) relative to other groups of economies.

- For higher levy price scenarios which include a GFI requirement (26/46) developing countries are more negatively impacted (larger reductions in GDP relative to BAULG) than developed economies in 2030 (than in scenarios without a levy), but less negatively impacted (smaller reductions in GDP relative to BAULG) in 2050 (than in scenarios without a levy).

7.1.3 Import and export volumes

- Relative to BAULG, at the global level, world import/export volumes see reductions in 2030 of between –0.05 per cent (S24) and –0.51 per cent (S26), and in 2050 of between –0.23 per cent (S43) and –0.97 per cent (S26).
- Import volumes see variations of between –1.2 per cent (developed economies) and +18.7 per cent (LDC grouping) in 2050. The largest increases and reductions in import volumes occur in scenario 26, with revenues disbursed only to SIDS and LDCs.
- Import volumes see smaller reductions across all scenarios with a GFI requirement but no levy (21/22/23/24/36/43). For these scenarios, the largest reduction in imports occur in developing economies (maximum value of -0.35 per cent in scenario 43 in 2050), and the smallest reductions in import volume are those of developed economies.
- Patterns of import volume variations are less consistent across scenarios that have a levy as well as a GFI requirement, than the consistent negative trends (import volume reductions) for scenarios with a GFI requirement but without a levy. They vary both as a function of the levy price and the revenue distribution. LDCs experience increases in their import volumes across all levy scenarios – in some scenarios, up to 18.7 per cent. Whereas SIDS experience drops in their import volumes in most scenarios. Developed economies experience some of the largest reductions in import volumes, relative to other groups of economies in scenarios with a higher levy price.
- Export volumes see variations of between –35 per cent (LDC grouping) and +0.08 per cent (developed economies) in scenario 26 in 2050.
- Export volumes go down compared to BAULG across all scenarios with a GFI requirement but no levy (21/22/23/24/36/43), except for SIDS which consistently see small increases in their export volumes. LDCs consistently experience the largest reductions in their exports (up to –0.5 per cent in 2050, scenario 22).
- Patterns of export volume variations are less consistent across scenarios with a levy than the consistent trend where export volumes drop in scenarios without a levy. Developed economies tend to have the smallest reduction in their export volumes, and SIDS the largest. However, there are isolated results where SIDS have the smallest reductions in

their export volumes or, in some cases, a positive impact (increase) - scenario 31, when revenue is disbursed to all world economies or all developing economies.

7.1.4 Consumer price index

A predominant pattern is that in all the policy scenarios result in an increase in CPI e.g. an increase in consumer prices. The reasons for the price increase are two-fold. First, if maritime logistics costs increase, higher costs are passed on to the consumer. Second, in cases where revenue is distributed to countries, GTAP modelling suggests that the surge in demand leads to additional price increases.

- At the global level and in 2030, CPI increases lie between 0.21 per cent and 0.044 per cent.
- Between 2030 and 2050, CPI increases steadily and in line with increases in maritime logistics costs.
- At the global level and by 2050, CPI increases lie between 0.38 per cent and 0.2 per cent.
- The largest increases in the global CPI by 2050 occur in scenarios with a GFI requirement as well as a levy and a higher levy price (S26), and the smallest increase during the same period occurs in Strive scenarios with a GFI requirement but without a levy (S43).
- There is significant variation in CPI between groups of economies particularly in scenarios with a GFI requirement as well as a levy. In these scenarios, depending on the scenario specifics, the year and the revenue distribution, there can be large increases in CPI particularly for LDCs, and decreases (positive impacts) in developed economies' CPI.
- In scenarios with a GFI requirement but without a levy, LDCs see the largest CPI increases while SIDS experience the smallest increases. The CPI of developing and developed economy groupings experience similar increases in their respective CPI.

7.2 Inferences from modelled scenarios to non-modelled scenarios

As described in Section 3.1, a subset of scenarios analysed by DNV under Task 2 were modelled under Task 3. The 22 GTAP runs used to for the impact assessment in Task 3 are based on 10 DNV scenarios of which some are combined with different revenue disbursement schemes

As described above, the policy parameter combinations included in the 22 GTAP runs have been carefully chosen by the SC in order to isolate the potential impacts of the policy parameters and produce evidence on more general relationships which can help understand the likely impacts from a wider range of scenarios. Comparison between scenario results described throughout this report (e.g. comparison between scenarios 24 and 36, between which the only change is the introduction of a feebate mechanism), are therefore used to understand the sensitivity of impacts to specific policy parameters/choices.

7.2.1 Sensitivity of TtW versus WtW

- The long run (2050) global impact is very similar for comparable TtW and WtW scenarios e.g. for scenarios 21 and 22, and scenarios 23 and 24. This output aligns with the findings from Task 2, which show that these scenarios do not result in significant differences in cost intensity. This is because they follow the same trajectory for WtW GHG emissions reduction. Relative to BAULG, the reduction in world GDP is larger in 2050 for the WtW scenario than the corresponding TtW scenario. For scenarios 31 and 32 (levy scenarios with a GFI requirement), the reduction in world GDP is relatively smaller in 2050 for the WtW scenario than the corresponding TtW scenario (at the same GHG price, the WtW levy generates higher revenues).
- The short run (2030) impacts on GDP in percentage terms are very similar across comparable TtW and WtW scenarios and show the same patterns globally as described above for the long run.
- The similarity derives from the similar cost intensities for comparable TtW and WtW scenarios that are also observed under Task 2. This is probably due to the use of sustainability criteria to incentivize lower TtW emissions acting in addition to WtW creating similar technology transitions and evolutions in fuel.

7.2.2 Sensitivity of Base versus Strive GHG emissions trajectories

- The long run (2050) global impact on GDP is not consistently larger for Strive GHG emissions trajectory scenarios than their corresponding Base GHG emissions trajectory parameter specifications. The Strive scenario 46 experiences a relatively larger reduction in world GDP in 2050 than the corresponding Base scenario 26, whereas the Strive scenario 43 experiences a relatively smaller reduction in world GDP in 2050 than the corresponding Base scenario 23.
- The short run (2030) global impacts on world GDP are consistently larger for Strive scenarios than their comparable Base scenarios.
- The explanation for these differences in long-run impact is subtle. Meeting the Base trajectory and applying a higher-price levy (as is in scenario 46) result in a larger reduction in world GDP in the short-run. In the short-run, scenario 46 leads to larger reduction in world GDP than scenario 26 as well as scenario 43 (which includes a GFI requirement but does not include a levy). However, as the GDP impacts increase over the period until 2050, the relative benefits of energy efficiency, lower cost energy mix and revenue disbursement that are associated with scenario 46 (relative to scenario 43, -0.16 per cent GDP relative to BAU in 2050) result in a smaller 2050 impact in that scenario (-0.1 per cent reduction in the world GDP relative to BAU in 2050). However, in the scenarios which combine a GFI requirement with a levy, the levy cannot fully moderate and counterbalance the early impacts associated with the Strive scenario 46, relative to its Base scenario equivalent (S26). In absolute impact terms, scenario 23 has a similar but fractionally smaller impact

than scenario 43, and both scenarios have larger reductions in the world GDP than scenario 26 and 46 (-0.08 per cent and –0.1 per cent, respectively). Expressed as a change in impacts (change in the reductions in GDP) in 2050, a levy (as modelled in scenario 26, in combination with WtW GFI and no flexibility mechanism) leads to reduced impacts (i.e., lessening the reduction in the world GDP) by ~50 per cent in the Base scenario (relative to a scenario with TtW GFI, flexibility and no levy, scenario 23), but by a lesser amount of ~38 per cent under a Strive trajectory (scenario 46 compared with scenario 43).

7.2.3 Sensitivity of flexibility versus no flexibility and feebate

- Among the modelled policy scenarios, the introduction of a flexibility mechanism (scenarios 23 and 24) has the effect of reducing the global long-run reduction in world GDP relative to the equivalent no-flexibility scenarios (scenarios 21 and 22). The scenarios with flexibility mechanism show less than 3 per cent smaller impact (smaller reduction in the GDP compared to BAULG) in 2050 at the global level than scenarios without. Based on comparisons at the global level, the feebate mechanism of scenario 36 leads to similar GDP impacts as the corresponding scenario without a feebate or a flexibility mechanism, scenario 22 (less than 2 per cent smaller impact in 2050 at the global level).
- In the short run (2030), there is a more pronounced difference between comparable flexibility and no-flexibility scenarios than in the longer run. Scenarios 23 and 24 have similar impacts (in the form of reductions) on GDP in 2030. Both lead to approximately 20 per cent smaller reductions in world GDP than no flexibility scenarios 21 and 22 respectively. In the short run, the feebate scenario has a small increase (3 per cent) in impact on GDP relative to the comparable no flexibility/feebate scenario (scenario 22).
- The GTAP results show little difference across different groups of economies regarding the impacts on GDP under different policy scenarios relative to each other. For example, the long run (2050) impact (reduction in the world GDP) of a feebate is consistently less than 2 per cent smaller than the impact (reduction in GDP) under scenario 22 across all groups of economies.
- The long run (2050) global impact on GDP is very similar across all scenarios that include a GFI requirement but do not include a levy (scenarios 21, 22, 23, 24, 36 and 43), regardless of whether no flexibility, flexibility or a feebate mechanism are specified in the policy parameters. This contrasts with the scenarios which combine a GFI requirement with a levy, which are consistently smaller impact in the long run, but also more variable in impact. Globally, scenario 26 with revenues disbursed to all economies has 45 per cent less impact (i.e., leads to a smaller reduction compared to BAULG) on the world GDP than scenario 22. Scenario 26 with revenues disbursed only to SIDS and LDCs has 49 per cent smaller impact on GDP than scenario 22. Conversely, scenario 32 has 13 per cent less impact on world GDP than scenario 24. This indicates that the long-run global impact on GDP can be smaller due to a levy in combination with a GFI requirement, with the smaller

initial impact (reduction) on GDP being positively related to the GHG price – a higher GHG price creates a larger reduction in long run impact.

- The short run (2030) global impact (in the form of a reduction) on GDP of levy scenarios, contrasted with their no levy equivalent scenarios, shows different relationships and a larger impact. Scenario 26 leads to a larger impact on the world GDP than scenario 22, whereas scenario 32 leads to a smaller impact on the world GDP than scenario 24.

7.3 Terms and further considerations under Task 3

The following sets out a summary of how the terms below have been considered in the present comprehensive impact assessment, to complement the quantitative outputs of the modelling of impacts on GDP, trade, and CPI, as requested in the Terms of Reference.

7.3.1 Geographic remoteness of and connectivity to main markets

Geographic remoteness of and connectivity to main markets are considered within the quantitative modelling of Task 3.

Countries that are geographically remote and have low connectivity are – ceteris paribus – confronted with higher shipping costs, compared to countries where trade travels over shorter distances and shippers (cargo interests) have more options (UNCTAD, 2015). Thus, the concept of geographic remoteness and connectivity is extensively covered in the modelling reported in the present comprehensive impact assessment, as the modelling includes speed and transport costs among the core variables. Countries that trade over longer distances will – ceteris paribus – also be more strongly impacted by policy scenarios that have an impact on maritime logistics costs.

UNCTAD (2021a) shows that SIDS, which are on average confronted with geographic remoteness and lower connectivity levels, are also more strongly affected by an increase in maritime freight rates, as their import prices and consumer prices record higher increases than those of other economic groups. SIDS are consistently the least connected countries when considering the UNCTAD Liner Shipping Connectivity Index. Data at individual port and country level on the LSCI are available on UNCTAD data centre.[30]

The 2023-2024 disruptions in the Red Sea, the Suez Canal and the Panama Canal have underscored ways in which increased distance and extended journey can affect shipping freight rates, and generally, maritime logistics costs. The disruption has led shipping lines to divert their ships away from the Red Sea and the Suez Canal and from the Panama Canal onto longer routes thereby causing the average maritime haul to increase. This in turn has had ripple effect on operations, port call patterns, fuel costs, labour costs, insurance premiums, and sailing speeds, among others. Maritime trade on the East-West trade lanes from Asia to Europe and East-Coat North America, for example, faced an increase in maritime freight rates as ships diverted onto

[30] https://unctadstat.unctad.org/datacentre/

the longer route via the Africa's Cape of Good Hope. The Shanghai Container Freight Index (SCFI) on the Shanghai-Europe route, increased more than threefold between the fourth quarter of 2023 and the second quarter of 2024.[31]

7.3.2 Cargo value and type

Cargo value and type are considered within the quantitative modelling of Task 3. Commodities are modelled in eleven different commodity groups, each with different value of time. In addition, commodities are assigned to different ship types, which are modelled by DNV to lead to different changes in shipping costs and time, and subsequently, each ship and each journey of each ship are included individually for the comprehensive assessment of changes in maritime logistics costs.

The analysis in Section 5.1 has shown that the breakdown by commodity group of the percentage increase in the maritime logistics costs of international trade is strongly driven by the type and value of the cargo, especially by the time-sensitivity of the maritime logistics costs for the trade delivery. Long shipping times become a cost-factor – in the transport of some goods more than in the transport of others – due to, among other factors, spoilage or depreciation of the goods during transit, interest costs, loss of opportunities due to changes of demand and supply on markets, disruption in the production process and lost opportunities to minimize inventory costs.

Metal products, electrical and machinery products, and beverages, have been identified above as products for which delays in shipping time cause relatively high maritime logistics costs, as indicated by a relatively high VoT coefficient. These goods are characterized by a relatively high share of time costs in maritime logistics costs, despite relatively short average delivery times (see Table 6). Non-food agricultural products such as wood and paper as well as mining and quarrying have been identified as products for which shipping time is a less important cost factor. These products are characterized by a relatively small share of time costs in maritime logistics costs, despite relatively long average shipping time. As the policy combinations under all policy scenarios have a larger impact on maritime transport costs than on shipping times (Table 8), the maritime logistics costs for the transport of the latter group of products, for which time cost play a less important role, are relatively more impacted by the policy measures.

7.3.3 Transport dependency

Transport dependency is considered within the quantitative modelling of Task 3.

Within GTAP, economies with a higher trade-to-GDP ratio are – ceteris paribus – also more impacted by any change to trade costs. Larger economies tend to be less dependent on foreign markets and suppliers than smaller economies, as companies from larger economies tend to sell and buy more to/from domestic buyers and suppliers.

[31] UNCTAD based on data from Clarksons Research Shipping Intelligence Network, July 2024.

Results pertaining to impacts on maritime logistic costs suggest that more maritime-transport dependent economies as reflected by the share of their maritime trade in their total merchandise trade for example, can be more impacted by increases in maritime logistics costs. The core of the assessment under Task 3 has focused on the impacts on maritime logistics costs, including transport costs and the cost of shipping time. In the long run (2050), maritime logistics costs are expected to increase at similar rate across all scenarios, ranging from 34.7 per cent to 36.8 per cent higher than the BAULG. Increases in the long run (2050) cost intensity and, therefore the related maritime logistics costs, are mainly a function of achieving the 2050 net-zero objective.

7.3.4 Food security

Food security is not explicitly considered within the quantitative modelling of Task 3. However, the quantitative modelling does provide data on impacts on trade in different commodities, and it provides impacts on maritime logistics costs and shipping speed. With this additional information, UNCTAD provides the following additional considerations.

The impact on the price and the quantity of the agricultural products imported, is of relevance for food security. It should be noted that food security entails more than one dimension. These include the availability of food which is determined by factors such as the level of food production, stock levels and trade. Economic and physical access to food is another dimension of food security and is determined by factors such as markets, prices and transportation. Meanwhile, food utilization is related to factors such as energy and nutrient intake by individuals. The stability of these three dimensions over time is also a dimension of food security. In this context, the impact on the quantity of agricultural products imported and their prices simulated in the present assessment report provides some insights into the food availability and access. However, the assessed impact on agricultural product trade volumes and prices provides a partial view as to the potential implications for food security as it does not reflect all the dimensions of food security (e.g., food utilisation and stability) nor cover all the food related items and products that contribute to improving food security. This is because while agricultural products are key for food security, other food items and products are also important and are carried in containers (e.g. processed food items, equipment used in agricultural production or food processing) as well as raw material (e.g. fertilisers). These products are not captured by the heading “agricultural products”.

In this context, and, as the candidate mid-term GHG reduction measures have an impact on the prices and the quantity of imports of agricultural products, there may be some implications for the food availability and access. Increases in the prices of agricultural products and reductions in imports could potentially reduce food availability. At constant demand, this will lead to rising prices for food in the importing economy. If food prices exceed a certain limit, the relatively poor population groups cannot anymore afford a sufficient nutrition, putting their food security at risk. In addition, higher CPI will increase the costs of inputs and raw material (e.g. fertilizers, equipment used for agricultural production, equipment used for food processing) that can be used for domestic production of food products such as grain or for food processing sectors.

It was shown in Section 5 that different policy measures have an impact on the maritime logistics costs of agricultural products. Maritime logistics costs are simulated to be more elevated by around four fifth compared to the BAULG scenario. This effect is relatively stronger in the case of the agricultural products compared to other commodities. Trade in fishery products is also simulated to face a relatively large impact. In 2050, the maritime logistics costs of fishery products are simulated to be around 50 per cent more elevated under the analysed policy combinations compared to the BAULG scenario.

As these numbers are global averages, some economies will face larger impacts on the maritime logistics costs of their agricultural imports, for example, due to their geographic remoteness. The extent to which these costs are translated into an overall increase in the prices of agricultural imports largely depends on the maritime transport dependency of those imports that is the extent to which these imports are delivered by sea and the potential for modes other than shipping to be used in order to deliver these imports.

The analysis in Sections 6.2.1 and 6.3.2.2 has shown that the world mean CIF price of agricultural product imports increase by up to 2.5 per cent by 2050 relative to BAULG in response to the GHG measure in individual economies. In some extreme cases, the rise in import prices of agricultural products in some economies reaches more than 10.0 per cent relative to BAULG when revenues are disbursed to SIDS and LDCs only. The reduction in the quantity of agricultural product imports is simulated to reach up to 6.2 per cent in 2050, relative to BAULG except in a few outlying cases, depending on the policy combination. All in all, the largest increases in agricultural import prices and the largest decreases in the quantities of agricultural product imports have been simulated for the scenarios 26 and 46, which assume a relatively high levy, in the short run (in 2030) and for the non-levy scenarios 24 and 43 in the medium term (in 2040), both representing TtW scenarios with GFI flexibility

The extent to which the food security situation of an economy will be affected by the reduction in their imports of agricultural products (i.e. food) or by the increase in the prices of these imports, will depend on several factors. The impact will be larger, the higher the food import dependency (*i.e.* the ratio of food imports to domestic demand for food), the lower the initial level of per-capita food supply, including stocks, and the more limited are the capacities of domestic producers undermining their ability to adequately react to fluctuations in food demand.

Meanwhile, the vulnerability of food supply chains to disruptions that drive up shipping costs and undermine food availability, access and utilisation, underscore the risks to food security arising from shock to shipping. The overlapping crises of recent years, including the COVID-19 pandemic, the war in Ukraine and the heightened impacts of climatic factors have exposed the weakness of current food systems and the fragility of food supply chains. The 2023 Global Hunger Index and the related report highlighted that alongside these crises, the volatility of the supply and prices of food and fertilizers has been a major contributor to unsustainable food systems.

Higher costs of shipping (port closures, higher fuel prices, re-routing/alternate sourcing involving longer distances travelled, delays at the border, inland capacity constraints) have also exposed the vulnerability of the transport and logistic systems underpinning food supply chains. UNCTAD (2021a) and UNCTAD (2022) assessed the impact on consumer prices including food prices of soaring freight rates and disruptions in shipping. The analysis showed that the increase in global dry bulk freight rates and grain prices will lead to an increase in consumer food prices of 1.2 per cent globally. Food price increases are expected to be slightly higher in middle-income countries whose economies rely more on dry bulk shipping. Smaller, low- income economies which have less food processing capacity tend to import processed foods which are mainly transported by container.

As regards increases in containerized trade, UNCTAD (2021a) estimates that consumer prices would be 1.5 per cent higher than they would have been without the container freight rate surge. Higher freight rates overall hit hardest LDCs and SIDS which rely more on imports of containerized goods.

7.3.5 Disaster response

Disaster response is not explicitly considered within the quantitative modelling of Task 3. However, the quantitative modelling does provide data on impacts on trade in different commodities, and it provides impacts on maritime logistics costs and shipping speed. With this additional information, UNCTAD provides the following additional considerations.

Increased maritime logistics costs will also affect shipments associated with disaster response involving maritime shipping and ports. Assessed impacts will not necessarily translate into dramatic shifts in port call patterns or a reconfiguration of shipping networks which may, in turn, undermine disaster response capabilities.

UNCTAD existing research focusing on maritime freight rates and transport cost increases and their impact on trade and consumer prices as well as the impact of disruptions on the liner shipping connectivity indicate that economies such as SIDS, LLDCs and LDCs tend to be more affected.

UNCTAD (2021) and UNCTAD (2022) assessed the economic impact of a disruption-induced jump in freight rates including on consumer prices across groups of economies. Results underscored the material and differentiated impact across groups of economies. These results also suggest that in case of a disaster that causes a disruption and heightens maritime logistics costs, the ability of maritime transportation to support disaster response could be affected given increases in costs and system inefficiencies (e.g. delays, port congestion, equipment repositioning requirements, rerouting onto longer routes, etc.).

Furthermore, UNCTAD's work on climate change impacts and adaptation in coastal transport infrastructure in SIDS emphasizes the challenges faced as regards disaster risk reduction and response.[32] Increases in maritime logistics costs and reductions in maritime trade flows as well as in GDP, in an already challenging context, could add complexity to disaster response efforts.

[32] see: https://sidsport-climateadapt.unctad.org/

7.3.6 Cost-effectiveness

Cost-effectiveness is considered within the quantitative modelling of Task 3, as all scenarios are assessed with respect to the maritime logistics costs that they would generate, the impact of these costs on trade and GDP, and compared over time. Each scenario achieves the objective of reducing GHG emissions from shipping over different trajectories, notably in the “Strive” or the “Base” scenarios.

Insight into cost-effectiveness, interpreted as the relative cost of policies in comparison to their effectiveness at GHG reduction, can be provided both from Task 2 and Task 3 results. The effectiveness of different policies is normalized to two GHG reduction trajectories (Base and Strive), and so any scenarios which have the same GHG reduction trajectory can have their cost-effectiveness compared by looking at their relative costs. The report from Task 2 provides data on cost intensity, and focuses on the costs borne by ship owners. The report on Task 3 provides both maritime logistics costs for the different scenarios, and impacts on States (GDP, import, export and CPI). Many of the key findings in this report are therefore of direct application to the discussion of ‘cost-effectiveness’.

Further research could be undertaken as regards the costs incurred per ton of GHG emissions saved. Also, it could be attempted to assess the benefits of reducing GHG emissions for countries’ development (UNCTAD, 2023). This latter assessment of cost-effectiveness was, however, outside the scope of this report as was the cost of no action.

7.3.7 Socio-economic progress and development

Socio-economic progress and development are considered within the quantitative modelling of Task 3, notably as regards the impact on GDP.

Overall impacts on GDP varied in magnitude and their incidence or actual effect will depend on the development status and size of economies. The analysis in the present report has shown that the level of development of economies broadly indicates susceptibility to negative impacts i.e. reductions in GDP, imports and exports as well as increases in CPI. The above results indicate that LDCs would experience the largest negative impacts. Results from scenarios that envisage revenue generation and disbursement show that, under these scenarios, these impacts are reduced.

7.4 Other topics under the Terms of Reference of Task 3

Views about the additional issues highlighted in Task 3 TORs as requiring consideration and analysis are summarized below.

7.4.1 Potential geographical specificities and route-related impacts

Geographical specificities and route-related impacts are considered within the quantitative modelling of Task 3. The modelling of maritime logistics costs is done on the basis of every ship’s journey, i.e. route taken, thus covering every country's geographic specificity concerning their position in the current shipping network.

Impacts vary significantly with variations in geographical specifics and trade routes. While general trends can be drawn, specific impacts on individual economies can be influenced by their trade route efficiency, commodity mix, and economic development level.

LDCs, on average, tend to be more negatively impacted than other country groups. SIDS show varied impacts reflecting their unique specificities including geography, size, trading patterns and commodity mixes. However, the aggregate result masks the fact that, individually, many SIDS are among those countries that experience the largest negative impacts.

7.4.2 Possibility of transport modal shift with changes in maritime logistics costs

As explained under the Assumptions and the Limitations section, modelling under Task 3 assumes no transport modal shift, focusing solely on maritime logistics costs and their impact on GDP, imports, exports and consumer prices while keeping maritime transport demand constant.

However, UNCTAD is of the view, as explained in the above section on Assumptions and Limitations that future cost increases in maritime logistics costs could drive shifts to other modes, depending on relative cost changes across transport sectors and the technical feasibility of the modal shift. This aspect remains speculative as the study does not directly model this aspect.

7.4.3 Potential changes in port-calling frequencies and changes in connectivity index

Port calling frequencies are largely determined by the volume of trade and the ship characteristics. Both are considered within the quantitative modelling of Task 3. If trade volumes decline, either the number of port calls would also decline, or ship sizes would decline. In either case, the UNCTAD Liner Shipping Connectivity Index (LSCI) sees a reduction, too.

Building on past experience with shipping regulatory measures, the COVID-19 pandemics, the war in Ukraine and disruptions to maritime chokepoints such as the Suez Canal or the Panama Canal, shipping networks and patterns can be volatile. Some levy scenarios may lead to considerable changes in import and export volumes, potentially altering port-calling frequencies and connectivity for specific economies.

That said, decisions by shipowners and operators regarding their fleet deployment, routing and port call configuration depend on many other factors and not only changes in trade volumes (strategy of alliances, stakes in port terminals, costs, etc.). By the same token, if different ships use different alternative fuels in the future, shipping network configurations may be modified not only in response to changing trade patterns, but also in response to available fuels.

7.4.4 Impacts of the measures on final consumer prices

Impacts on consumer prices are considered within the quantitative modelling of Task 3.

Simulations results show that GHG reduction measures would lead to an increase in consumer prices globally. The extent of price increases varies by group of economies, with LDCs experiencing the largest increases.

Price increases result from both, higher maritime logistics costs (prices increase on the supply side), and from a surge in demand resulting from revenue distribution (prices increase on the demand side). In this context, higher levy price scenarios could exacerbate consumer price increases compared to scenarios without levies.

7.4.5 Potential loss of competitiveness of States in their main exports, as well as the consequent substitution of imports in their main destination markets

Changes in trade flows, including substitution, are considered within the quantitative modelling of Task 3.

GTAP builds on a general equilibrium model, where higher trade costs will lead to shifts in demand towards sources of supply that benefit from lower trade costs. Developing economies and LDCs could potentially experience a reduction in their export competitiveness due to relatively higher maritime logistics costs, leading to potential substitution of imports in their main markets. The impact varies by commodity and trade partner, with some SIDS experiencing increased export activity, driven mostly by the service sector for some of them.

7.4.6 Magnitude of the impacts of the measures in comparison with other maritime cost or freight rate developments

The long-term increases in maritime logistics costs are similar across different policy scenarios, ranging from 34.7 per cent to 36.8 per cent more elevated compared to the baseline scenario by 2050.

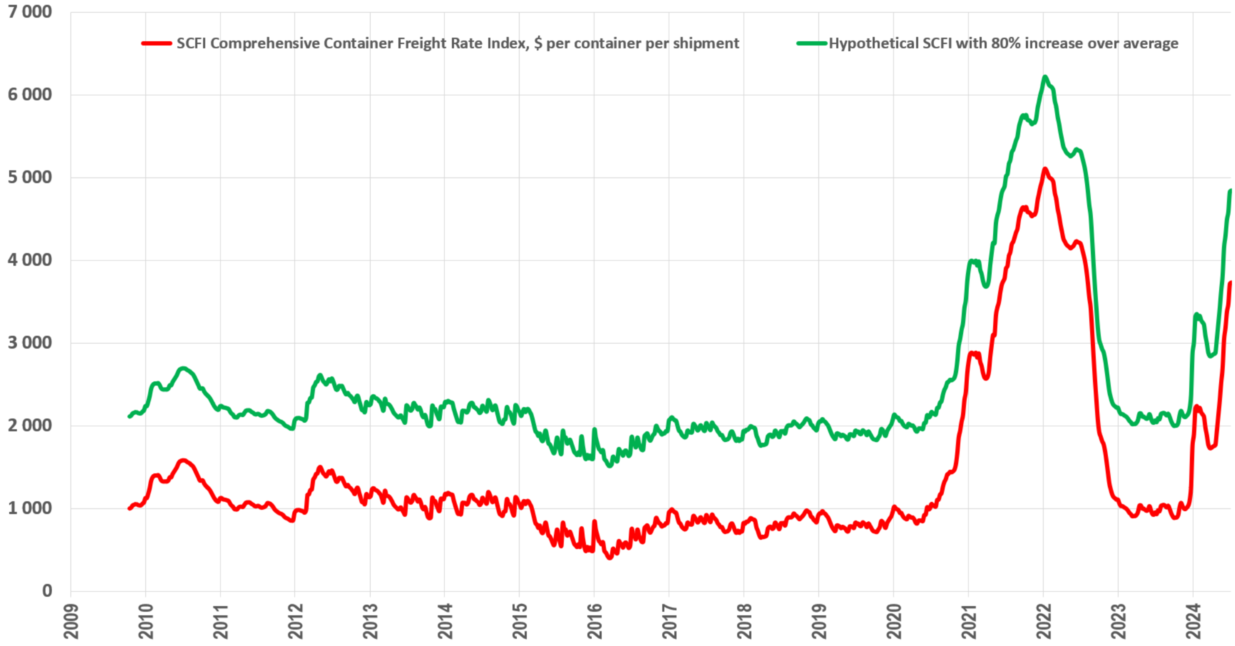
Looking only at the transport cost increases, and limiting the assessment to those commodities that are mostly containerized, UNCTAD estimates that by 2050, container freight rates could increase by 80 per cent.

These cost increases are primarily driven by the 2050 net-zero objective, with minimal variation due to policy specifics, indicating that the magnitude of impacts from GHG measures is comparable to other significant cost drivers in maritime logistics.

Figure 15 compares an 80 per cent average container freight rate increase with the recent changes and volatility of the Shanghai Container Freight Index SCFI.

Figure 15. Recent changes in container freight rates compared to a potential general increase of 80 per cent of maritime transport costs for containerized maritime trade

(Dollar per container per shipment)



Source: UNCTAD, based on data from Clarksons Shipping Intelligence Network, applying an 80% increase over the average SCFI

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Annexes

Annex 1. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG) – Scenario 21

Impact on GDP, no disbursement	**Scenario 21**		
GTAP Economy	**2030**	**2040**	**2050**
Albania	-0.054	-0.153	-0.160
Algeria	-0.119	-0.295	-0.351
Argentina	-0.038	-0.097	-0.114
Armenia	-0.040	-0.100	-0.126
Australia	-0.093	-0.242	-0.292
Bahrain	-0.109	-0.318	-0.365
Bangladesh	-0.083	-0.268	-0.301
Belgium	-0.067	-0.171	-0.198
Bolivia (Plurinational State of)	-0.018	-0.049	-0.056
Botswana	-0.019	-0.050	-0.050
Brazil	-0.052	-0.120	-0.139
Brunei Darussalam	-0.067	-0.229	-0.249
Bulgaria	-0.097	-0.241	-0.284
Cameroon	-0.075	-0.205	-0.229
Canada	-0.036	-0.098	-0.117
Chile	-0.179	-0.428	-0.499
China	-0.055	-0.151	-0.179
Colombia	-0.092	-0.224	-0.251
Costa Rica	-0.163	-0.392	-0.424
Côte d'Ivoire	-0.102	-0.284	-0.316
Croatia	-0.028	-0.080	-0.089
Cyprus	-0.073	-0.202	-0.226
Denmark	-0.030	-0.083	-0.095
Dominican Republic	-0.088	-0.246	-0.269
Ecuador	-0.126	-0.291	-0.317
Egypt	-0.110	-0.342	-0.408
El Salvador	-0.112	-0.284	-0.307
Equatorial Guinea	0.002	0.008	0.023
Estonia	-0.051	-0.129	-0.150
Eswatini	-0.021	-0.051	-0.054
Finland	-0.048	-0.124	-0.146
France	-0.017	-0.044	-0.050
Gabon	-0.127	-0.333	-0.406
Georgia	-0.066	-0.186	-0.216
Germany	-0.026	-0.069	-0.081
Ghana	-0.094	-0.265	-0.304
Greece	-0.047	-0.118	-0.135
Guatemala	-0.138	-0.314	-0.341

Impact on GDP, no disbursement	Scenario 21		
GTAP Economy	**2030**	**2040**	**2050**
Honduras	-0.189	-0.475	-0.518
India	-0.044	-0.127	-0.151
Indonesia	-0.081	-0.227	-0.285
Iran (Islamic Republic of)	-0.024	-0.083	-0.094
Iraq	-0.047	-0.148	-0.173
Ireland	-0.027	-0.078	-0.087
Israel	-0.053	-0.147	-0.166
Italy	-0.029	-0.079	-0.088
Japan	-0.042	-0.114	-0.135
Jordan	-0.025	-0.071	-0.083
Kenya	-0.185	-0.449	-0.494
Kuwait	-0.048	-0.156	-0.170
Latvia	-0.059	-0.147	-0.172
Lithuania	-0.057	-0.144	-0.160
Madagascar	-0.136	-0.372	-0.415
Malaysia	-0.104	-0.310	-0.363
Malta	-0.191	-0.580	-0.629
Mauritius	-0.100	-0.240	-0.260
Mexico	-0.033	-0.096	-0.117
Morocco	-0.105	-0.283	-0.325
Namibia	-0.028	-0.066	-0.069
Netherlands (Kingdom of the)	-0.033	-0.087	-0.100
New Zealand	-0.114	-0.284	-0.312
Nicaragua	-0.165	-0.413	-0.448
Nigeria	-0.058	-0.164	-0.184
Norway	-0.023	-0.063	-0.076
Oman	-0.131	-0.389	-0.465
Pakistan	-0.056	-0.162	-0.185
Panama	-0.084	-0.256	-0.279
Paraguay	-0.075	-0.197	-0.223
Peru	-0.151	-0.362	-0.427
Philippines	-0.079	-0.240	-0.285
Poland	-0.025	-0.069	-0.081
Portugal	-0.054	-0.144	-0.163
Qatar	-0.126	-0.413	-0.454
Republic of Korea	-0.088	-0.253	-0.295
Romania	-0.024	-0.062	-0.072
Russian Federation	-0.035	-0.089	-0.106
Saudi Arabia	-0.093	-0.260	-0.290
Serbia	-0.025	-0.063	-0.072
Singapore	-0.079	-0.227	-0.254
Slovenia	-0.044	-0.125	-0.139

Impact on GDP, no disbursement	**Scenario 21**		
GTAP Economy	**2030**	**2040**	**2050**
South Africa	-0.101	-0.233	-0.268
Spain	-0.045	-0.119	-0.137
Sri Lanka	-0.061	-0.173	-0.192
Sweden	-0.030	-0.079	-0.094
Syrian Arab Republic	-0.072	-0.195	-0.210
Thailand	-0.083	-0.240	-0.279
Trinidad and Tobago	-0.145	-0.398	-0.430
Tunisia	-0.104	-0.286	-0.324
Türkiye	-0.083	-0.220	-0.259
Ukraine	-0.093	-0.213	-0.258
United Arab Emirates	-0.097	-0.287	-0.321
United Kingdom of Great Britain and Northern Ireland	-0.034	-0.091	-0.104
United Republic of Tanzania	-0.131	-0.328	-0.359
United States of America	-0.018	-0.051	-0.058
Uruguay	-0.091	-0.218	-0.251
Uzbekistan	-0.014	-0.055	-0.061
Venezuela (Bolivarian Republic of)	-0.031	-0.077	-0.086
Viet Nam	-0.242	-0.824	-0.981
Zimbabwe	-0.069	-0.165	-0.177
Rest of American SIDS	-0.152	-0.440	-0.479
Rest of Asia	-0.030	-0.100	-0.113
Rest of Asian SIDS and LDCs	-0.125	-0.372	-0.430
Rest of Caribbean	-0.078	-0.206	-0.230
Rest of developing economies in Europe and Central Asia	-0.029	-0.084	-0.096
Rest of Europe	-0.021	-0.059	-0.067
Rest of landlocked economies in Africa	-0.048	-0.126	-0.138
Rest of LDC in Africa	-0.109	-0.299	-0.343
Rest of Middle East and North Africa	-0.077	-0.200	-0.216
Rest of Oceania	-0.180	-0.472	-0.531
Rest of the world	-0.026	-0.072	-0.079
Rest of Western Africa	-0.280	-0.783	-0.927

Annex 2. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG) – Scenario 22

Impact on GDP, no disbursement	**Scenario 22**		
GTAP Economy	**2030**	**2040**	**2050**
Albania	-0.053	-0.153	-0.161
Algeria	-0.108	-0.293	-0.353
Argentina	-0.036	-0.095	-0.115
Armenia	-0.036	-0.099	-0.128
Australia	-0.085	-0.239	-0.297
Bahrain	-0.103	-0.313	-0.371
Bangladesh	-0.078	-0.265	-0.308
Belgium	-0.062	-0.169	-0.199
Bolivia (Plurinational State of)	-0.018	-0.048	-0.057
Botswana	-0.022	-0.048	-0.051
Brazil	-0.048	-0.118	-0.141
Brunei Darussalam	-0.065	-0.226	-0.253
Bulgaria	-0.088	-0.239	-0.286
Cameroon	-0.075	-0.201	-0.233
Canada	-0.034	-0.097	-0.119
Chile	-0.170	-0.422	-0.508
China	-0.051	-0.150	-0.182
Colombia	-0.089	-0.220	-0.257
Costa Rica	-0.161	-0.383	-0.431
Côte d'Ivoire	-0.103	-0.278	-0.320
Croatia	-0.026	-0.079	-0.090
Cyprus	-0.070	-0.201	-0.228
Denmark	-0.028	-0.082	-0.096
Dominican Republic	-0.086	-0.241	-0.273
Ecuador	-0.125	-0.285	-0.323
Egypt	-0.102	-0.340	-0.415
El Salvador	-0.108	-0.278	-0.312
Equatorial Guinea	0.002	0.011	0.024
Estonia	-0.047	-0.127	-0.150
Eswatini	-0.022	-0.050	-0.055
Finland	-0.044	-0.122	-0.147
France	-0.015	-0.043	-0.051
Gabon	-0.120	-0.329	-0.413
Georgia	-0.063	-0.184	-0.218
Germany	-0.025	-0.067	-0.082
Ghana	-0.093	-0.260	-0.310
Greece	-0.043	-0.117	-0.136
Guatemala	-0.134	-0.307	-0.346
Honduras	-0.184	-0.466	-0.527
India	-0.041	-0.126	-0.154

Impact on GDP, no disbursement	Scenario 22		
GTAP Economy	**2030**	**2040**	**2050**
Indonesia	-0.073	-0.226	-0.290
Iran (Islamic Republic of)	-0.024	-0.082	-0.095
Iraq	-0.046	-0.146	-0.182
Ireland	-0.025	-0.077	-0.089
Israel	-0.050	-0.146	-0.169
Italy	-0.027	-0.078	-0.089
Japan	-0.039	-0.112	-0.136
Jordan	-0.024	-0.071	-0.084
Kenya	-0.185	-0.440	-0.505
Kuwait	-0.045	-0.155	-0.174
Latvia	-0.054	-0.144	-0.173
Lithuania	-0.052	-0.142	-0.161
Madagascar	-0.136	-0.364	-0.425
Malaysia	-0.093	-0.309	-0.368
Malta	-0.186	-0.574	-0.635
Mauritius	-0.100	-0.235	-0.266
Mexico	-0.031	-0.095	-0.120
Morocco	-0.098	-0.282	-0.330
Namibia	-0.030	-0.064	-0.070
Netherlands (Kingdom of the)	-0.030	-0.086	-0.101
New Zealand	-0.113	-0.278	-0.318
Nicaragua	-0.162	-0.404	-0.457
Nigeria	-0.058	-0.160	-0.188
Norway	-0.020	-0.062	-0.077
Oman	-0.123	-0.385	-0.472
Pakistan	-0.053	-0.160	-0.189
Panama	-0.075	-0.255	-0.286
Paraguay	-0.074	-0.193	-0.228
Peru	-0.142	-0.358	-0.434
Philippines	-0.072	-0.239	-0.289
Poland	-0.024	-0.068	-0.081
Portugal	-0.050	-0.142	-0.165
Qatar	-0.121	-0.406	-0.460
Republic of Korea	-0.081	-0.250	-0.298
Romania	-0.023	-0.061	-0.073
Russian Federation	-0.032	-0.087	-0.107
Saudi Arabia	-0.085	-0.258	-0.295
Serbia	-0.023	-0.062	-0.073
Singapore	-0.070	-0.225	-0.257
Slovenia	-0.043	-0.123	-0.140
South Africa	-0.100	-0.227	-0.271
Spain	-0.042	-0.117	-0.138

Impact on GDP, no disbursement	**Scenario 22**		
GTAP Economy	**2030**	**2040**	**2050**
Sri Lanka	-0.057	-0.171	-0.196
Sweden	-0.028	-0.078	-0.095
Syrian Arab Republic	-0.070	-0.194	-0.212
Thailand	-0.078	-0.237	-0.282
Trinidad and Tobago	-0.137	-0.393	-0.435
Tunisia	-0.096	-0.285	-0.327
Türkiye	-0.077	-0.217	-0.262
Ukraine	-0.085	-0.210	-0.260
United Arab Emirates	-0.094	-0.282	-0.325
United Kingdom of Great Britain and Northern Ireland	-0.032	-0.090	-0.106
United Republic of Tanzania	-0.132	-0.321	-0.366
United States of America	-0.017	-0.051	-0.059
Uruguay	-0.087	-0.214	-0.254
Uzbekistan	-0.014	-0.054	-0.061
Venezuela (Bolivarian Republic of)	-0.029	-0.076	-0.088
Viet Nam	-0.222	-0.825	-1.003
Zimbabwe	-0.068	-0.161	-0.179
Rest of American SIDS	-0.148	-0.432	-0.490
Rest of Asia	-0.029	-0.098	-0.115
Rest of Asian SIDS and LDCs	-0.115	-0.369	-0.439
Rest of Caribbean	-0.075	-0.203	-0.233
Rest of developing economies in Europe and Central Asia	-0.028	-0.083	-0.098
Rest of Europe	-0.020	-0.059	-0.068
Rest of landlocked economies in Africa	-0.048	-0.123	-0.141
Rest of LDC in Africa	-0.105	-0.293	-0.350
Rest of Middle East and North Africa	-0.073	-0.199	-0.218
Rest of Oceania	-0.173	-0.465	-0.542
Rest of the world	-0.023	-0.072	-0.081
Rest of Western Africa	-0.257	-0.779	-0.951

Annex 3. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG) – Scenario 23

Impact on GDP, no disbursement	**Scenario 23**		
GTAP Economy	**2030**	**2040**	**2050**
Albania	-0.043	-0.153	-0.159
Algeria	-0.089	-0.295	-0.344
Argentina	-0.031	-0.095	-0.113
Armenia	-0.035	-0.098	-0.123
Australia	-0.071	-0.235	-0.288
Bahrain	-0.074	-0.322	-0.361
Bangladesh	-0.065	-0.257	-0.296
Belgium	-0.051	-0.168	-0.193
Bolivia (Plurinational State of)	-0.014	-0.044	-0.054
Botswana	-0.014	-0.053	-0.053
Brazil	-0.043	-0.117	-0.136
Brunei Darussalam	-0.054	-0.225	-0.244
Bulgaria	-0.073	-0.239	-0.279
Cameroon	-0.057	-0.207	-0.230
Canada	-0.031	-0.093	-0.114
Chile	-0.141	-0.411	-0.488
China	-0.045	-0.149	-0.176
Colombia	-0.069	-0.213	-0.246
Costa Rica	-0.120	-0.375	-0.416
Côte d'Ivoire	-0.077	-0.289	-0.318
Croatia	-0.022	-0.080	-0.087
Cyprus	-0.054	-0.203	-0.224
Denmark	-0.023	-0.083	-0.094
Dominican Republic	-0.066	-0.239	-0.267
Ecuador	-0.094	-0.280	-0.310
Egypt	-0.086	-0.349	-0.403
El Salvador	-0.084	-0.271	-0.300
Equatorial Guinea	0.000	0.009	0.023
Estonia	-0.037	-0.128	-0.147
Eswatini	-0.016	-0.050	-0.054
Finland	-0.036	-0.123	-0.143
France	-0.013	-0.043	-0.049
Gabon	-0.102	-0.328	-0.402
Georgia	-0.049	-0.188	-0.214
Germany	-0.020	-0.068	-0.080
Ghana	-0.072	-0.266	-0.304
Greece	-0.035	-0.117	-0.132
Guatemala	-0.102	-0.294	-0.330
Honduras	-0.141	-0.451	-0.505
India	-0.033	-0.124	-0.149

Impact on GDP, no disbursement	**Scenario 23**		
GTAP Economy	**2030**	**2040**	**2050**
Indonesia	-0.068	-0.227	-0.280
Iran (Islamic Republic of)	-0.018	-0.085	-0.093
Iraq	-0.031	-0.145	-0.174
Ireland	-0.020	-0.078	-0.086
Israel	-0.039	-0.148	-0.165
Italy	-0.022	-0.079	-0.087
Japan	-0.034	-0.113	-0.132
Jordan	-0.019	-0.071	-0.082
Kenya	-0.147	-0.438	-0.491
Kuwait	-0.031	-0.159	-0.171
Latvia	-0.042	-0.146	-0.168
Lithuania	-0.043	-0.141	-0.155
Madagascar	-0.104	-0.366	-0.413
Malaysia	-0.085	-0.310	-0.356
Malta	-0.145	-0.585	-0.626
Mauritius	-0.078	-0.230	-0.256
Mexico	-0.027	-0.093	-0.116
Morocco	-0.079	-0.286	-0.322
Namibia	-0.020	-0.066	-0.070
Netherlands (Kingdom of the)	-0.025	-0.086	-0.098
New Zealand	-0.087	-0.273	-0.306
Nicaragua	-0.121	-0.394	-0.439
Nigeria	-0.043	-0.166	-0.186
Norway	-0.016	-0.063	-0.075
Oman	-0.096	-0.392	-0.460
Pakistan	-0.042	-0.157	-0.182
Panama	-0.068	-0.249	-0.273
Paraguay	-0.061	-0.189	-0.219
Peru	-0.121	-0.348	-0.417
Philippines	-0.064	-0.241	-0.280
Poland	-0.019	-0.069	-0.079
Portugal	-0.042	-0.142	-0.160
Qatar	-0.089	-0.416	-0.450
Republic of Korea	-0.070	-0.253	-0.290
Romania	-0.019	-0.061	-0.071
Russian Federation	-0.026	-0.088	-0.104
Saudi Arabia	-0.061	-0.256	-0.286
Serbia	-0.020	-0.062	-0.071
Singapore	-0.059	-0.225	-0.249
Slovenia	-0.033	-0.126	-0.138
South Africa	-0.076	-0.227	-0.265
Spain	-0.034	-0.119	-0.135

Impact on GDP, no disbursement	**Scenario 23**		
GTAP Economy	**2030**	**2040**	**2050**
Sri Lanka	-0.045	-0.163	-0.187
Sweden	-0.023	-0.079	-0.093
Syrian Arab Republic	-0.054	-0.195	-0.207
Thailand	-0.065	-0.237	-0.275
Trinidad and Tobago	-0.109	-0.392	-0.427
Tunisia	-0.080	-0.287	-0.320
Türkiye	-0.065	-0.219	-0.255
Ukraine	-0.072	-0.210	-0.252
United Arab Emirates	-0.070	-0.288	-0.318
United Kingdom of Great Britain and Northern Ireland	-0.026	-0.091	-0.103
United Republic of Tanzania	-0.101	-0.324	-0.358
United States of America	-0.015	-0.049	-0.057
Uruguay	-0.076	-0.210	-0.246
Uzbekistan	-0.010	-0.057	-0.060
Venezuela (Bolivarian Republic of)	-0.024	-0.073	-0.083
Viet Nam	-0.200	-0.820	-0.967
Zimbabwe	-0.054	-0.159	-0.174
Rest of American SIDS	-0.113	-0.427	-0.477
Rest of Asia	-0.023	-0.102	-0.112
Rest of Asian SIDS and LDCs	-0.093	-0.365	-0.424
Rest of Caribbean	-0.059	-0.202	-0.227
Rest of developing economies in Europe and Central Asia	-0.022	-0.085	-0.096
Rest of Europe	-0.016	-0.059	-0.066
Rest of landlocked economies in Africa	-0.036	-0.123	-0.137
Rest of LDC in Africa	-0.084	-0.294	-0.340
Rest of Middle East and North Africa	-0.058	-0.200	-0.214
Rest of Oceania	-0.137	-0.459	-0.523
Rest of the world	-0.017	-0.067	-0.076
Rest of Western Africa	-0.225	-0.784	-0.926

Annex 4. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG) – Scenario 24

Impact on GDP, no disbursement	Scenario 24		
GTAP Economy	**2030**	**2040**	**2050**
Albania	-0.047	-0.152	-0.158
Algeria	-0.092	-0.280	-0.344
Argentina	-0.028	-0.095	-0.114
Armenia	-0.032	-0.098	-0.125
Australia	-0.058	-0.235	-0.291
Bahrain	-0.077	-0.306	-0.363
Bangladesh	-0.069	-0.251	-0.297
Belgium	-0.050	-0.162	-0.194
Bolivia (Plurinational State of)	-0.014	-0.045	-0.054
Botswana	-0.014	-0.065	-0.059
Brazil	-0.037	-0.116	-0.137
Brunei Darussalam	-0.058	-0.218	-0.244
Bulgaria	-0.075	-0.230	-0.280
Cameroon	-0.055	-0.222	-0.239
Canada	-0.029	-0.093	-0.116
Chile	-0.128	-0.419	-0.498
China	-0.043	-0.145	-0.177
Colombia	-0.066	-0.220	-0.252
Costa Rica	-0.117	-0.397	-0.432
Côte d'Ivoire	-0.076	-0.311	-0.334
Croatia	-0.023	-0.077	-0.087
Cyprus	-0.058	-0.196	-0.224
Denmark	-0.024	-0.080	-0.094
Dominican Republic	-0.066	-0.249	-0.275
Ecuador	-0.089	-0.296	-0.322
Egypt	-0.089	-0.330	-0.406
El Salvador	-0.083	-0.281	-0.310
Equatorial Guinea	0.000	0.003	0.026
Estonia	-0.038	-0.122	-0.148
Eswatini	-0.015	-0.055	-0.057
Finland	-0.036	-0.117	-0.144
France	-0.013	-0.042	-0.049
Gabon	-0.091	-0.337	-0.411
Georgia	-0.052	-0.181	-0.215
Germany	-0.020	-0.067	-0.081
Ghana	-0.068	-0.281	-0.314
Greece	-0.036	-0.112	-0.131
Guatemala	-0.100	-0.306	-0.339
Honduras	-0.139	-0.468	-0.519
India	-0.031	-0.123	-0.151

Impact on GDP, no disbursement	**Scenario 24**		
GTAP Economy	**2030**	**2040**	**2050**
Indonesia	-0.064	-0.215	-0.283
Iran (Islamic Republic of)	-0.021	-0.079	-0.093
Iraq	-0.032	-0.144	-0.179
Ireland	-0.021	-0.074	-0.087
Israel	-0.041	-0.143	-0.165
Italy	-0.023	-0.077	-0.087
Japan	-0.033	-0.108	-0.132
Jordan	-0.020	-0.069	-0.082
Kenya	-0.134	-0.469	-0.510
Kuwait	-0.036	-0.145	-0.168
Latvia	-0.044	-0.138	-0.169
Lithuania	-0.043	-0.134	-0.156
Madagascar	-0.096	-0.390	-0.432
Malaysia	-0.083	-0.292	-0.356
Malta	-0.160	-0.565	-0.621
Mauritius	-0.070	-0.244	-0.263
Mexico	-0.026	-0.092	-0.117
Morocco	-0.081	-0.274	-0.322
Namibia	-0.019	-0.076	-0.076
Netherlands (Kingdom of the)	-0.025	-0.082	-0.098
New Zealand	-0.081	-0.286	-0.315
Nicaragua	-0.120	-0.414	-0.456
Nigeria	-0.041	-0.180	-0.193
Norway	-0.016	-0.058	-0.075
Oman	-0.100	-0.374	-0.462
Pakistan	-0.043	-0.155	-0.183
Panama	-0.061	-0.242	-0.279
Paraguay	-0.052	-0.196	-0.225
Peru	-0.107	-0.354	-0.425
Philippines	-0.064	-0.228	-0.281
Poland	-0.019	-0.066	-0.080
Portugal	-0.042	-0.139	-0.161
Qatar	-0.103	-0.393	-0.446
Republic of Korea	-0.071	-0.239	-0.289
Romania	-0.019	-0.059	-0.071
Russian Federation	-0.026	-0.083	-0.104
Saudi Arabia	-0.069	-0.239	-0.285
Serbia	-0.020	-0.061	-0.071
Singapore	-0.059	-0.212	-0.247
Slovenia	-0.035	-0.125	-0.140
South Africa	-0.070	-0.243	-0.275
Spain	-0.035	-0.115	-0.136

Impact on GDP, no disbursement	Scenario 24		
GTAP Economy	**2030**	**2040**	**2050**
Sri Lanka	-0.048	-0.160	-0.188
Sweden	-0.023	-0.076	-0.093
Syrian Arab Republic	-0.061	-0.190	-0.207
Thailand	-0.066	-0.229	-0.275
Trinidad and Tobago	-0.107	-0.388	-0.426
Tunisia	-0.084	-0.275	-0.319
Türkiye	-0.063	-0.212	-0.256
Ukraine	-0.070	-0.203	-0.254
United Arab Emirates	-0.075	-0.280	-0.319
United Kingdom of Great Britain and Northern Ireland	-0.026	-0.088	-0.104
United Republic of Tanzania	-0.093	-0.348	-0.371
United States of America	-0.014	-0.048	-0.057
Uruguay	-0.066	-0.217	-0.251
Uzbekistan	-0.014	-0.053	-0.060
Venezuela (Bolivarian Republic of)	-0.022	-0.073	-0.085
Viet Nam	-0.202	-0.782	-0.975
Zimbabwe	-0.049	-0.171	-0.182
Rest of American SIDS	-0.109	-0.443	-0.491
Rest of Asia	-0.026	-0.095	-0.111
Rest of Asian SIDS and LDCs	-0.101	-0.348	-0.425
Rest of Caribbean	-0.057	-0.207	-0.235
Rest of developing economies in Europe and Central Asia	-0.023	-0.082	-0.096
Rest of Europe	-0.017	-0.058	-0.066
Rest of landlocked economies in Africa	-0.036	-0.128	-0.142
Rest of LDC in Africa	-0.081	-0.302	-0.348
Rest of Middle East and North Africa	-0.063	-0.194	-0.213
Rest of Oceania	-0.127	-0.469	-0.536
Rest of the world	-0.021	-0.063	-0.076
Rest of Western Africa	-0.204	-0.793	-0.940

Annex 5. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG) – Scenario 26

Impact on GDP, no disbursement	**Scenario 26**		
GTAP Economy	**2030**	**2040**	**2050**
Albania	-0.047	-0.152	-0.158
Algeria	-0.092	-0.280	-0.344
Argentina	-0.028	-0.095	-0.114
Armenia	-0.032	-0.098	-0.125
Australia	-0.058	-0.235	-0.291
Bahrain	-0.077	-0.306	-0.363
Bangladesh	-0.069	-0.251	-0.297
Belgium	-0.050	-0.162	-0.194
Bolivia (Plurinational State of)	-0.014	-0.045	-0.054
Botswana	-0.014	-0.065	-0.059
Brazil	-0.037	-0.116	-0.137
Brunei Darussalam	-0.058	-0.218	-0.244
Bulgaria	-0.075	-0.230	-0.280
Cameroon	-0.055	-0.222	-0.239
Canada	-0.029	-0.093	-0.116
Chile	-0.128	-0.419	-0.498
China	-0.043	-0.145	-0.177
Colombia	-0.066	-0.220	-0.252
Costa Rica	-0.117	-0.397	-0.432
Côte d'Ivoire	-0.076	-0.311	-0.334
Croatia	-0.023	-0.077	-0.087
Cyprus	-0.058	-0.196	-0.224
Denmark	-0.024	-0.080	-0.094
Dominican Republic	-0.066	-0.249	-0.275
Ecuador	-0.089	-0.296	-0.322
Egypt	-0.089	-0.330	-0.406
El Salvador	-0.083	-0.281	-0.310
Equatorial Guinea	0.000	0.003	0.026
Estonia	-0.038	-0.122	-0.148
Eswatini	-0.015	-0.055	-0.057
Finland	-0.036	-0.117	-0.144
France	-0.013	-0.042	-0.049
Gabon	-0.091	-0.337	-0.411
Georgia	-0.052	-0.181	-0.215
Germany	-0.020	-0.067	-0.081
Ghana	-0.068	-0.281	-0.314
Greece	-0.036	-0.112	-0.131
Guatemala	-0.100	-0.306	-0.339
Honduras	-0.139	-0.468	-0.519
India	-0.031	-0.123	-0.151

Impact on GDP, no disbursement	**Scenario 26**		
GTAP Economy	**2030**	**2040**	**2050**
Indonesia	-0.064	-0.215	-0.283
Iran (Islamic Republic of)	-0.021	-0.079	-0.093
Iraq	-0.032	-0.144	-0.179
Ireland	-0.021	-0.074	-0.087
Israel	-0.041	-0.143	-0.165
Italy	-0.023	-0.077	-0.087
Japan	-0.033	-0.108	-0.132
Jordan	-0.020	-0.069	-0.082
Kenya	-0.134	-0.469	-0.510
Kuwait	-0.036	-0.145	-0.168
Latvia	-0.044	-0.138	-0.169
Lithuania	-0.043	-0.134	-0.156
Madagascar	-0.096	-0.390	-0.432
Malaysia	-0.083	-0.292	-0.356
Malta	-0.160	-0.565	-0.621
Mauritius	-0.070	-0.244	-0.263
Mexico	-0.026	-0.092	-0.117
Morocco	-0.081	-0.274	-0.322
Namibia	-0.019	-0.076	-0.076
Netherlands (Kingdom of the)	-0.025	-0.082	-0.098
New Zealand	-0.081	-0.286	-0.315
Nicaragua	-0.120	-0.414	-0.456
Nigeria	-0.041	-0.180	-0.193
Norway	-0.016	-0.058	-0.075
Oman	-0.100	-0.374	-0.462
Pakistan	-0.043	-0.155	-0.183
Panama	-0.061	-0.242	-0.279
Paraguay	-0.052	-0.196	-0.225
Peru	-0.107	-0.354	-0.425
Philippines	-0.064	-0.228	-0.281
Poland	-0.019	-0.066	-0.080
Portugal	-0.042	-0.139	-0.161
Qatar	-0.103	-0.393	-0.446
Republic of Korea	-0.071	-0.239	-0.289
Romania	-0.019	-0.059	-0.071
Russian Federation	-0.026	-0.083	-0.104
Saudi Arabia	-0.069	-0.239	-0.285
Serbia	-0.020	-0.061	-0.071
Singapore	-0.059	-0.212	-0.247
Slovenia	-0.035	-0.125	-0.140
South Africa	-0.070	-0.243	-0.275
Spain	-0.035	-0.115	-0.136

Impact on GDP, no disbursement	**Scenario 26**		
GTAP Economy	**2030**	**2040**	**2050**
Sri Lanka	-0.048	-0.160	-0.188
Sweden	-0.023	-0.076	-0.093
Syrian Arab Republic	-0.061	-0.190	-0.207
Thailand	-0.066	-0.229	-0.275
Trinidad and Tobago	-0.107	-0.388	-0.426
Tunisia	-0.084	-0.275	-0.319
Türkiye	-0.063	-0.212	-0.256
Ukraine	-0.070	-0.203	-0.254
United Arab Emirates	-0.075	-0.280	-0.319
United Kingdom of Great Britain and Northern Ireland	-0.026	-0.088	-0.104
United Republic of Tanzania	-0.093	-0.348	-0.371
United States of America	-0.014	-0.048	-0.057
Uruguay	-0.066	-0.217	-0.251
Uzbekistan	-0.014	-0.053	-0.060
Venezuela (Bolivarian Republic of)	-0.022	-0.073	-0.085
Viet Nam	-0.202	-0.782	-0.975
Zimbabwe	-0.049	-0.171	-0.182
Rest of American SIDS	-0.109	-0.443	-0.491
Rest of Asia	-0.026	-0.095	-0.111
Rest of Asian SIDS and LDCs	-0.101	-0.348	-0.425
Rest of Caribbean	-0.057	-0.207	-0.235
Rest of developing economies in Europe and Central Asia	-0.023	-0.082	-0.096
Rest of Europe	-0.017	-0.058	-0.066
Rest of landlocked economies in Africa	-0.036	-0.128	-0.142
Rest of LDC in Africa	-0.081	-0.302	-0.348
Rest of Middle East and North Africa	-0.063	-0.194	-0.213
Rest of Oceania	-0.127	-0.469	-0.536
Rest of the world	-0.021	-0.063	-0.076
Rest of Western Africa	-0.204	-0.793	-0.940

Annex 6. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG) – Scenario 31

Impact on GDP, no disbursement	**Scenario 31**		
GTAP Economy	**2030**	**2040**	**2050**
Albania	-0.047	-0.143	-0.155
Algeria	-0.101	-0.265	-0.340
Argentina	-0.031	-0.082	-0.110
Armenia	-0.036	-0.089	-0.123
Australia	-0.065	-0.201	-0.284
Bahrain	-0.086	-0.261	-0.346
Bangladesh	-0.069	-0.219	-0.287
Belgium	-0.055	-0.145	-0.188
Bolivia (Plurinational State of)	-0.014	-0.040	-0.053
Botswana	-0.012	-0.043	-0.050
Brazil	-0.043	-0.101	-0.133
Brunei Darussalam	-0.060	-0.191	-0.233
Bulgaria	-0.081	-0.214	-0.275
Cameroon	-0.057	-0.174	-0.223
Canada	-0.032	-0.084	-0.114
Chile	-0.140	-0.359	-0.479
China	-0.047	-0.130	-0.173
Colombia	-0.069	-0.184	-0.240
Costa Rica	-0.119	-0.321	-0.403
Côte d'Ivoire	-0.078	-0.242	-0.307
Croatia	-0.024	-0.070	-0.085
Cyprus	-0.062	-0.177	-0.218
Denmark	-0.025	-0.072	-0.092
Dominican Republic	-0.066	-0.202	-0.258
Ecuador	-0.092	-0.239	-0.299
Egypt	-0.096	-0.297	-0.397
El Salvador	-0.085	-0.232	-0.290
Equatorial Guinea	0.002	0.007	0.020
Estonia	-0.042	-0.115	-0.146
Eswatini	-0.015	-0.042	-0.052
Finland	-0.040	-0.108	-0.141
France	-0.014	-0.038	-0.048
Gabon	-0.103	-0.285	-0.399
Georgia	-0.056	-0.164	-0.209
Germany	-0.022	-0.058	-0.078
Ghana	-0.072	-0.224	-0.297
Greece	-0.039	-0.101	-0.126
Guatemala	-0.101	-0.255	-0.319
Honduras	-0.141	-0.389	-0.491
India	-0.034	-0.105	-0.147

Impact on GDP, no disbursement	**Scenario 31**		
GTAP Economy	**2030**	**2040**	**2050**
Indonesia	-0.070	-0.196	-0.278
Iran (Islamic Republic of)	-0.023	-0.068	-0.087
Iraq	-0.036	-0.119	-0.176
Ireland	-0.022	-0.068	-0.084
Israel	-0.045	-0.128	-0.160
Italy	-0.025	-0.069	-0.084
Japan	-0.036	-0.096	-0.129
Jordan	-0.022	-0.063	-0.081
Kenya	-0.139	-0.373	-0.476
Kuwait	-0.042	-0.126	-0.155
Latvia	-0.048	-0.132	-0.167
Lithuania	-0.047	-0.125	-0.152
Madagascar	-0.100	-0.305	-0.407
Malaysia	-0.089	-0.263	-0.347
Malta	-0.171	-0.510	-0.598
Mauritius	-0.073	-0.197	-0.246
Mexico	-0.029	-0.081	-0.115
Morocco	-0.090	-0.249	-0.314
Namibia	-0.019	-0.055	-0.067
Netherlands (Kingdom of the)	-0.027	-0.074	-0.095
New Zealand	-0.085	-0.234	-0.295
Nicaragua	-0.122	-0.338	-0.426
Nigeria	-0.044	-0.139	-0.182
Norway	-0.018	-0.055	-0.074
Oman	-0.110	-0.323	-0.445
Pakistan	-0.044	-0.132	-0.178
Panama	-0.068	-0.204	-0.261
Paraguay	-0.058	-0.163	-0.215
Peru	-0.120	-0.305	-0.410
Philippines	-0.069	-0.206	-0.275
Poland	-0.021	-0.061	-0.078
Portugal	-0.045	-0.124	-0.156
Qatar	-0.112	-0.337	-0.418
Republic of Korea	-0.077	-0.212	-0.280
Romania	-0.021	-0.054	-0.070
Russian Federation	-0.029	-0.077	-0.102
Saudi Arabia	-0.077	-0.211	-0.268
Serbia	-0.022	-0.057	-0.070
Singapore	-0.066	-0.189	-0.237
Slovenia	-0.037	-0.109	-0.134
South Africa	-0.075	-0.194	-0.259
Spain	-0.038	-0.103	-0.132

Impact on GDP, no disbursement	Scenario 31		
GTAP Economy	**2030**	**2040**	**2050**
Sri Lanka	-0.048	-0.140	-0.181
Sweden	-0.025	-0.069	-0.091
Syrian Arab Republic	-0.064	-0.178	-0.202
Thailand	-0.072	-0.202	-0.267
Trinidad and Tobago	-0.110	-0.322	-0.394
Tunisia	-0.089	-0.253	-0.312
Türkiye	-0.070	-0.191	-0.250
Ukraine	-0.078	-0.188	-0.250
United Arab Emirates	-0.081	-0.236	-0.299
United Kingdom of Great Britain and Northern Ireland	-0.028	-0.078	-0.100
United Republic of Tanzania	-0.098	-0.275	-0.345
United States of America	-0.016	-0.043	-0.056
Uruguay	-0.076	-0.186	-0.242
Uzbekistan	-0.015	-0.045	-0.055
Venezuela (Bolivarian Republic of)	-0.024	-0.063	-0.081
Viet Nam	-0.212	-0.703	-0.958
Zimbabwe	-0.052	-0.135	-0.167
Rest of American SIDS	-0.114	-0.360	-0.459
Rest of Asia	-0.029	-0.083	-0.105
Rest of Asian SIDS and LDCs	-0.105	-0.308	-0.411
Rest of Caribbean	-0.061	-0.170	-0.220
Rest of developing economies in Europe and Central Asia	-0.025	-0.073	-0.092
Rest of Europe	-0.018	-0.051	-0.064
Rest of landlocked economies in Africa	-0.037	-0.103	-0.131
Rest of LDC in Africa	-0.086	-0.248	-0.332
Rest of Middle East and North Africa	-0.067	-0.181	-0.207
Rest of Oceania	-0.135	-0.388	-0.506
Rest of the world	-0.020	-0.057	-0.073
Rest of Western Africa	-0.220	-0.658	-0.910

Annex 7. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG) – Scenario 32

Impact on GDP, no disbursement	**Scenario 32**		
GTAP Economy	**2030**	**2040**	**2050**
Albania	-0.053	-0.151	-0.166
Algeria	-0.112	-0.272	-0.346
Argentina	-0.034	-0.083	-0.109
Armenia	-0.038	-0.092	-0.124
Australia	-0.073	-0.205	-0.282
Bahrain	-0.101	-0.267	-0.344
Bangladesh	-0.081	-0.219	-0.284
Belgium	-0.062	-0.148	-0.188
Bolivia (Plurinational State of)	-0.016	-0.040	-0.053
Botswana	-0.014	-0.044	-0.049
Brazil	-0.046	-0.104	-0.133
Brunei Darussalam	-0.075	-0.195	-0.233
Bulgaria	-0.091	-0.219	-0.279
Cameroon	-0.065	-0.178	-0.221
Canada	-0.034	-0.085	-0.113
Chile	-0.151	-0.362	-0.476
China	-0.053	-0.132	-0.173
Colombia	-0.075	-0.184	-0.238
Costa Rica	-0.132	-0.321	-0.398
Côte d'Ivoire	-0.089	-0.247	-0.305
Croatia	-0.028	-0.072	-0.086
Cyprus	-0.070	-0.183	-0.222
Denmark	-0.029	-0.074	-0.092
Dominican Republic	-0.076	-0.203	-0.255
Ecuador	-0.101	-0.241	-0.296
Egypt	-0.110	-0.302	-0.396
El Salvador	-0.096	-0.233	-0.288
Equatorial Guinea	-0.001	0.005	0.018
Estonia	-0.046	-0.118	-0.148
Eswatini	-0.017	-0.042	-0.051
Finland	-0.046	-0.111	-0.142
France	-0.016	-0.038	-0.048
Gabon	-0.113	-0.291	-0.396
Georgia	-0.064	-0.168	-0.212
Germany	-0.025	-0.060	-0.078
Ghana	-0.082	-0.228	-0.294
Greece	-0.045	-0.104	-0.127
Guatemala	-0.111	-0.255	-0.317
Honduras	-0.158	-0.389	-0.487
India	-0.038	-0.106	-0.145

Impact on GDP, no disbursement	**Scenario 32**		
GTAP Economy	**2030**	**2040**	**2050**
Indonesia	-0.078	-0.200	-0.277
Iran (Islamic Republic of)	-0.029	-0.071	-0.087
Iraq	-0.041	-0.118	-0.171
Ireland	-0.026	-0.070	-0.086
Israel	-0.052	-0.131	-0.161
Italy	-0.029	-0.071	-0.085
Japan	-0.041	-0.099	-0.129
Jordan	-0.025	-0.065	-0.082
Kenya	-0.150	-0.375	-0.469
Kuwait	-0.052	-0.130	-0.155
Latvia	-0.054	-0.134	-0.171
Lithuania	-0.052	-0.128	-0.155
Madagascar	-0.112	-0.307	-0.400
Malaysia	-0.104	-0.269	-0.346
Malta	-0.198	-0.529	-0.612
Mauritius	-0.080	-0.197	-0.244
Mexico	-0.031	-0.082	-0.115
Morocco	-0.101	-0.256	-0.318
Namibia	-0.021	-0.055	-0.066
Netherlands (Kingdom of the)	-0.031	-0.075	-0.095
New Zealand	-0.095	-0.236	-0.293
Nicaragua	-0.136	-0.338	-0.422
Nigeria	-0.049	-0.140	-0.179
Norway	-0.021	-0.055	-0.074
Oman	-0.127	-0.332	-0.443
Pakistan	-0.051	-0.134	-0.177
Panama	-0.076	-0.206	-0.257
Paraguay	-0.063	-0.163	-0.212
Peru	-0.129	-0.309	-0.409
Philippines	-0.081	-0.210	-0.274
Poland	-0.024	-0.062	-0.079
Portugal	-0.052	-0.126	-0.156
Qatar	-0.137	-0.346	-0.417
Republic of Korea	-0.089	-0.218	-0.280
Romania	-0.023	-0.056	-0.071
Russian Federation	-0.032	-0.079	-0.103
Saudi Arabia	-0.089	-0.215	-0.268
Serbia	-0.024	-0.059	-0.072
Singapore	-0.078	-0.194	-0.237
Slovenia	-0.043	-0.112	-0.135
South Africa	-0.082	-0.198	-0.258
Spain	-0.043	-0.106	-0.133

Impact on GDP, no disbursement	**Scenario 32**		
GTAP Economy	**2030**	**2040**	**2050**
Sri Lanka	-0.056	-0.141	-0.180
Sweden	-0.028	-0.070	-0.091
Syrian Arab Republic	-0.072	-0.184	-0.209
Thailand	-0.082	-0.207	-0.267
Trinidad and Tobago	-0.129	-0.326	-0.394
Tunisia	-0.102	-0.261	-0.317
Türkiye	-0.078	-0.196	-0.252
Ukraine	-0.085	-0.191	-0.251
United Arab Emirates	-0.096	-0.243	-0.299
United Kingdom of Great Britain and Northern Ireland	-0.032	-0.080	-0.101
United Republic of Tanzania	-0.108	-0.277	-0.341
United States of America	-0.017	-0.043	-0.056
Uruguay	-0.082	-0.189	-0.241
Uzbekistan	-0.019	-0.047	-0.055
Venezuela (Bolivarian Republic of)	-0.026	-0.063	-0.080
Viet Nam	-0.250	-0.709	-0.945
Zimbabwe	-0.057	-0.137	-0.166
Rest of American SIDS	-0.129	-0.359	-0.452
Rest of Asia	-0.035	-0.085	-0.104
Rest of Asian SIDS and LDCs	-0.123	-0.312	-0.409
Rest of Caribbean	-0.069	-0.172	-0.218
Rest of developing economies in Europe and Central Asia	-0.029	-0.075	-0.093
Rest of Europe	-0.021	-0.053	-0.065
Rest of landlocked economies in Africa	-0.041	-0.104	-0.130
Rest of LDC in Africa	-0.097	-0.252	-0.328
Rest of Middle East and North Africa	-0.075	-0.188	-0.215
Rest of Oceania	-0.152	-0.393	-0.501
Rest of the world	-0.023	-0.056	-0.073
Rest of Western Africa	-0.246	-0.675	-0.903

Annex 8. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG) – Scenario 36

Impact on GDP, no disbursement	**Scenario 36**		
GTAP Economy	**2030**	**2040**	**2050**
Albania	-0.051	-0.152	-0.168
Algeria	-0.106	-0.274	-0.353
Argentina	-0.035	-0.089	-0.114
Armenia	-0.039	-0.094	-0.126
Australia	-0.075	-0.225	-0.293
Bahrain	-0.107	-0.291	-0.364
Bangladesh	-0.082	-0.234	-0.298
Belgium	-0.063	-0.156	-0.196
Bolivia (Plurinational State of)	-0.017	-0.043	-0.056
Botswana	-0.018	-0.053	-0.053
Brazil	-0.046	-0.111	-0.138
Brunei Darussalam	-0.074	-0.206	-0.247
Bulgaria	-0.086	-0.223	-0.285
Cameroon	-0.068	-0.198	-0.234
Canada	-0.034	-0.088	-0.117
Chile	-0.158	-0.390	-0.497
China	-0.053	-0.139	-0.179
Colombia	-0.080	-0.202	-0.251
Costa Rica	-0.141	-0.359	-0.423
Côte d'Ivoire	-0.091	-0.276	-0.323
Croatia	-0.028	-0.074	-0.089
Cyprus	-0.071	-0.191	-0.230
Denmark	-0.029	-0.077	-0.096
Dominican Republic	-0.079	-0.225	-0.269
Ecuador	-0.112	-0.269	-0.316
Egypt	-0.114	-0.312	-0.411
El Salvador	-0.098	-0.257	-0.304
Equatorial Guinea	-0.002	0.002	0.017
Estonia	-0.045	-0.120	-0.151
Eswatini	-0.018	-0.049	-0.055
Finland	-0.045	-0.114	-0.146
France	-0.016	-0.040	-0.050
Gabon	-0.111	-0.311	-0.410
Georgia	-0.063	-0.174	-0.218
Germany	-0.026	-0.063	-0.081
Ghana	-0.084	-0.252	-0.310
Greece	-0.045	-0.109	-0.133
Guatemala	-0.118	-0.281	-0.336

Impact on GDP, no disbursement	**Scenario 36**		
GTAP Economy	**2030**	**2040**	**2050**
Honduras	-0.164	-0.428	-0.515
India	-0.038	-0.115	-0.152
Indonesia	-0.076	-0.206	-0.285
Iran (Islamic Republic of)	-0.035	-0.076	-0.093
Iraq	-0.050	-0.131	-0.184
Ireland	-0.025	-0.072	-0.089
Israel	-0.052	-0.138	-0.168
Italy	-0.030	-0.074	-0.089
Japan	-0.043	-0.105	-0.133
Jordan	-0.025	-0.067	-0.085
Kenya	-0.167	-0.419	-0.501
Kuwait	-0.062	-0.140	-0.168
Latvia	-0.051	-0.136	-0.173
Lithuania	-0.051	-0.132	-0.159
Madagascar	-0.120	-0.347	-0.424
Malaysia	-0.100	-0.281	-0.360
Malta	-0.209	-0.550	-0.639
Mauritius	-0.089	-0.220	-0.262
Mexico	-0.031	-0.087	-0.119
Morocco	-0.099	-0.266	-0.330
Namibia	-0.024	-0.065	-0.071
Netherlands (Kingdom of the)	-0.031	-0.079	-0.099
New Zealand	-0.103	-0.261	-0.313
Nicaragua	-0.142	-0.376	-0.448
Nigeria	-0.051	-0.158	-0.189
Norway	-0.019	-0.056	-0.076
Oman	-0.140	-0.354	-0.463
Pakistan	-0.053	-0.145	-0.186
Panama	-0.077	-0.228	-0.275
Paraguay	-0.067	-0.179	-0.224
Peru	-0.134	-0.332	-0.425
Philippines	-0.077	-0.219	-0.284
Poland	-0.023	-0.064	-0.081
Portugal	-0.052	-0.133	-0.163
Qatar	-0.170	-0.373	-0.449
Republic of Korea	-0.095	-0.229	-0.291
Romania	-0.022	-0.057	-0.073
Russian Federation	-0.032	-0.081	-0.106
Saudi Arabia	-0.099	-0.229	-0.284
Serbia	-0.023	-0.060	-0.073
Singapore	-0.077	-0.205	-0.250
Slovenia	-0.045	-0.119	-0.141

Impact on GDP, no disbursement	**Scenario 36**		
GTAP Economy	**2030**	**2040**	**2050**
South Africa	-0.088	-0.221	-0.270
Spain	-0.044	-0.111	-0.138
Sri Lanka	-0.056	-0.151	-0.190
Sweden	-0.028	-0.073	-0.094
Syrian Arab Republic	-0.073	-0.187	-0.216
Thailand	-0.083	-0.218	-0.278
Trinidad and Tobago	-0.140	-0.361	-0.422
Tunisia	-0.100	-0.268	-0.327
Türkiye	-0.077	-0.203	-0.260
Ukraine	-0.082	-0.196	-0.257
United Arab Emirates	-0.112	-0.264	-0.319
United Kingdom of Great Britain and Northern Ireland	-0.033	-0.084	-0.105
United Republic of Tanzania	-0.118	-0.310	-0.363
United States of America	-0.017	-0.046	-0.058
Uruguay	-0.082	-0.202	-0.251
Uzbekistan	-0.024	-0.049	-0.059
Venezuela (Bolivarian Republic of)	-0.027	-0.068	-0.085
Viet Nam	-0.239	-0.742	-0.986
Zimbabwe	-0.061	-0.155	-0.177
Rest of American SIDS	-0.132	-0.401	-0.482
Rest of Asia	-0.040	-0.090	-0.111
Rest of Asian SIDS and LDCs	-0.125	-0.331	-0.430
Rest of Caribbean	-0.070	-0.190	-0.230
Rest of developing economies in Europe and Central Asia	-0.031	-0.078	-0.097
Rest of Europe	-0.021	-0.055	-0.067
Rest of landlocked economies in Africa	-0.047	-0.116	-0.139
Rest of LDC in Africa	-0.106	-0.275	-0.345
Rest of Middle East and North Africa	-0.073	-0.192	-0.222
Rest of Oceania	-0.160	-0.432	-0.532
Rest of the world	-0.022	-0.060	-0.076
Rest of Western Africa	-0.257	-0.732	-0.939

Annex 9. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG) – Scenario 43

Impact on GDP, no disbursement	**Scenario 43**		
GTAP Economy	**2030**	**2040**	**2050**
Albania	-0.059	-0.171	-0.165
Algeria	-0.134	-0.331	-0.342
Argentina	-0.045	-0.111	-0.113
Armenia	-0.048	-0.111	-0.119
Australia	-0.112	-0.274	-0.284
Bahrain	-0.126	-0.360	-0.359
Bangladesh	-0.101	-0.286	-0.285
Belgium	-0.079	-0.191	-0.194
Bolivia (Plurinational State of)	-0.019	-0.050	-0.051
Botswana	-0.016	-0.072	-0.067
Brazil	-0.062	-0.138	-0.141
Brunei Darussalam	-0.090	-0.248	-0.243
Bulgaria	-0.110	-0.271	-0.279
Cameroon	-0.082	-0.253	-0.246
Canada	-0.043	-0.107	-0.111
Chile	-0.197	-0.482	-0.489
China	-0.068	-0.167	-0.172
Colombia	-0.097	-0.251	-0.248
Costa Rica	-0.165	-0.449	-0.436
Côte d'Ivoire	-0.110	-0.355	-0.346
Croatia	-0.034	-0.088	-0.088
Cyprus	-0.083	-0.227	-0.226
Denmark	-0.035	-0.091	-0.092
Dominican Republic	-0.096	-0.284	-0.275
Ecuador	-0.130	-0.338	-0.329
Egypt	-0.131	-0.376	-0.381
El Salvador	-0.122	-0.323	-0.316
Equatorial Guinea	-0.008	-0.005	0.007
Estonia	-0.055	-0.145	-0.148
Eswatini	-0.021	-0.062	-0.059
Finland	-0.056	-0.138	-0.142
France	-0.020	-0.049	-0.049
Gabon	-0.145	-0.388	-0.400
Georgia	-0.074	-0.210	-0.214
Germany	-0.029	-0.076	-0.079
Ghana	-0.105	-0.322	-0.316
Greece	-0.056	-0.134	-0.135
Guatemala	-0.142	-0.350	-0.343
Honduras	-0.200	-0.533	-0.518
India	-0.050	-0.142	-0.144

Impact on GDP, no disbursement	**Scenario 43**		
GTAP Economy	**2030**	**2040**	**2050**
Indonesia	-0.104	-0.254	-0.269
Iran (Islamic Republic of)	-0.031	-0.091	-0.090
Iraq	-0.048	-0.160	-0.150
Ireland	-0.032	-0.086	-0.086
Israel	-0.061	-0.164	-0.164
Italy	-0.033	-0.088	-0.088
Japan	-0.053	-0.127	-0.131
Jordan	-0.029	-0.079	-0.080
Kenya	-0.195	-0.530	-0.515
Kuwait	-0.057	-0.169	-0.165
Latvia	-0.065	-0.166	-0.170
Lithuania	-0.067	-0.161	-0.160
Madagascar	-0.146	-0.438	-0.421
Malaysia	-0.142	-0.348	-0.352
Malta	-0.220	-0.633	-0.628
Mauritius	-0.105	-0.275	-0.267
Mexico	-0.039	-0.106	-0.111
Morocco	-0.122	-0.318	-0.319
Namibia	-0.025	-0.084	-0.079
Netherlands (Kingdom of the)	-0.039	-0.097	-0.098
New Zealand	-0.121	-0.324	-0.319
Nicaragua	-0.169	-0.469	-0.457
Nigeria	-0.061	-0.202	-0.194
Norway	-0.027	-0.072	-0.074
Oman	-0.156	-0.437	-0.446
Pakistan	-0.065	-0.179	-0.177
Panama	-0.114	-0.290	-0.278
Paraguay	-0.085	-0.220	-0.219
Peru	-0.170	-0.409	-0.418
Philippines	-0.104	-0.266	-0.272
Poland	-0.029	-0.078	-0.079
Portugal	-0.064	-0.160	-0.161
Qatar	-0.154	-0.451	-0.441
Republic of Korea	-0.114	-0.281	-0.287
Romania	-0.028	-0.069	-0.071
Russian Federation	-0.041	-0.100	-0.103
Saudi Arabia	-0.103	-0.279	-0.279
Serbia	-0.029	-0.070	-0.071
Singapore	-0.101	-0.252	-0.251
Slovenia	-0.050	-0.140	-0.140
South Africa	-0.102	-0.277	-0.277
Spain	-0.052	-0.134	-0.135

Impact on GDP, no disbursement	**Scenario 43**		
GTAP Economy	**2030**	**2040**	**2050**
Sri Lanka	-0.070	-0.185	-0.185
Sweden	-0.035	-0.088	-0.091
Syrian Arab Republic	-0.077	-0.213	-0.210
Thailand	-0.102	-0.266	-0.271
Trinidad and Tobago	-0.181	-0.461	-0.448
Tunisia	-0.122	-0.319	-0.319
Türkiye	-0.097	-0.248	-0.253
Ukraine	-0.105	-0.241	-0.252
United Arab Emirates	-0.113	-0.323	-0.321
United Kingdom of Great Britain and Northern Ireland	-0.039	-0.101	-0.102
United Republic of Tanzania	-0.136	-0.392	-0.380
United States of America	-0.023	-0.056	-0.057
Uruguay	-0.104	-0.248	-0.252
Uzbekistan	-0.017	-0.058	-0.057
Venezuela (Bolivarian Republic of)	-0.035	-0.084	-0.083
Viet Nam	-0.319	-0.890	-0.912
Zimbabwe	-0.073	-0.195	-0.189
Rest of American SIDS	-0.166	-0.502	-0.487
Rest of Asia	-0.037	-0.107	-0.107
Rest of Asian SIDS and LDCs	-0.149	-0.404	-0.409
Rest of Caribbean	-0.088	-0.240	-0.236
Rest of developing economies in Europe and Central Asia	-0.033	-0.093	-0.094
Rest of Europe	-0.024	-0.065	-0.066
Rest of landlocked economies in Africa	-0.051	-0.145	-0.143
Rest of LDC in Africa	-0.120	-0.343	-0.342
Rest of Middle East and North Africa	-0.084	-0.223	-0.219
Rest of Oceania	-0.203	-0.541	-0.537
Rest of the world	-0.029	-0.076	-0.075
Rest of Western Africa	-0.342	-0.924	-0.928

Annex 10. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG) – Scenario 46

Impact on GDP, no disbursement	Scenario 46		
GTAP Economy	**2030**	**2040**	**2050**
Albania	-0.095	-0.175	-0.166
Algeria	-0.239	-0.345	-0.351
Argentina	-0.079	-0.109	-0.111
Armenia	-0.074	-0.109	-0.116
Australia	-0.191	-0.271	-0.278
Bahrain	-0.260	-0.361	-0.357
Bangladesh	-0.196	-0.281	-0.272
Belgium	-0.145	-0.198	-0.199
Bolivia (Plurinational State of)	-0.036	-0.052	-0.053
Botswana	-0.038	-0.053	-0.048
Brazil	-0.106	-0.141	-0.143
Brunei Darussalam	-0.194	-0.256	-0.247
Bulgaria	-0.200	-0.282	-0.287
Cameroon	-0.166	-0.228	-0.221
Canada	-0.076	-0.106	-0.109
Chile	-0.338	-0.475	-0.479
China	-0.124	-0.169	-0.173
Colombia	-0.175	-0.246	-0.239
Costa Rica	-0.316	-0.434	-0.417
Côte d'Ivoire	-0.235	-0.319	-0.311
Croatia	-0.064	-0.091	-0.090
Cyprus	-0.154	-0.230	-0.227
Denmark	-0.066	-0.092	-0.092
Dominican Republic	-0.191	-0.268	-0.258
Ecuador	-0.241	-0.328	-0.316
Egypt	-0.241	-0.365	-0.363
El Salvador	-0.237	-0.321	-0.312
Equatorial Guinea	-0.018	-0.008	0.002
Estonia	-0.103	-0.151	-0.151
Eswatini	-0.043	-0.058	-0.055
Finland	-0.103	-0.144	-0.146
France	-0.037	-0.050	-0.050
Gabon	-0.259	-0.367	-0.380
Georgia	-0.138	-0.210	-0.210
Germany	-0.055	-0.076	-0.078
Ghana	-0.210	-0.292	-0.288
Greece	-0.105	-0.141	-0.140
Guatemala	-0.261	-0.354	-0.343
Honduras	-0.384	-0.526	-0.506
India	-0.093	-0.135	-0.136

Impact on GDP, no disbursement	**Scenario 46**		
GTAP Economy	**2030**	**2040**	**2050**
Indonesia	-0.179	-0.253	-0.266
Iran (Islamic Republic of)	-0.064	-0.093	-0.091
Iraq	-0.102	-0.152	-0.139
Ireland	-0.061	-0.088	-0.086
Israel	-0.117	-0.165	-0.163
Italy	-0.063	-0.091	-0.089
Japan	-0.097	-0.132	-0.135
Jordan	-0.052	-0.080	-0.080
Kenya	-0.361	-0.497	-0.479
Kuwait	-0.122	-0.176	-0.167
Latvia	-0.123	-0.176	-0.177
Lithuania	-0.122	-0.171	-0.168
Madagascar	-0.283	-0.401	-0.384
Malaysia	-0.266	-0.356	-0.358
Malta	-0.421	-0.642	-0.627
Mauritius	-0.196	-0.268	-0.258
Mexico	-0.071	-0.103	-0.107
Morocco	-0.219	-0.320	-0.319
Namibia	-0.054	-0.073	-0.068
Netherlands (Kingdom of the)	-0.073	-0.100	-0.100
New Zealand	-0.232	-0.317	-0.308
Nicaragua	-0.332	-0.457	-0.440
Nigeria	-0.125	-0.176	-0.169
Norway	-0.053	-0.074	-0.075
Oman	-0.300	-0.435	-0.438
Pakistan	-0.125	-0.177	-0.173
Panama	-0.205	-0.279	-0.265
Paraguay	-0.150	-0.211	-0.208
Peru	-0.288	-0.404	-0.411
Philippines	-0.198	-0.267	-0.271
Poland	-0.056	-0.080	-0.080
Portugal	-0.121	-0.164	-0.163
Qatar	-0.321	-0.462	-0.443
Republic of Korea	-0.211	-0.291	-0.294
Romania	-0.050	-0.071	-0.072
Russian Federation	-0.074	-0.104	-0.105
Saudi Arabia	-0.205	-0.291	-0.282
Serbia	-0.052	-0.072	-0.073
Singapore	-0.201	-0.264	-0.261
Slovenia	-0.097	-0.139	-0.137
South Africa	-0.190	-0.264	-0.265
Spain	-0.096	-0.136	-0.136

Impact on GDP, no disbursement	**Scenario 46**		
GTAP Economy	**2030**	**2040**	**2050**
Sri Lanka	-0.137	-0.191	-0.186
Sweden	-0.063	-0.089	-0.090
Syrian Arab Republic	-0.139	-0.221	-0.214
Thailand	-0.200	-0.272	-0.274
Trinidad and Tobago	-0.348	-0.467	-0.451
Tunisia	-0.225	-0.327	-0.324
Türkiye	-0.176	-0.249	-0.252
Ukraine	-0.183	-0.250	-0.259
United Arab Emirates	-0.230	-0.325	-0.318
United Kingdom of Great Britain and Northern Ireland	-0.074	-0.102	-0.102
United Republic of Tanzania	-0.261	-0.361	-0.348
United States of America	-0.043	-0.058	-0.058
Uruguay	-0.182	-0.246	-0.249
Uzbekistan	-0.039	-0.059	-0.055
Venezuela (Bolivarian Republic of)	-0.063	-0.085	-0.083
Viet Nam	-0.618	-0.862	-0.869
Zimbabwe	-0.141	-0.189	-0.183
Rest of American SIDS	-0.332	-0.467	-0.446
Rest of Asia	-0.074	-0.107	-0.105
Rest of Asian SIDS and LDCs	-0.292	-0.410	-0.404
Rest of Caribbean	-0.171	-0.233	-0.227
Rest of developing economies in Europe and Central Asia	-0.063	-0.094	-0.092
Rest of Europe	-0.047	-0.066	-0.065
Rest of landlocked economies in Africa	-0.098	-0.138	-0.133
Rest of LDC in Africa	-0.224	-0.323	-0.318
Rest of Middle East and North Africa	-0.151	-0.232	-0.226
Rest of Oceania	-0.384	-0.528	-0.520
Rest of the world	-0.058	-0.080	-0.078
Rest of Western Africa	-0.616	-0.861	-0.863

Annex 11. Relative impact of policy scenarios on gross domestic product, with disbursement of revenues (percentage difference to BAULG) – Scenario 26

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 26		
		2030	2040	2050
Albania	SIDS and LDCs	-0.068	-0.141	-0.139
	Developing economies, LDCs and SIDS	-0.046	-0.088	-0.091
	All economies	-0.050	-0.096	-0.099
United Arab Emirates	SIDS and LDCs	-0.044	-0.051	-0.027
	Developing economies, LDCs and SIDS	-0.061	-0.077	-0.057
	All economies	-0.061	-0.077	-0.057
Argentina	SIDS and LDCs	-0.049	-0.072	-0.077
	Developing economies, LDCs and SIDS	-0.042	-0.062	-0.065
	All economies	-0.043	-0.063	-0.066
Armenia	SIDS and LDCs	-0.024	-0.033	-0.038
	Developing economies, LDCs and SIDS	-0.023	-0.032	-0.036
	All economies	-0.024	-0.034	-0.038
Australia	SIDS and LDCs	-0.121	-0.187	-0.203
	Developing economies, LDCs and SIDS	-0.124	-0.193	-0.210
	All economies	-0.122	-0.189	-0.205
Belgium	SIDS and LDCs	-0.146	-0.219	-0.236
	Developing economies, LDCs and SIDS	-0.146	-0.218	-0.235
	All economies	-0.137	-0.205	-0.219
Bangladesh	SIDS and LDCs	-0.115	-0.182	-0.182
	Developing economies, LDCs and SIDS	-0.121	-0.185	-0.184
	All economies	-0.121	-0.185	-0.184
Bulgaria	SIDS and LDCs	-0.117	-0.175	-0.185
	Developing economies, LDCs and SIDS	-0.090	-0.134	-0.138
	All economies	-0.091	-0.136	-0.140
Bahrain	SIDS and LDCs	-0.131	-0.189	-0.188
	Developing economies, LDCs and SIDS	-0.134	-0.193	-0.192
	All economies	-0.132	-0.191	-0.190
Bolivia (Plurinational State of)	SIDS and LDCs	-0.010	-0.015	-0.013
	Developing economies, LDCs and SIDS	-0.005	-0.006	-0.004
	All economies	-0.006	-0.007	-0.005
Brazil	SIDS and LDCs	-0.076	-0.107	-0.114
	Developing economies, LDCs and SIDS	-0.055	-0.076	-0.079
	All economies	-0.057	-0.080	-0.083
Brunei Darussalam	SIDS and LDCs	-0.101	-0.130	-0.118
	Developing economies, LDCs and SIDS	-0.103	-0.132	-0.122
	All economies	-0.103	-0.133	-0.122
Botswana	SIDS and LDCs	0.000	0.003	0.016
	Developing economies, LDCs and SIDS	-0.001	0.002	0.014

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 26		
		2030	2040	2050
	All economies	-0.001	0.001	0.013
Canada	SIDS and LDCs	-0.075	-0.113	-0.125
	Developing economies, LDCs and SIDS	-0.076	-0.115	-0.127
	All economies	-0.074	-0.112	-0.123
Chile	SIDS and LDCs	-0.231	-0.347	-0.368
	Developing economies, LDCs and SIDS	-0.234	-0.351	-0.373
	All economies	-0.227	-0.341	-0.361
China	SIDS and LDCs	-0.080	-0.112	-0.120
	Developing economies, LDCs and SIDS	-0.072	-0.101	-0.106
	All economies	-0.072	-0.101	-0.107
Côte d'Ivoire	SIDS and LDCs	-0.121	-0.173	-0.159
	Developing economies, LDCs and SIDS	-0.089	-0.126	-0.117
	All economies	-0.094	-0.135	-0.125
Cameroon	SIDS and LDCs	-0.102	-0.148	-0.141
	Developing economies, LDCs and SIDS	-0.059	-0.092	-0.087
	All economies	-0.064	-0.099	-0.094
Colombia	SIDS and LDCs	-0.122	-0.184	-0.186
	Developing economies, LDCs and SIDS	-0.102	-0.153	-0.153
	All economies	-0.104	-0.156	-0.156
Costa Rica	SIDS and LDCs	-0.227	-0.338	-0.335
	Developing economies, LDCs and SIDS	-0.203	-0.301	-0.296
	All economies	-0.205	-0.304	-0.299
Cyprus	SIDS and LDCs	-0.100	-0.162	-0.165
	Developing economies, LDCs and SIDS	-0.102	-0.166	-0.171
	All economies	-0.098	-0.159	-0.162
Germany	SIDS and LDCs	-0.029	-0.040	-0.043
	Developing economies, LDCs and SIDS	-0.025	-0.033	-0.034
	All economies	-0.023	-0.031	-0.031
Denmark	SIDS and LDCs	-0.088	-0.135	-0.147
	Developing economies, LDCs and SIDS	-0.083	-0.127	-0.138
	All economies	-0.080	-0.122	-0.133
Dominican Republic	SIDS and LDCs	-0.087	-0.132	-0.123
	Developing economies, LDCs and SIDS	-0.116	-0.177	-0.171
	All economies	-0.117	-0.178	-0.173
Algeria	SIDS and LDCs	-0.146	-0.228	-0.243
	Developing economies, LDCs and SIDS	-0.139	-0.217	-0.231
	All economies	-0.140	-0.218	-0.232
Ecuador	SIDS and LDCs	-0.169	-0.246	-0.243
	Developing economies, LDCs and SIDS	-0.147	-0.214	-0.210
	All economies	-0.149	-0.217	-0.213
Egypt	SIDS and LDCs	-0.137	-0.214	-0.215
	Developing economies, LDCs and SIDS	-0.121	-0.205	-0.218

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 26		
		2030	2040	2050
	All economies	-0.124	-0.209	-0.221
Spain	SIDS and LDCs	-0.059	-0.088	-0.091
	Developing economies, LDCs and SIDS	-0.056	-0.083	-0.085
	All economies	-0.051	-0.076	-0.077
Estonia	SIDS and LDCs	-0.120	-0.193	-0.210
	Developing economies, LDCs and SIDS	-0.124	-0.200	-0.217
	All economies	-0.116	-0.186	-0.202
Finland	SIDS and LDCs	-0.082	-0.123	-0.133
	Developing economies, LDCs and SIDS	-0.075	-0.114	-0.123
	All economies	-0.072	-0.109	-0.116
France	SIDS and LDCs	-0.038	-0.055	-0.059
	Developing economies, LDCs and SIDS	-0.034	-0.049	-0.052
	All economies	-0.032	-0.047	-0.049
Gabon	SIDS and LDCs	-0.136	-0.201	-0.218
	Developing economies, LDCs and SIDS	-0.153	-0.231	-0.254
	All economies	-0.154	-0.233	-0.256
United Kingdom of Great Britain and Northern Ireland	SIDS and LDCs	-0.045	-0.064	-0.065
	Developing economies, LDCs and SIDS	-0.045	-0.065	-0.067
	All economies	-0.042	-0.061	-0.062
Georgia	SIDS and LDCs	-0.052	-0.084	-0.082
	Developing economies, LDCs and SIDS	-0.045	-0.073	-0.070
	All economies	-0.045	-0.074	-0.071
Ghana	SIDS and LDCs	-0.097	-0.141	-0.133
	Developing economies, LDCs and SIDS	-0.036	-0.043	-0.030
	All economies	-0.045	-0.057	-0.045
Greece	SIDS and LDCs	-0.092	-0.134	-0.142
	Developing economies, LDCs and SIDS	-0.085	-0.124	-0.131
	All economies	-0.077	-0.113	-0.118
Guatemala	SIDS and LDCs	-0.180	-0.261	-0.259
	Developing economies, LDCs and SIDS	-0.147	-0.212	-0.209
	All economies	-0.151	-0.217	-0.214
Honduras	SIDS and LDCs	-0.233	-0.339	-0.324
	Developing economies, LDCs and SIDS	-0.160	-0.230	-0.213
	All economies	-0.167	-0.240	-0.223
Croatia	SIDS and LDCs	-0.074	-0.114	-0.122
	Developing economies, LDCs and SIDS	-0.070	-0.109	-0.116
	All economies	-0.063	-0.097	-0.103
Indonesia	SIDS and LDCs	-0.112	-0.167	-0.188
	Developing economies, LDCs and SIDS	-0.112	-0.168	-0.189
	All economies	-0.111	-0.167	-0.188

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 26		
		2030	2040	2050
India	SIDS and LDCs	-0.039	-0.057	-0.057
	Developing economies, LDCs and SIDS	-0.051	-0.078	-0.081
	All economies	-0.049	-0.076	-0.078
Ireland	SIDS and LDCs	0.015	0.029	0.044
	Developing economies, LDCs and SIDS	0.016	0.031	0.045
	All economies	0.016	0.031	0.045
Iran (Islamic Republic of)	SIDS and LDCs	-0.023	-0.032	-0.028
	Developing economies, LDCs and SIDS	-0.029	-0.042	-0.040
	All economies	-0.030	-0.043	-0.041
Iraq	SIDS and LDCs	-0.034	-0.049	-0.018
	Developing economies, LDCs and SIDS	-0.030	-0.044	-0.015
	All economies	-0.031	-0.045	-0.016
Israel	SIDS and LDCs	-0.079	-0.115	-0.118
	Developing economies, LDCs and SIDS	-0.077	-0.113	-0.115
	All economies	-0.073	-0.106	-0.107
Italy	SIDS and LDCs	-0.042	-0.063	-0.064
	Developing economies, LDCs and SIDS	-0.039	-0.059	-0.059
	All economies	-0.037	-0.055	-0.055
Jordan	SIDS and LDCs	0.025	0.043	0.055
	Developing economies, LDCs and SIDS	0.021	0.034	0.046
	All economies	0.023	0.037	0.049
Japan	SIDS and LDCs	-0.056	-0.080	-0.085
	Developing economies, LDCs and SIDS	-0.055	-0.079	-0.085
	All economies	-0.055	-0.078	-0.083
Kenya	SIDS and LDCs	-0.166	-0.244	-0.228
	Developing economies, LDCs and SIDS	-0.023	-0.058	-0.048
	All economies	-0.046	-0.089	-0.080
Kuwait	SIDS and LDCs	-0.019	-0.023	-0.004
	Developing economies, LDCs and SIDS	-0.021	-0.027	-0.008
	All economies	-0.022	-0.028	-0.009
Sri Lanka	SIDS and LDCs	-0.096	-0.141	-0.141
	Developing economies, LDCs and SIDS	-0.068	-0.099	-0.097
	All economies	-0.070	-0.102	-0.100
Lithuania	SIDS and LDCs	-0.110	-0.169	-0.177
	Developing economies, LDCs and SIDS	-0.104	-0.161	-0.167
	All economies	-0.096	-0.148	-0.153
Latvia	SIDS and LDCs	-0.155	-0.248	-0.272
	Developing economies, LDCs and SIDS	-0.155	-0.249	-0.272
	All economies	-0.138	-0.222	-0.242
Morocco	SIDS and LDCs	-0.113	-0.175	-0.175
	Developing economies, LDCs and SIDS	-0.105	-0.160	-0.159
	All economies	-0.106	-0.161	-0.160

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 26		
		2030	2040	2050
Madagascar	SIDS and LDCs	0.155	0.240	0.273
	Developing economies, LDCs and SIDS	-0.084	-0.123	-0.108
	All economies	-0.091	-0.135	-0.120
Mexico	SIDS and LDCs	-0.061	-0.096	-0.107
	Developing economies, LDCs and SIDS	-0.054	-0.084	-0.092
	All economies	-0.054	-0.084	-0.092
Malta	SIDS and LDCs	-0.398	-0.659	-0.690
	Developing economies, LDCs and SIDS	-0.435	-0.715	-0.753
	All economies	-0.395	-0.645	-0.679
Mauritius	SIDS and LDCs	-0.067	-0.095	-0.085
	Developing economies, LDCs and SIDS	-0.103	-0.150	-0.141
	All economies	-0.104	-0.150	-0.142
Malaysia	SIDS and LDCs	-0.087	-0.101	-0.089
	Developing economies, LDCs and SIDS	-0.082	-0.094	-0.082
	All economies	-0.083	-0.096	-0.083
Namibia	SIDS and LDCs	0.055	0.096	0.122
	Developing economies, LDCs and SIDS	0.039	0.071	0.092
	All economies	0.038	0.069	0.091
Nigeria	SIDS and LDCs	-0.074	-0.113	-0.107
	Developing economies, LDCs and SIDS	-0.033	-0.042	-0.034
	All economies	-0.037	-0.049	-0.041
Nicaragua	SIDS and LDCs	-0.184	-0.264	-0.246
	Developing economies, LDCs and SIDS	-0.070	-0.091	-0.068
	All economies	-0.081	-0.106	-0.084
Netherlands (Kingdom of the)	SIDS and LDCs	-0.069	-0.103	-0.110
	Developing economies, LDCs and SIDS	-0.067	-0.099	-0.105
	All economies	-0.064	-0.095	-0.100
Norway	SIDS and LDCs	-0.020	-0.031	-0.033
	Developing economies, LDCs and SIDS	-0.020	-0.031	-0.032
	All economies	-0.020	-0.031	-0.032
New Zealand	SIDS and LDCs	-0.163	-0.241	-0.242
	Developing economies, LDCs and SIDS	-0.163	-0.241	-0.241
	All economies	-0.158	-0.234	-0.234
Oman	SIDS and LDCs	-0.153	-0.235	-0.244
	Developing economies, LDCs and SIDS	-0.164	-0.254	-0.266
	All economies	-0.162	-0.250	-0.262
Pakistan	SIDS and LDCs	-0.065	-0.099	-0.097
	Developing economies, LDCs and SIDS	-0.016	-0.028	-0.022
	All economies	-0.022	-0.036	-0.031
Panama	SIDS and LDCs	-0.161	-0.246	-0.248
	Developing economies, LDCs and SIDS	-0.173	-0.264	-0.269
	All economies	-0.160	-0.244	-0.249

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 26		
		2030	2040	2050
Peru	SIDS and LDCs	-0.200	-0.300	-0.323
	Developing economies, LDCs and SIDS	-0.195	-0.293	-0.315
	All economies	-0.196	-0.294	-0.316
Philippines	SIDS and LDCs	-0.094	-0.123	-0.123
	Developing economies, LDCs and SIDS	-0.091	-0.118	-0.117
	All economies	-0.091	-0.118	-0.118
Poland	SIDS and LDCs	-0.027	-0.039	-0.039
	Developing economies, LDCs and SIDS	-0.025	-0.037	-0.036
	All economies	-0.020	-0.029	-0.027
Portugal	SIDS and LDCs	-0.075	-0.108	-0.111
	Developing economies, LDCs and SIDS	-0.083	-0.121	-0.125
	All economies	-0.075	-0.108	-0.111
Paraguay	SIDS and LDCs	-0.093	-0.142	-0.145
	Developing economies, LDCs and SIDS	-0.071	-0.106	-0.105
	All economies	-0.074	-0.110	-0.109
Qatar	SIDS and LDCs	-0.202	-0.310	-0.301
	Developing economies, LDCs and SIDS	-0.204	-0.313	-0.305
	All economies	-0.204	-0.313	-0.305
Republic of Korea	SIDS and LDCs	-0.111	-0.159	-0.164
	Developing economies, LDCs and SIDS	-0.109	-0.155	-0.160
	All economies	-0.105	-0.150	-0.154
Romania	SIDS and LDCs	0.012	0.025	0.033
	Developing economies, LDCs and SIDS	0.017	0.032	0.040
	All economies	0.019	0.036	0.045
Russian Federation	SIDS and LDCs	-0.025	-0.036	-0.036
	Developing economies, LDCs and SIDS	-0.025	-0.035	-0.035
	All economies	-0.025	-0.036	-0.036
Saudi Arabia	SIDS and LDCs	-0.103	-0.152	-0.143
	Developing economies, LDCs and SIDS	-0.108	-0.159	-0.151
	All economies	-0.109	-0.161	-0.153
Singapore	SIDS and LDCs	-0.075	-0.094	-0.086
	Developing economies, LDCs and SIDS	-0.084	-0.107	-0.101
	All economies	-0.084	-0.108	-0.101
El Salvador	SIDS and LDCs	-0.159	-0.235	-0.233
	Developing economies, LDCs and SIDS	-0.118	-0.171	-0.167
	All economies	-0.122	-0.176	-0.172
Serbia	SIDS and LDCs	-0.002	0.005	0.011
	Developing economies, LDCs and SIDS	0.011	0.024	0.033
	All economies	0.011	0.024	0.033
Slovenia	SIDS and LDCs	-0.111	-0.172	-0.184
	Developing economies, LDCs and SIDS	-0.114	-0.177	-0.189
	All economies	-0.106	-0.164	-0.174

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 26		
		2030	2040	2050
Sweden	SIDS and LDCs	-0.042	-0.061	-0.066
	Developing economies, LDCs and SIDS	-0.039	-0.056	-0.060
	All economies	-0.037	-0.053	-0.056
Eswatini	SIDS and LDCs	-0.003	0.000	0.008
	Developing economies, LDCs and SIDS	-0.006	-0.005	0.002
	All economies	-0.007	-0.006	0.001
Syrian Arab Republic	SIDS and LDCs	-0.054	-0.097	-0.088
	Developing economies, LDCs and SIDS	-0.608	-0.927	-0.935
	All economies	-0.549	-0.843	-0.849
Thailand	SIDS and LDCs	-0.079	-0.103	-0.101
	Developing economies, LDCs and SIDS	-0.068	-0.085	-0.080
	All economies	-0.068	-0.085	-0.079
Trinidad and Tobago	SIDS and LDCs	-0.209	-0.305	-0.299
	Developing economies, LDCs and SIDS	-0.235	-0.342	-0.338
	All economies	-0.236	-0.343	-0.338
Tunisia	SIDS and LDCs	-0.106	-0.161	-0.156
	Developing economies, LDCs and SIDS	-0.092	-0.139	-0.132
	All economies	-0.092	-0.139	-0.132
Türkiye	SIDS and LDCs	-0.090	-0.134	-0.139
	Developing economies, LDCs and SIDS	-0.090	-0.134	-0.140
	All economies	-0.091	-0.136	-0.141
United Republic of Tanzania	SIDS and LDCs	0.538	0.801	0.840
	Developing economies, LDCs and SIDS	0.016	0.033	0.046
	All economies	-0.002	0.006	0.018
Ukraine	SIDS and LDCs	-0.139	-0.205	-0.226
	Developing economies, LDCs and SIDS	-0.041	-0.061	-0.058
	All economies	-0.052	-0.077	-0.076
Uruguay	SIDS and LDCs	-0.139	-0.204	-0.219
	Developing economies, LDCs and SIDS	-0.143	-0.210	-0.225
	All economies	-0.133	-0.194	-0.207
United States of America	SIDS and LDCs	-0.022	-0.031	-0.031
	Developing economies, LDCs and SIDS	-0.022	-0.031	-0.032
	All economies	-0.022	-0.031	-0.031
Uzbekistan	SIDS and LDCs	-0.010	-0.012	-0.004
	Developing economies, LDCs and SIDS	-0.026	-0.040	-0.038
	All economies	-0.027	-0.041	-0.040
Venezuela (Bolivarian Republic of)	SIDS and LDCs	-0.040	-0.057	-0.057
	Developing economies, LDCs and SIDS	-0.035	-0.050	-0.050
	All economies	-0.036	-0.051	-0.051
Viet Nam	SIDS and LDCs	-0.255	-0.321	-0.302
	Developing economies, LDCs and SIDS	-0.035	0.040	0.131
	All economies	-0.054	0.009	0.095

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 26		
		2030	2040	2050
Rest of Caribbean	SIDS and LDCs	0.042	0.062	0.077
	Developing economies, LDCs and SIDS	-0.088	-0.129	-0.130
	All economies	-0.092	-0.136	-0.137
Rest of Oceania	SIDS and LDCs	0.393	0.643	0.761
	Developing economies, LDCs and SIDS	-0.084	-0.101	-0.081
	All economies	-0.101	-0.128	-0.109
Rest of the world	SIDS and LDCs	-0.056	-0.087	-0.091
	Developing economies, LDCs and SIDS	-0.057	-0.088	-0.092
	All economies	-0.057	-0.088	-0.092
South Africa	SIDS and LDCs	-0.101	-0.148	-0.151
	Developing economies, LDCs and SIDS	-0.087	-0.127	-0.128
	All economies	-0.090	-0.131	-0.132
Zimbabwe	SIDS and LDCs	-0.053	-0.071	-0.061
	Developing economies, LDCs and SIDS	-0.016	-0.018	-0.012
	All economies	-0.023	-0.029	-0.024
Rest of developing economies in Europe and Central Asia	SIDS and LDCs	-0.040	-0.063	-0.064
	Developing economies, LDCs and SIDS	-0.031	-0.049	-0.048
	All economies	-0.032	-0.050	-0.049
Equatorial Guinea	SIDS and LDCs	0.022	0.052	0.076
	Developing economies, LDCs and SIDS	-0.014	-0.004	0.011
	All economies	-0.014	-0.004	0.011
Rest of Asia	SIDS and LDCs	-0.016	-0.019	-0.012
	Developing economies, LDCs and SIDS	-0.017	-0.020	-0.014
	All economies	-0.018	-0.021	-0.014
Rest of Asian SIDS and LDCs	SIDS and LDCs	0.552	0.854	1.012
	Developing economies, LDCs and SIDS	0.017	0.042	0.073
	All economies	-0.001	0.016	0.044
Rest of American SIDS	SIDS and LDCs	-0.110	-0.162	-0.142
	Developing economies, LDCs and SIDS	-0.205	-0.314	-0.307
	All economies	-0.208	-0.318	-0.311
Rest of Europe	SIDS and LDCs	0.040	0.070	0.084
	Developing economies, LDCs and SIDS	0.042	0.074	0.090
	All economies	0.044	0.076	0.092
Rest of Middle East and North Africa	SIDS and LDCs	-0.082	-0.138	-0.133
	Developing economies, LDCs and SIDS	-0.066	-0.107	-0.103
	All economies	-0.069	-0.112	-0.108
Rest of landlocked economies in Africa	SIDS and LDCs	0.407	0.591	0.629
	Developing economies, LDCs and SIDS	0.075	0.116	0.131
	All economies	0.064	0.100	0.114

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 26		
		2030	2040	2050
Rest of LDCs in Africa	SIDS and LDCs	0.180	0.246	0.283
	Developing economies, LDCs and SIDS	-0.062	-0.103	-0.099
	All economies	-0.070	-0.114	-0.111
Rest of Western Africa	SIDS and LDCs	3.555	5.770	7.096
	Developing economies, LDCs and SIDS	0.721	1.226	1.491
	All economies	0.618	1.063	1.303

Annex 12. Relative impact of policy scenarios on gross domestic product, with disbursement of revenues (percentage difference to BAULG) – Scenario 31

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 31		
		2030	2040	2050
Albania	SIDS and LDCs	-0.044	-0.140	-0.152
	Developing economies, LDCs and SIDS	-0.041	-0.134	-0.147
	All economies	-0.041	-0.135	-0.148
United Arab Emirates	SIDS and LDCs	-0.054	-0.202	-0.259
	Developing economies, LDCs and SIDS	-0.057	-0.206	-0.263
	All economies	-0.057	-0.206	-0.263
Argentina	SIDS and LDCs	-0.028	-0.078	-0.105
	Developing economies, LDCs and SIDS	-0.027	-0.076	-0.104
	All economies	-0.027	-0.076	-0.104
Armenia	SIDS and LDCs	-0.028	-0.080	-0.112
	Developing economies, LDCs and SIDS	-0.028	-0.080	-0.112
	All economies	-0.028	-0.080	-0.112
Australia	SIDS and LDCs	-0.059	-0.192	-0.274
	Developing economies, LDCs and SIDS	-0.059	-0.193	-0.275
	All economies	-0.059	-0.192	-0.274
Belgium	SIDS and LDCs	-0.059	-0.150	-0.194
	Developing economies, LDCs and SIDS	-0.059	-0.150	-0.193
	All economies	-0.057	-0.148	-0.191
Bangladesh	SIDS and LDCs	-0.061	-0.208	-0.274
	Developing economies, LDCs and SIDS	-0.061	-0.209	-0.274
	All economies	-0.061	-0.209	-0.274
Bulgaria	SIDS and LDCs	-0.072	-0.202	-0.261
	Developing economies, LDCs and SIDS	-0.067	-0.197	-0.254
	All economies	-0.067	-0.197	-0.254
Bahrain	SIDS and LDCs	-0.070	-0.241	-0.323
	Developing economies, LDCs and SIDS	-0.071	-0.242	-0.323
	All economies	-0.070	-0.241	-0.323
Bolivia (Plurinational State of)	SIDS and LDCs	-0.011	-0.036	-0.048
	Developing economies, LDCs and SIDS	-0.009	-0.034	-0.046
	All economies	-0.010	-0.034	-0.046
Brazil	SIDS and LDCs	-0.040	-0.098	-0.130
	Developing economies, LDCs and SIDS	-0.036	-0.094	-0.125
	All economies	-0.037	-0.094	-0.125
Brunei Darussalam	SIDS and LDCs	-0.048	-0.176	-0.215
	Developing economies, LDCs and SIDS	-0.049	-0.176	-0.216
	All economies	-0.049	-0.176	-0.216
Botswana	SIDS and LDCs	-0.007	-0.036	-0.041
	Developing economies, LDCs and SIDS	-0.007	-0.036	-0.042
	All economies	-0.007	-0.036	-0.042
Canada	SIDS and LDCs	-0.034	-0.086	-0.116

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 31		
		2030	2040	2050
	Developing economies, LDCs and SIDS	-0.034	-0.086	-0.116
	All economies	-0.033	-0.085	-0.116
Chile	SIDS and LDCs	-0.130	-0.346	-0.464
	Developing economies, LDCs and SIDS	-0.130	-0.347	-0.464
	All economies	-0.129	-0.345	-0.463
China	SIDS and LDCs	-0.043	-0.124	-0.166
	Developing economies, LDCs and SIDS	-0.041	-0.122	-0.164
	All economies	-0.041	-0.122	-0.164
Côte d'Ivoire	SIDS and LDCs	-0.065	-0.226	-0.287
	Developing economies, LDCs and SIDS	-0.059	-0.218	-0.281
	All economies	-0.060	-0.220	-0.282
Cameroon	SIDS and LDCs	-0.050	-0.166	-0.213
	Developing economies, LDCs and SIDS	-0.043	-0.157	-0.205
	All economies	-0.043	-0.158	-0.206
Colombia	SIDS and LDCs	-0.065	-0.179	-0.233
	Developing economies, LDCs and SIDS	-0.061	-0.174	-0.228
	All economies	-0.061	-0.174	-0.229
Costa Rica	SIDS and LDCs	-0.112	-0.312	-0.392
	Developing economies, LDCs and SIDS	-0.108	-0.307	-0.387
	All economies	-0.108	-0.307	-0.387
Cyprus	SIDS and LDCs	-0.057	-0.170	-0.209
	Developing economies, LDCs and SIDS	-0.057	-0.171	-0.210
	All economies	-0.056	-0.170	-0.209
Germany	SIDS and LDCs	-0.019	-0.054	-0.073
	Developing economies, LDCs and SIDS	-0.018	-0.053	-0.072
	All economies	-0.018	-0.053	-0.072
Denmark	SIDS and LDCs	-0.031	-0.079	-0.100
	Developing economies, LDCs and SIDS	-0.030	-0.078	-0.098
	All economies	-0.029	-0.077	-0.098
Dominican Republic	SIDS and LDCs	-0.054	-0.186	-0.239
	Developing economies, LDCs and SIDS	-0.059	-0.193	-0.246
	All economies	-0.059	-0.193	-0.247
Algeria	SIDS and LDCs	-0.091	-0.253	-0.325
	Developing economies, LDCs and SIDS	-0.090	-0.251	-0.323
	All economies	-0.090	-0.251	-0.324
Ecuador	SIDS and LDCs	-0.086	-0.231	-0.290
	Developing economies, LDCs and SIDS	-0.082	-0.227	-0.285
	All economies	-0.083	-0.227	-0.285
Egypt	SIDS and LDCs	-0.084	-0.280	-0.375
	Developing economies, LDCs and SIDS	-0.081	-0.278	-0.375
	All economies	-0.081	-0.278	-0.375
Spain	SIDS and LDCs	-0.034	-0.098	-0.125

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 31		
		2030	2040	2050
	Developing economies, LDCs and SIDS	-0.033	-0.097	-0.124
	All economies	-0.032	-0.096	-0.123
Estonia	SIDS and LDCs	-0.047	-0.122	-0.154
	Developing economies, LDCs and SIDS	-0.048	-0.123	-0.155
	All economies	-0.047	-0.122	-0.153
Finland	SIDS and LDCs	-0.039	-0.107	-0.139
	Developing economies, LDCs and SIDS	-0.038	-0.106	-0.138
	All economies	-0.038	-0.105	-0.137
France	SIDS and LDCs	-0.015	-0.039	-0.049
	Developing economies, LDCs and SIDS	-0.014	-0.038	-0.048
	All economies	-0.014	-0.038	-0.048
Gabon	SIDS and LDCs	-0.088	-0.265	-0.376
	Developing economies, LDCs and SIDS	-0.091	-0.270	-0.381
	All economies	-0.091	-0.270	-0.382
United Kingdom of Great Britain and Northern Ireland	SIDS and LDCs	-0.025	-0.074	-0.095
	Developing economies, LDCs and SIDS	-0.025	-0.074	-0.095
	All economies	-0.025	-0.073	-0.095
Georgia	SIDS and LDCs	-0.044	-0.148	-0.190
	Developing economies, LDCs and SIDS	-0.043	-0.147	-0.188
	All economies	-0.043	-0.147	-0.189
Ghana	SIDS and LDCs	-0.059	-0.206	-0.276
	Developing economies, LDCs and SIDS	-0.047	-0.192	-0.261
	All economies	-0.049	-0.194	-0.263
Greece	SIDS and LDCs	-0.040	-0.101	-0.127
	Developing economies, LDCs and SIDS	-0.039	-0.100	-0.126
	All economies	-0.037	-0.098	-0.124
Guatemala	SIDS and LDCs	-0.094	-0.246	-0.308
	Developing economies, LDCs and SIDS	-0.089	-0.239	-0.301
	All economies	-0.089	-0.240	-0.302
Honduras	SIDS and LDCs	-0.125	-0.369	-0.467
	Developing economies, LDCs and SIDS	-0.112	-0.353	-0.451
	All economies	-0.113	-0.355	-0.452
Croatia	SIDS and LDCs	-0.027	-0.074	-0.090
	Developing economies, LDCs and SIDS	-0.027	-0.073	-0.089
	All economies	-0.025	-0.072	-0.087
Indonesia	SIDS and LDCs	-0.063	-0.187	-0.267
	Developing economies, LDCs and SIDS	-0.063	-0.187	-0.267
	All economies	-0.063	-0.186	-0.267
India	SIDS and LDCs	-0.027	-0.095	-0.135
	Developing economies, LDCs and SIDS	-0.029	-0.098	-0.139

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 31		
		2030	2040	2050
	All economies	-0.029	-0.098	-0.138
Ireland	SIDS and LDCs	-0.010	-0.053	-0.066
	Developing economies, LDCs and SIDS	-0.010	-0.053	-0.066
	All economies	-0.010	-0.053	-0.066
Iran (Islamic Republic of)	SIDS and LDCs	-0.018	-0.062	-0.079
	Developing economies, LDCs and SIDS	-0.019	-0.062	-0.080
	All economies	-0.019	-0.063	-0.080
Iraq	SIDS and LDCs	-0.027	-0.107	-0.157
	Developing economies, LDCs and SIDS	-0.026	-0.106	-0.156
	All economies	-0.026	-0.106	-0.157
Israel	SIDS and LDCs	-0.041	-0.122	-0.153
	Developing economies, LDCs and SIDS	-0.041	-0.122	-0.153
	All economies	-0.040	-0.121	-0.152
Italy	SIDS and LDCs	-0.022	-0.066	-0.081
	Developing economies, LDCs and SIDS	-0.022	-0.065	-0.080
	All economies	-0.021	-0.065	-0.079
Jordan	SIDS and LDCs	-0.010	-0.047	-0.061
	Developing economies, LDCs and SIDS	-0.010	-0.048	-0.062
	All economies	-0.010	-0.048	-0.062
Japan	SIDS and LDCs	-0.032	-0.090	-0.122
	Developing economies, LDCs and SIDS	-0.032	-0.090	-0.122
	All economies	-0.031	-0.090	-0.121
Kenya	SIDS and LDCs	-0.115	-0.343	-0.441
	Developing economies, LDCs and SIDS	-0.091	-0.316	-0.415
	All economies	-0.095	-0.320	-0.420
Kuwait	SIDS and LDCs	-0.028	-0.108	-0.133
	Developing economies, LDCs and SIDS	-0.028	-0.108	-0.133
	All economies	-0.028	-0.108	-0.133
Sri Lanka	SIDS and LDCs	-0.045	-0.135	-0.175
	Developing economies, LDCs and SIDS	-0.040	-0.129	-0.169
	All economies	-0.040	-0.130	-0.169
Lithuania	SIDS and LDCs	-0.048	-0.126	-0.153
	Developing economies, LDCs and SIDS	-0.047	-0.125	-0.152
	All economies	-0.045	-0.123	-0.150
Latvia	SIDS and LDCs	-0.058	-0.144	-0.181
	Developing economies, LDCs and SIDS	-0.058	-0.144	-0.181
	All economies	-0.055	-0.140	-0.177
Morocco	SIDS and LDCs	-0.076	-0.232	-0.294
	Developing economies, LDCs and SIDS	-0.075	-0.230	-0.291
	All economies	-0.075	-0.230	-0.292
Madagascar	SIDS and LDCs	-0.029	-0.216	-0.310
	Developing economies, LDCs and SIDS	-0.073	-0.271	-0.368

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 31		
		2030	2040	2050
	All economies	-0.074	-0.272	-0.370
Mexico	SIDS and LDCs	-0.029	-0.081	-0.115
	Developing economies, LDCs and SIDS	-0.028	-0.079	-0.113
	All economies	-0.028	-0.079	-0.113
Malta	SIDS and LDCs	-0.176	-0.518	-0.607
	Developing economies, LDCs and SIDS	-0.182	-0.525	-0.616
	All economies	-0.175	-0.516	-0.606
Mauritius	SIDS and LDCs	-0.056	-0.176	-0.223
	Developing economies, LDCs and SIDS	-0.062	-0.184	-0.231
	All economies	-0.063	-0.184	-0.231
Malaysia	SIDS and LDCs	-0.065	-0.232	-0.310
	Developing economies, LDCs and SIDS	-0.064	-0.231	-0.308
	All economies	-0.064	-0.231	-0.308
Namibia	SIDS and LDCs	-0.001	-0.032	-0.041
	Developing economies, LDCs and SIDS	-0.004	-0.036	-0.045
	All economies	-0.004	-0.036	-0.045
Nigeria	SIDS and LDCs	-0.039	-0.132	-0.174
	Developing economies, LDCs and SIDS	-0.031	-0.122	-0.164
	All economies	-0.032	-0.123	-0.165
Nicaragua	SIDS and LDCs	-0.105	-0.316	-0.400
	Developing economies, LDCs and SIDS	-0.085	-0.292	-0.374
	All economies	-0.087	-0.294	-0.377
Netherlands (Kingdom of the)	SIDS and LDCs	-0.028	-0.075	-0.097
	Developing economies, LDCs and SIDS	-0.028	-0.075	-0.096
	All economies	-0.028	-0.074	-0.095
Norway	SIDS and LDCs	-0.014	-0.050	-0.068
	Developing economies, LDCs and SIDS	-0.014	-0.050	-0.068
	All economies	-0.014	-0.049	-0.068
New Zealand	SIDS and LDCs	-0.080	-0.227	-0.287
	Developing economies, LDCs and SIDS	-0.080	-0.227	-0.287
	All economies	-0.079	-0.226	-0.286
Oman	SIDS and LDCs	-0.092	-0.300	-0.417
	Developing economies, LDCs and SIDS	-0.094	-0.303	-0.420
	All economies	-0.094	-0.302	-0.420
Pakistan	SIDS and LDCs	-0.037	-0.123	-0.168
	Developing economies, LDCs and SIDS	-0.029	-0.113	-0.157
	All economies	-0.030	-0.114	-0.158
Panama	SIDS and LDCs	-0.066	-0.202	-0.259
	Developing economies, LDCs and SIDS	-0.068	-0.205	-0.262
	All economies	-0.066	-0.202	-0.259
Peru	SIDS and LDCs	-0.112	-0.295	-0.398
	Developing economies, LDCs and SIDS	-0.112	-0.294	-0.397

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 31		
		2030	2040	2050
	All economies	-0.112	-0.294	-0.397
Philippines	SIDS and LDCs	-0.056	-0.189	-0.254
	Developing economies, LDCs and SIDS	-0.055	-0.188	-0.253
	All economies	-0.055	-0.188	-0.253
Poland	SIDS and LDCs	-0.017	-0.056	-0.072
	Developing economies, LDCs and SIDS	-0.017	-0.056	-0.072
	All economies	-0.016	-0.055	-0.071
Portugal	SIDS and LDCs	-0.040	-0.118	-0.149
	Developing economies, LDCs and SIDS	-0.042	-0.119	-0.151
	All economies	-0.040	-0.118	-0.149
Paraguay	SIDS and LDCs	-0.052	-0.155	-0.206
	Developing economies, LDCs and SIDS	-0.048	-0.151	-0.200
	All economies	-0.049	-0.151	-0.201
Qatar	SIDS and LDCs	-0.099	-0.321	-0.399
	Developing economies, LDCs and SIDS	-0.100	-0.321	-0.399
	All economies	-0.100	-0.321	-0.399
Republic of Korea	SIDS and LDCs	-0.064	-0.197	-0.262
	Developing economies, LDCs and SIDS	-0.064	-0.196	-0.261
	All economies	-0.064	-0.195	-0.260
Romania	SIDS and LDCs	-0.011	-0.042	-0.055
	Developing economies, LDCs and SIDS	-0.010	-0.041	-0.054
	All economies	-0.010	-0.041	-0.053
Russian Federation	SIDS and LDCs	-0.022	-0.069	-0.093
	Developing economies, LDCs and SIDS	-0.022	-0.069	-0.092
	All economies	-0.022	-0.069	-0.092
Saudi Arabia	SIDS and LDCs	-0.065	-0.195	-0.249
	Developing economies, LDCs and SIDS	-0.066	-0.196	-0.250
	All economies	-0.066	-0.196	-0.251
Singapore	SIDS and LDCs	-0.049	-0.168	-0.213
	Developing economies, LDCs and SIDS	-0.051	-0.170	-0.215
	All economies	-0.051	-0.170	-0.215
El Salvador	SIDS and LDCs	-0.078	-0.223	-0.280
	Developing economies, LDCs and SIDS	-0.071	-0.214	-0.270
	All economies	-0.071	-0.215	-0.271
Serbia	SIDS and LDCs	-0.014	-0.047	-0.058
	Developing economies, LDCs and SIDS	-0.012	-0.044	-0.055
	All economies	-0.011	-0.044	-0.055
Slovenia	SIDS and LDCs	-0.041	-0.114	-0.141
	Developing economies, LDCs and SIDS	-0.042	-0.115	-0.141
	All economies	-0.041	-0.113	-0.139
Sweden	SIDS and LDCs	-0.023	-0.066	-0.088
	Developing economies, LDCs and SIDS	-0.022	-0.065	-0.087

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 31		
		2030	2040	2050
	All economies	-0.022	-0.065	-0.086
Eswatini	SIDS and LDCs	-0.009	-0.035	-0.043
	Developing economies, LDCs and SIDS	-0.010	-0.035	-0.044
	All economies	-0.010	-0.035	-0.044
Syrian Arab Republic	SIDS and LDCs	-0.052	-0.163	-0.185
	Developing economies, LDCs and SIDS	-0.139	-0.269	-0.293
	All economies	-0.131	-0.259	-0.284
Thailand	SIDS and LDCs	-0.054	-0.181	-0.242
	Developing economies, LDCs and SIDS	-0.053	-0.179	-0.239
	All economies	-0.053	-0.179	-0.239
Trinidad and Tobago	SIDS and LDCs	-0.096	-0.305	-0.375
	Developing economies, LDCs and SIDS	-0.100	-0.310	-0.381
	All economies	-0.100	-0.310	-0.381
Tunisia	SIDS and LDCs	-0.074	-0.233	-0.288
	Developing economies, LDCs and SIDS	-0.071	-0.230	-0.284
	All economies	-0.071	-0.230	-0.284
Türkiye	SIDS and LDCs	-0.059	-0.177	-0.234
	Developing economies, LDCs and SIDS	-0.059	-0.178	-0.234
	All economies	-0.059	-0.178	-0.235
United Republic of Tanzania	SIDS and LDCs	0.043	-0.106	-0.168
	Developing economies, LDCs and SIDS	-0.056	-0.223	-0.289
	All economies	-0.059	-0.227	-0.294
Ukraine	SIDS and LDCs	-0.075	-0.184	-0.246
	Developing economies, LDCs and SIDS	-0.058	-0.163	-0.220
	All economies	-0.060	-0.165	-0.223
Uruguay	SIDS and LDCs	-0.073	-0.182	-0.238
	Developing economies, LDCs and SIDS	-0.074	-0.183	-0.239
	All economies	-0.072	-0.181	-0.236
United States of America	SIDS and LDCs	-0.013	-0.040	-0.052
	Developing economies, LDCs and SIDS	-0.013	-0.040	-0.052
	All economies	-0.013	-0.040	-0.052
Uzbekistan	SIDS and LDCs	-0.010	-0.039	-0.048
	Developing economies, LDCs and SIDS	-0.013	-0.043	-0.053
	All economies	-0.013	-0.043	-0.053
Venezuela (Bolivarian Republic of)	SIDS and LDCs	-0.022	-0.061	-0.078
	Developing economies, LDCs and SIDS	-0.021	-0.059	-0.076
	All economies	-0.021	-0.060	-0.077
Viet Nam	SIDS and LDCs	-0.163	-0.638	-0.876
	Developing economies, LDCs and SIDS	-0.123	-0.587	-0.813
	All economies	-0.126	-0.592	-0.818
Rest of Caribbean	SIDS and LDCs	-0.029	-0.130	-0.177
	Developing economies, LDCs and SIDS	-0.052	-0.158	-0.207

GTAP Economy	**Impact on GDP, revenue disbursement scheme**	**Scenario 31**		
		2030	**2040**	**2050**
	All economies	-0.052	-0.159	-0.208
Rest of Oceania	SIDS and LDCs	-0.006	-0.229	-0.322
	Developing economies, LDCs and SIDS	-0.093	-0.335	-0.445
	All economies	-0.096	-0.339	-0.449
Rest of the world	SIDS and LDCs	-0.021	-0.058	-0.075
	Developing economies, LDCs and SIDS	-0.022	-0.058	-0.075
	All economies	-0.022	-0.058	-0.075
South Africa	SIDS and LDCs	-0.065	-0.181	-0.244
	Developing economies, LDCs and SIDS	-0.063	-0.178	-0.240
	All economies	-0.063	-0.178	-0.241
Zimbabwe	SIDS and LDCs	-0.040	-0.121	-0.151
	Developing economies, LDCs and SIDS	-0.033	-0.113	-0.143
	All economies	-0.035	-0.115	-0.145
Rest of developing economies in Europe and Central Asia	SIDS and LDCs	-0.023	-0.069	-0.088
	Developing economies, LDCs and SIDS	-0.021	-0.067	-0.086
	All economies	-0.021	-0.068	-0.086
Equatorial Guinea	SIDS and LDCs	0.009	0.015	0.030
	Developing economies, LDCs and SIDS	0.002	0.007	0.020
	All economies	0.002	0.007	0.020
Rest of Asia	SIDS and LDCs	-0.020	-0.072	-0.092
	Developing economies, LDCs and SIDS	-0.020	-0.072	-0.092
	All economies	-0.020	-0.072	-0.092
Rest of Asian SIDS and LDCs	SIDS and LDCs	0.044	-0.125	-0.195
	Developing economies, LDCs and SIDS	-0.057	-0.248	-0.341
	All economies	-0.060	-0.252	-0.346
Rest of American SIDS	SIDS and LDCs	-0.084	-0.322	-0.416
	Developing economies, LDCs and SIDS	-0.101	-0.343	-0.440
	All economies	-0.102	-0.344	-0.440
Rest of Europe	SIDS and LDCs	-0.004	-0.033	-0.043
	Developing economies, LDCs and SIDS	-0.003	-0.033	-0.042
	All economies	-0.003	-0.032	-0.042
Rest of Middle East and North Africa	SIDS and LDCs	-0.058	-0.170	-0.195
	Developing economies, LDCs and SIDS	-0.055	-0.166	-0.191
	All economies	-0.056	-0.167	-0.192
Rest of landlocked economies in Africa	SIDS and LDCs	0.052	0.002	-0.018
	Developing economies, LDCs and SIDS	-0.009	-0.069	-0.093
	All economies	-0.011	-0.071	-0.096
Rest of LDCs in Africa	SIDS and LDCs	-0.016	-0.164	-0.238
	Developing economies, LDCs and SIDS	-0.063	-0.220	-0.300

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 31		
		2030	2040	2050
	All economies	-0.065	-0.222	-0.302
Rest of Western Africa	SIDS and LDCs	0.565	0.310	0.303
	Developing economies, LDCs and SIDS	0.006	-0.375	-0.568
	All economies	-0.013	-0.399	-0.596

Annex 13. Relative impact of policy scenarios on gross domestic product, with disbursement of revenues (percentage difference to BAULG) – Scenario 32

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 32		
		2030	2040	2050
Albania	SIDS and LDCs	-0.050	-0.147	-0.160
	Developing economies, LDCs and SIDS	-0.048	-0.134	-0.150
	All economies	-0.048	-0.136	-0.152
United Arab Emirates	SIDS and LDCs	-0.074	-0.191	-0.231
	Developing economies, LDCs and SIDS	-0.076	-0.196	-0.238
	All economies	-0.076	-0.196	-0.238
Argentina	SIDS and LDCs	-0.031	-0.077	-0.101
	Developing economies, LDCs and SIDS	-0.030	-0.075	-0.099
	All economies	-0.030	-0.075	-0.099
Armenia	SIDS and LDCs	-0.032	-0.077	-0.105
	Developing economies, LDCs and SIDS	-0.032	-0.077	-0.104
	All economies	-0.032	-0.077	-0.105
Australia	SIDS and LDCs	-0.067	-0.191	-0.264
	Developing economies, LDCs and SIDS	-0.067	-0.192	-0.265
	All economies	-0.067	-0.191	-0.264
Belgium	SIDS and LDCs	-0.065	-0.155	-0.197
	Developing economies, LDCs and SIDS	-0.065	-0.155	-0.197
	All economies	-0.064	-0.152	-0.193
Bangladesh	SIDS and LDCs	-0.073	-0.202	-0.261
	Developing economies, LDCs and SIDS	-0.074	-0.202	-0.261
	All economies	-0.074	-0.202	-0.261
Bulgaria	SIDS and LDCs	-0.083	-0.201	-0.254
	Developing economies, LDCs and SIDS	-0.079	-0.193	-0.244
	All economies	-0.079	-0.193	-0.244
Bahrain	SIDS and LDCs	-0.088	-0.237	-0.305
	Developing economies, LDCs and SIDS	-0.088	-0.237	-0.306
	All economies	-0.088	-0.237	-0.305
Bolivia (Plurinational State of)	SIDS and LDCs	-0.013	-0.033	-0.044
	Developing economies, LDCs and SIDS	-0.012	-0.031	-0.041
	All economies	-0.012	-0.031	-0.041
Brazil	SIDS and LDCs	-0.044	-0.099	-0.127
	Developing economies, LDCs and SIDS	-0.041	-0.093	-0.119
	All economies	-0.041	-0.094	-0.120
Brunei Darussalam	SIDS and LDCs	-0.065	-0.172	-0.202
	Developing economies, LDCs and SIDS	-0.065	-0.172	-0.203
	All economies	-0.065	-0.172	-0.203
Botswana	SIDS and LDCs	-0.010	-0.033	-0.034
	Developing economies, LDCs and SIDS	-0.010	-0.033	-0.035
	All economies	-0.010	-0.033	-0.035
Canada	SIDS and LDCs	-0.036	-0.087	-0.117

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 32		
		2030	2040	2050
	Developing economies, LDCs and SIDS	-0.036	-0.088	-0.117
	All economies	-0.036	-0.087	-0.116
Chile	SIDS and LDCs	-0.142	-0.343	-0.451
	Developing economies, LDCs and SIDS	-0.143	-0.344	-0.452
	All economies	-0.142	-0.341	-0.449
China	SIDS and LDCs	-0.049	-0.123	-0.160
	Developing economies, LDCs and SIDS	-0.048	-0.120	-0.157
	All economies	-0.048	-0.121	-0.157
Côte d'Ivoire	SIDS and LDCs	-0.079	-0.222	-0.270
	Developing economies, LDCs and SIDS	-0.074	-0.212	-0.262
	All economies	-0.074	-0.214	-0.264
Cameroon	SIDS and LDCs	-0.060	-0.164	-0.203
	Developing economies, LDCs and SIDS	-0.053	-0.153	-0.193
	All economies	-0.054	-0.155	-0.194
Colombia	SIDS and LDCs	-0.071	-0.175	-0.226
	Developing economies, LDCs and SIDS	-0.069	-0.169	-0.218
	All economies	-0.069	-0.169	-0.219
Costa Rica	SIDS and LDCs	-0.126	-0.308	-0.381
	Developing economies, LDCs and SIDS	-0.123	-0.300	-0.373
	All economies	-0.123	-0.301	-0.373
Cyprus	SIDS and LDCs	-0.065	-0.173	-0.208
	Developing economies, LDCs and SIDS	-0.066	-0.173	-0.209
	All economies	-0.065	-0.172	-0.207
Germany	SIDS and LDCs	-0.022	-0.053	-0.070
	Developing economies, LDCs and SIDS	-0.021	-0.052	-0.068
	All economies	-0.021	-0.051	-0.067
Denmark	SIDS and LDCs	-0.034	-0.084	-0.106
	Developing economies, LDCs and SIDS	-0.033	-0.082	-0.103
	All economies	-0.033	-0.081	-0.102
Dominican Republic	SIDS and LDCs	-0.065	-0.178	-0.224
	Developing economies, LDCs and SIDS	-0.069	-0.187	-0.235
	All economies	-0.070	-0.187	-0.235
Algeria	SIDS and LDCs	-0.104	-0.252	-0.320
	Developing economies, LDCs and SIDS	-0.103	-0.250	-0.317
	All economies	-0.103	-0.250	-0.317
Ecuador	SIDS and LDCs	-0.096	-0.229	-0.281
	Developing economies, LDCs and SIDS	-0.093	-0.223	-0.274
	All economies	-0.093	-0.223	-0.275
Egypt	SIDS and LDCs	-0.100	-0.275	-0.355
	Developing economies, LDCs and SIDS	-0.098	-0.274	-0.360
	All economies	-0.098	-0.274	-0.360
Spain	SIDS and LDCs	-0.040	-0.098	-0.122

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 32		
		2030	2040	2050
	Developing economies, LDCs and SIDS	-0.039	-0.097	-0.121
	All economies	-0.038	-0.095	-0.119
Estonia	SIDS and LDCs	-0.051	-0.128	-0.162
	Developing economies, LDCs and SIDS	-0.052	-0.130	-0.164
	All economies	-0.051	-0.127	-0.160
Finland	SIDS and LDCs	-0.045	-0.108	-0.139
	Developing economies, LDCs and SIDS	-0.044	-0.107	-0.137
	All economies	-0.043	-0.106	-0.135
France	SIDS and LDCs	-0.017	-0.040	-0.050
	Developing economies, LDCs and SIDS	-0.016	-0.039	-0.048
	All economies	-0.016	-0.038	-0.048
Gabon	SIDS and LDCs	-0.100	-0.261	-0.356
	Developing economies, LDCs and SIDS	-0.103	-0.267	-0.366
	All economies	-0.103	-0.268	-0.366
United Kingdom of Great Britain and Northern Ireland	SIDS and LDCs	-0.029	-0.073	-0.092
	Developing economies, LDCs and SIDS	-0.030	-0.073	-0.092
	All economies	-0.029	-0.072	-0.091
Georgia	SIDS and LDCs	-0.054	-0.144	-0.180
	Developing economies, LDCs and SIDS	-0.053	-0.142	-0.177
	All economies	-0.053	-0.143	-0.178
Ghana	SIDS and LDCs	-0.071	-0.201	-0.257
	Developing economies, LDCs and SIDS	-0.062	-0.180	-0.234
	All economies	-0.063	-0.183	-0.237
Greece	SIDS and LDCs	-0.045	-0.104	-0.129
	Developing economies, LDCs and SIDS	-0.044	-0.102	-0.126
	All economies	-0.043	-0.100	-0.123
Guatemala	SIDS and LDCs	-0.105	-0.242	-0.299
	Developing economies, LDCs and SIDS	-0.100	-0.232	-0.288
	All economies	-0.101	-0.233	-0.290
Honduras	SIDS and LDCs	-0.145	-0.358	-0.445
	Developing economies, LDCs and SIDS	-0.134	-0.336	-0.422
	All economies	-0.135	-0.338	-0.424
Croatia	SIDS and LDCs	-0.031	-0.078	-0.094
	Developing economies, LDCs and SIDS	-0.030	-0.077	-0.093
	All economies	-0.029	-0.074	-0.089
Indonesia	SIDS and LDCs	-0.072	-0.185	-0.257
	Developing economies, LDCs and SIDS	-0.072	-0.185	-0.257
	All economies	-0.072	-0.185	-0.257
India	SIDS and LDCs	-0.032	-0.090	-0.125
	Developing economies, LDCs and SIDS	-0.034	-0.095	-0.131

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 32		
		2030	2040	2050
	All economies	-0.034	-0.095	-0.130
Ireland	SIDS and LDCs	-0.016	-0.046	-0.054
	Developing economies, LDCs and SIDS	-0.016	-0.046	-0.054
	All economies	-0.016	-0.046	-0.054
Iran (Islamic Republic of)	SIDS and LDCs	-0.024	-0.060	-0.073
	Developing economies, LDCs and SIDS	-0.025	-0.062	-0.075
	All economies	-0.025	-0.062	-0.075
Iraq	SIDS and LDCs	-0.034	-0.098	-0.135
	Developing economies, LDCs and SIDS	-0.033	-0.097	-0.135
	All economies	-0.033	-0.097	-0.135
Israel	SIDS and LDCs	-0.048	-0.123	-0.150
	Developing economies, LDCs and SIDS	-0.048	-0.122	-0.149
	All economies	-0.048	-0.121	-0.147
Italy	SIDS and LDCs	-0.027	-0.067	-0.079
	Developing economies, LDCs and SIDS	-0.026	-0.066	-0.078
	All economies	-0.026	-0.065	-0.077
Jordan	SIDS and LDCs	-0.015	-0.040	-0.049
	Developing economies, LDCs and SIDS	-0.015	-0.042	-0.051
	All economies	-0.015	-0.042	-0.051
Japan	SIDS and LDCs	-0.037	-0.090	-0.117
	Developing economies, LDCs and SIDS	-0.037	-0.090	-0.117
	All economies	-0.037	-0.090	-0.117
Kenya	SIDS and LDCs	-0.130	-0.330	-0.414
	Developing economies, LDCs and SIDS	-0.110	-0.297	-0.384
	All economies	-0.114	-0.303	-0.390
Kuwait	SIDS and LDCs	-0.039	-0.101	-0.117
	Developing economies, LDCs and SIDS	-0.040	-0.102	-0.118
	All economies	-0.040	-0.102	-0.118
Sri Lanka	SIDS and LDCs	-0.053	-0.133	-0.170
	Developing economies, LDCs and SIDS	-0.049	-0.124	-0.160
	All economies	-0.049	-0.125	-0.160
Lithuania	SIDS and LDCs	-0.053	-0.130	-0.157
	Developing economies, LDCs and SIDS	-0.053	-0.128	-0.155
	All economies	-0.051	-0.126	-0.152
Latvia	SIDS and LDCs	-0.062	-0.152	-0.193
	Developing economies, LDCs and SIDS	-0.062	-0.152	-0.193
	All economies	-0.060	-0.147	-0.187
Morocco	SIDS and LDCs	-0.090	-0.230	-0.283
	Developing economies, LDCs and SIDS	-0.089	-0.227	-0.280
	All economies	-0.089	-0.227	-0.280
Madagascar	SIDS and LDCs	-0.052	-0.176	-0.249
	Developing economies, LDCs and SIDS	-0.089	-0.254	-0.335

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 32		
		2030	**2040**	**2050**
	All economies	-0.091	-0.256	-0.338
Mexico	SIDS and LDCs	-0.031	-0.082	-0.114
	Developing economies, LDCs and SIDS	-0.030	-0.079	-0.110
	All economies	-0.030	-0.079	-0.110
Malta	SIDS and LDCs	-0.202	-0.543	-0.630
	Developing economies, LDCs and SIDS	-0.207	-0.553	-0.644
	All economies	-0.202	-0.540	-0.629
Mauritius	SIDS and LDCs	-0.066	-0.167	-0.207
	Developing economies, LDCs and SIDS	-0.071	-0.177	-0.218
	All economies	-0.071	-0.177	-0.218
Malaysia	SIDS and LDCs	-0.084	-0.220	-0.282
	Developing economies, LDCs and SIDS	-0.083	-0.219	-0.280
	All economies	-0.083	-0.219	-0.280
Namibia	SIDS and LDCs	-0.007	-0.021	-0.021
	Developing economies, LDCs and SIDS	-0.009	-0.026	-0.028
	All economies	-0.009	-0.027	-0.028
Nigeria	SIDS and LDCs	-0.045	-0.130	-0.164
	Developing economies, LDCs and SIDS	-0.039	-0.114	-0.148
	All economies	-0.039	-0.116	-0.150
Nicaragua	SIDS and LDCs	-0.122	-0.304	-0.376
	Developing economies, LDCs and SIDS	-0.105	-0.269	-0.339
	All economies	-0.107	-0.272	-0.343
Netherlands (Kingdom of the)	SIDS and LDCs	-0.032	-0.077	-0.097
	Developing economies, LDCs and SIDS	-0.032	-0.076	-0.096
	All economies	-0.031	-0.075	-0.095
Norway	SIDS and LDCs	-0.017	-0.047	-0.065
	Developing economies, LDCs and SIDS	-0.017	-0.047	-0.064
	All economies	-0.017	-0.047	-0.064
New Zealand	SIDS and LDCs	-0.090	-0.225	-0.279
	Developing economies, LDCs and SIDS	-0.090	-0.225	-0.279
	All economies	-0.090	-0.224	-0.278
Oman	SIDS and LDCs	-0.112	-0.296	-0.395
	Developing economies, LDCs and SIDS	-0.114	-0.300	-0.401
	All economies	-0.114	-0.299	-0.400
Pakistan	SIDS and LDCs	-0.045	-0.120	-0.159
	Developing economies, LDCs and SIDS	-0.038	-0.106	-0.143
	All economies	-0.038	-0.108	-0.145
Panama	SIDS and LDCs	-0.074	-0.204	-0.255
	Developing economies, LDCs and SIDS	-0.076	-0.207	-0.259
	All economies	-0.074	-0.203	-0.255
Peru	SIDS and LDCs	-0.123	-0.294	-0.388
	Developing economies, LDCs and SIDS	-0.122	-0.293	-0.386

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 32		
		2030	2040	2050
	All economies	-0.122	-0.293	-0.386
Philippines	SIDS and LDCs	-0.070	-0.183	-0.237
	Developing economies, LDCs and SIDS	-0.069	-0.181	-0.235
	All economies	-0.069	-0.181	-0.235
Poland	SIDS and LDCs	-0.021	-0.054	-0.069
	Developing economies, LDCs and SIDS	-0.021	-0.054	-0.068
	All economies	-0.020	-0.052	-0.066
Portugal	SIDS and LDCs	-0.048	-0.117	-0.145
	Developing economies, LDCs and SIDS	-0.049	-0.120	-0.148
	All economies	-0.048	-0.117	-0.145
Paraguay	SIDS and LDCs	-0.058	-0.152	-0.197
	Developing economies, LDCs and SIDS	-0.055	-0.144	-0.187
	All economies	-0.055	-0.145	-0.188
Qatar	SIDS and LDCs	-0.127	-0.321	-0.384
	Developing economies, LDCs and SIDS	-0.127	-0.322	-0.385
	All economies	-0.127	-0.322	-0.385
Republic of Korea	SIDS and LDCs	-0.079	-0.195	-0.250
	Developing economies, LDCs and SIDS	-0.079	-0.195	-0.249
	All economies	-0.078	-0.194	-0.248
Romania	SIDS and LDCs	-0.015	-0.037	-0.045
	Developing economies, LDCs and SIDS	-0.014	-0.035	-0.044
	All economies	-0.014	-0.035	-0.043
Russian Federation	SIDS and LDCs	-0.027	-0.066	-0.087
	Developing economies, LDCs and SIDS	-0.027	-0.066	-0.086
	All economies	-0.027	-0.066	-0.086
Saudi Arabia	SIDS and LDCs	-0.079	-0.190	-0.235
	Developing economies, LDCs and SIDS	-0.079	-0.191	-0.237
	All economies	-0.079	-0.192	-0.238
Singapore	SIDS and LDCs	-0.064	-0.163	-0.199
	Developing economies, LDCs and SIDS	-0.065	-0.165	-0.202
	All economies	-0.065	-0.165	-0.202
El Salvador	SIDS and LDCs	-0.090	-0.221	-0.272
	Developing economies, LDCs and SIDS	-0.084	-0.208	-0.258
	All economies	-0.084	-0.209	-0.258
Serbia	SIDS and LDCs	-0.018	-0.043	-0.051
	Developing economies, LDCs and SIDS	-0.016	-0.040	-0.046
	All economies	-0.016	-0.039	-0.046
Slovenia	SIDS and LDCs	-0.047	-0.120	-0.146
	Developing economies, LDCs and SIDS	-0.047	-0.121	-0.147
	All economies	-0.046	-0.119	-0.144
Sweden	SIDS and LDCs	-0.027	-0.066	-0.085
	Developing economies, LDCs and SIDS	-0.026	-0.065	-0.084

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 32		
		2030	2040	2050
	All economies	-0.026	-0.064	-0.083
Eswatini	SIDS and LDCs	-0.012	-0.031	-0.037
	Developing economies, LDCs and SIDS	-0.012	-0.032	-0.038
	All economies	-0.013	-0.032	-0.038
Syrian Arab Republic	SIDS and LDCs	-0.063	-0.162	-0.180
	Developing economies, LDCs and SIDS	-0.134	-0.313	-0.338
	All economies	-0.127	-0.299	-0.324
Thailand	SIDS and LDCs	-0.068	-0.174	-0.225
	Developing economies, LDCs and SIDS	-0.067	-0.171	-0.220
	All economies	-0.067	-0.171	-0.220
Trinidad and Tobago	SIDS and LDCs	-0.118	-0.302	-0.364
	Developing economies, LDCs and SIDS	-0.121	-0.309	-0.372
	All economies	-0.121	-0.309	-0.372
Tunisia	SIDS and LDCs	-0.089	-0.230	-0.277
	Developing economies, LDCs and SIDS	-0.087	-0.226	-0.271
	All economies	-0.087	-0.226	-0.271
Türkiye	SIDS and LDCs	-0.069	-0.175	-0.225
	Developing economies, LDCs and SIDS	-0.070	-0.175	-0.225
	All economies	-0.070	-0.175	-0.225
United Republic of Tanzania	SIDS and LDCs	0.008	-0.043	-0.087
	Developing economies, LDCs and SIDS	-0.073	-0.201	-0.257
	All economies	-0.076	-0.207	-0.263
Ukraine	SIDS and LDCs	-0.083	-0.186	-0.244
	Developing economies, LDCs and SIDS	-0.068	-0.157	-0.204
	All economies	-0.070	-0.160	-0.208
Uruguay	SIDS and LDCs	-0.079	-0.184	-0.235
	Developing economies, LDCs and SIDS	-0.080	-0.185	-0.236
	All economies	-0.078	-0.182	-0.232
United States of America	SIDS and LDCs	-0.015	-0.039	-0.049
	Developing economies, LDCs and SIDS	-0.015	-0.039	-0.050
	All economies	-0.015	-0.039	-0.049
Uzbekistan	SIDS and LDCs	-0.015	-0.037	-0.042
	Developing economies, LDCs and SIDS	-0.017	-0.043	-0.051
	All economies	-0.017	-0.044	-0.051
Venezuela (Bolivarian Republic of)	SIDS and LDCs	-0.025	-0.059	-0.074
	Developing economies, LDCs and SIDS	-0.024	-0.057	-0.073
	All economies	-0.024	-0.058	-0.073
Viet Nam	SIDS and LDCs	-0.209	-0.601	-0.795
	Developing economies, LDCs and SIDS	-0.176	-0.524	-0.686
	All economies	-0.179	-0.531	-0.695
Rest of Caribbean	SIDS and LDCs	-0.041	-0.117	-0.153
	Developing economies, LDCs and SIDS	-0.060	-0.154	-0.198

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 32		
		2030	2040	2050
	All economies	-0.061	-0.156	-0.199
Rest of Oceania	SIDS and LDCs	-0.045	-0.158	-0.205
	Developing economies, LDCs and SIDS	-0.117	-0.312	-0.402
	All economies	-0.119	-0.317	-0.408
Rest of the world	SIDS and LDCs	-0.024	-0.059	-0.076
	Developing economies, LDCs and SIDS	-0.024	-0.059	-0.076
	All economies	-0.024	-0.059	-0.076
South Africa	SIDS and LDCs	-0.073	-0.178	-0.232
	Developing economies, LDCs and SIDS	-0.071	-0.174	-0.227
	All economies	-0.072	-0.174	-0.228
Zimbabwe	SIDS and LDCs	-0.048	-0.116	-0.139
	Developing economies, LDCs and SIDS	-0.042	-0.105	-0.131
	All economies	-0.043	-0.108	-0.133
Rest of developing economies in Europe and Central Asia	SIDS and LDCs	-0.027	-0.070	-0.086
	Developing economies, LDCs and SIDS	-0.026	-0.067	-0.082
	All economies	-0.026	-0.067	-0.083
Equatorial Guinea	SIDS and LDCs	0.005	0.017	0.034
	Developing economies, LDCs and SIDS	-0.001	0.005	0.019
	All economies	-0.001	0.005	0.019
Rest of Asia	SIDS and LDCs	-0.028	-0.069	-0.082
	Developing economies, LDCs and SIDS	-0.028	-0.069	-0.082
	All economies	-0.028	-0.069	-0.082
Rest of Asian SIDS and LDCs	SIDS and LDCs	0.002	-0.051	-0.064
	Developing economies, LDCs and SIDS	-0.083	-0.223	-0.295
	All economies	-0.086	-0.229	-0.302
Rest of American SIDS	SIDS and LDCs	-0.104	-0.301	-0.382
	Developing economies, LDCs and SIDS	-0.119	-0.333	-0.420
	All economies	-0.119	-0.333	-0.420
Rest of Europe	SIDS and LDCs	-0.009	-0.025	-0.030
	Developing economies, LDCs and SIDS	-0.008	-0.024	-0.028
	All economies	-0.008	-0.024	-0.027
Rest of Middle East and North Africa	SIDS and LDCs	-0.068	-0.172	-0.194
	Developing economies, LDCs and SIDS	-0.066	-0.165	-0.187
	All economies	-0.066	-0.166	-0.188
Rest of landlocked economies in Africa	SIDS and LDCs	0.032	0.040	0.033
	Developing economies, LDCs and SIDS	-0.018	-0.055	-0.072
	All economies	-0.020	-0.058	-0.075
Rest of LDCs in Africa	SIDS and LDCs	-0.039	-0.136	-0.189
	Developing economies, LDCs and SIDS	-0.078	-0.211	-0.278

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 32		
		2030	2040	2050
	All economies	-0.079	-0.213	-0.281
Rest of Western Africa	SIDS and LDCs	0.404	0.744	1.127
	Developing economies, LDCs and SIDS	-0.059	-0.246	-0.328
	All economies	-0.075	-0.280	-0.373

Annex 14. Relative impact of policy scenarios on gross domestic product, with disbursement of revenues (percentage difference to BAULG) – Scenario 46

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 46		
		2030	2040	2050
Albania	SIDS and LDCs	-0.082	-0.157	-0.147
	Developing economies, LDCs and SIDS	-0.064	-0.120	-0.112
	All economies	-0.068	-0.126	-0.120
United Arab Emirates	SIDS and LDCs	-0.106	-0.139	-0.108
	Developing economies, LDCs and SIDS	-0.120	-0.158	-0.131
	All economies	-0.120	-0.158	-0.130
Argentina	SIDS and LDCs	-0.064	-0.087	-0.087
	Developing economies, LDCs and SIDS	-0.059	-0.080	-0.078
	All economies	-0.060	-0.081	-0.079
Armenia	SIDS and LDCs	-0.040	-0.057	-0.058
	Developing economies, LDCs and SIDS	-0.039	-0.056	-0.056
	All economies	-0.040	-0.058	-0.058
Australia	SIDS and LDCs	-0.159	-0.223	-0.223
	Developing economies, LDCs and SIDS	-0.161	-0.227	-0.228
	All economies	-0.159	-0.224	-0.224
Belgium	SIDS and LDCs	-0.165	-0.226	-0.230
	Developing economies, LDCs and SIDS	-0.164	-0.225	-0.228
	All economies	-0.157	-0.215	-0.217
Bangladesh	SIDS and LDCs	-0.153	-0.218	-0.201
	Developing economies, LDCs and SIDS	-0.158	-0.222	-0.205
	All economies	-0.158	-0.222	-0.204
Bulgaria	SIDS and LDCs	-0.157	-0.217	-0.213
	Developing economies, LDCs and SIDS	-0.134	-0.186	-0.178
	All economies	-0.135	-0.187	-0.180
Bahrain	SIDS and LDCs	-0.188	-0.253	-0.236
	Developing economies, LDCs and SIDS	-0.191	-0.256	-0.239
	All economies	-0.189	-0.255	-0.238
Bolivia (Plurinational State of)	SIDS and LDCs	-0.020	-0.027	-0.024
	Developing economies, LDCs and SIDS	-0.015	-0.020	-0.017
	All economies	-0.016	-0.021	-0.017
Brazil	SIDS and LDCs	-0.094	-0.124	-0.124
	Developing economies, LDCs and SIDS	-0.077	-0.100	-0.098
	All economies	-0.079	-0.103	-0.101
Brunei Darussalam	SIDS and LDCs	-0.140	-0.174	-0.154
	Developing economies, LDCs and SIDS	-0.141	-0.176	-0.157
	All economies	-0.141	-0.177	-0.157
Botswana	SIDS and LDCs	-0.013	-0.014	-0.004
	Developing economies, LDCs and SIDS	-0.013	-0.015	-0.005
	All economies	-0.014	-0.015	-0.006
Canada	SIDS and LDCs	-0.085	-0.117	-0.121

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 46		
		2030	2040	2050
	Developing economies, LDCs and SIDS	-0.085	-0.118	-0.122
	All economies	-0.084	-0.115	-0.119
Chile	SIDS and LDCs	-0.292	-0.406	-0.400
	Developing economies, LDCs and SIDS	-0.294	-0.409	-0.404
	All economies	-0.289	-0.401	-0.395
China	SIDS and LDCs	-0.102	-0.135	-0.134
	Developing economies, LDCs and SIDS	-0.095	-0.126	-0.124
	All economies	-0.096	-0.127	-0.125
Côte d'Ivoire	SIDS and LDCs	-0.175	-0.228	-0.206
	Developing economies, LDCs and SIDS	-0.147	-0.192	-0.172
	All economies	-0.152	-0.198	-0.179
Cameroon	SIDS and LDCs	-0.137	-0.181	-0.167
	Developing economies, LDCs and SIDS	-0.100	-0.137	-0.123
	All economies	-0.104	-0.142	-0.129
Colombia	SIDS and LDCs	-0.154	-0.213	-0.202
	Developing economies, LDCs and SIDS	-0.138	-0.190	-0.177
	All economies	-0.139	-0.192	-0.179
Costa Rica	SIDS and LDCs	-0.286	-0.388	-0.365
	Developing economies, LDCs and SIDS	-0.265	-0.359	-0.336
	All economies	-0.267	-0.362	-0.338
Cyprus	SIDS and LDCs	-0.128	-0.191	-0.183
	Developing economies, LDCs and SIDS	-0.130	-0.194	-0.187
	All economies	-0.127	-0.189	-0.181
Germany	SIDS and LDCs	-0.040	-0.053	-0.052
	Developing economies, LDCs and SIDS	-0.036	-0.048	-0.046
	All economies	-0.035	-0.046	-0.043
Denmark	SIDS and LDCs	-0.091	-0.128	-0.133
	Developing economies, LDCs and SIDS	-0.087	-0.122	-0.126
	All economies	-0.084	-0.119	-0.122
Dominican Republic	SIDS and LDCs	-0.132	-0.180	-0.160
	Developing economies, LDCs and SIDS	-0.156	-0.214	-0.197
	All economies	-0.156	-0.215	-0.198
Algeria	SIDS and LDCs	-0.193	-0.277	-0.273
	Developing economies, LDCs and SIDS	-0.187	-0.267	-0.263
	All economies	-0.187	-0.268	-0.264
Ecuador	SIDS and LDCs	-0.214	-0.287	-0.270
	Developing economies, LDCs and SIDS	-0.196	-0.262	-0.244
	All economies	-0.198	-0.265	-0.247
Egypt	SIDS and LDCs	-0.183	-0.270	-0.250
	Developing economies, LDCs and SIDS	-0.169	-0.260	-0.247
	All economies	-0.172	-0.263	-0.250
Spain	SIDS and LDCs	-0.077	-0.108	-0.104

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 46		
		2030	2040	2050
	Developing economies, LDCs and SIDS	-0.074	-0.104	-0.099
	All economies	-0.071	-0.098	-0.093
Estonia	SIDS and LDCs	-0.131	-0.191	-0.196
	Developing economies, LDCs and SIDS	-0.135	-0.196	-0.202
	All economies	-0.128	-0.186	-0.190
Finland	SIDS and LDCs	-0.099	-0.136	-0.137
	Developing economies, LDCs and SIDS	-0.094	-0.130	-0.130
	All economies	-0.091	-0.125	-0.125
France	SIDS and LDCs	-0.042	-0.057	-0.057
	Developing economies, LDCs and SIDS	-0.039	-0.052	-0.052
	All economies	-0.038	-0.050	-0.050
Gabon	SIDS and LDCs	-0.190	-0.262	-0.260
	Developing economies, LDCs and SIDS	-0.205	-0.285	-0.287
	All economies	-0.206	-0.286	-0.288
United Kingdom of Great Britain and Northern Ireland	SIDS and LDCs	-0.058	-0.078	-0.075
	Developing economies, LDCs and SIDS	-0.059	-0.079	-0.077
	All economies	-0.056	-0.076	-0.073
Georgia	SIDS and LDCs	-0.084	-0.126	-0.116
	Developing economies, LDCs and SIDS	-0.078	-0.118	-0.107
	All economies	-0.079	-0.119	-0.108
Ghana	SIDS and LDCs	-0.147	-0.196	-0.177
	Developing economies, LDCs and SIDS	-0.096	-0.121	-0.099
	All economies	-0.103	-0.132	-0.110
Greece	SIDS and LDCs	-0.108	-0.145	-0.145
	Developing economies, LDCs and SIDS	-0.102	-0.137	-0.136
	All economies	-0.095	-0.128	-0.126
Guatemala	SIDS and LDCs	-0.228	-0.306	-0.289
	Developing economies, LDCs and SIDS	-0.201	-0.268	-0.250
	All economies	-0.204	-0.272	-0.254
Honduras	SIDS and LDCs	-0.311	-0.416	-0.381
	Developing economies, LDCs and SIDS	-0.249	-0.332	-0.295
	All economies	-0.255	-0.339	-0.302
Croatia	SIDS and LDCs	-0.079	-0.112	-0.114
	Developing economies, LDCs and SIDS	-0.077	-0.109	-0.110
	All economies	-0.070	-0.100	-0.100
Indonesia	SIDS and LDCs	-0.145	-0.202	-0.206
	Developing economies, LDCs and SIDS	-0.145	-0.202	-0.207
	All economies	-0.145	-0.201	-0.206
India	SIDS and LDCs	-0.061	-0.084	-0.077
	Developing economies, LDCs and SIDS	-0.070	-0.100	-0.095

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 46		
		2030	2040	2050
	All economies	-0.069	-0.098	-0.093
Ireland	SIDS and LDCs	-0.006	-0.005	0.009
	Developing economies, LDCs and SIDS	-0.005	-0.004	0.010
	All economies	-0.005	-0.003	0.011
Iran (Islamic Republic of)	SIDS and LDCs	-0.038	-0.053	-0.045
	Developing economies, LDCs and SIDS	-0.043	-0.060	-0.053
	All economies	-0.043	-0.061	-0.055
Iraq	SIDS and LDCs	-0.060	-0.084	-0.047
	Developing economies, LDCs and SIDS	-0.056	-0.080	-0.044
	All economies	-0.057	-0.081	-0.045
Israel	SIDS and LDCs	-0.099	-0.136	-0.130
	Developing economies, LDCs and SIDS	-0.098	-0.135	-0.129
	All economies	-0.094	-0.129	-0.123
Italy	SIDS and LDCs	-0.053	-0.075	-0.072
	Developing economies, LDCs and SIDS	-0.051	-0.072	-0.068
	All economies	-0.049	-0.069	-0.065
Jordan	SIDS and LDCs	0.006	0.008	0.020
	Developing economies, LDCs and SIDS	0.002	0.002	0.013
	All economies	0.004	0.004	0.015
Japan	SIDS and LDCs	-0.075	-0.100	-0.099
	Developing economies, LDCs and SIDS	-0.075	-0.100	-0.099
	All economies	-0.074	-0.099	-0.098
Kenya	SIDS and LDCs	-0.249	-0.335	-0.302
	Developing economies, LDCs and SIDS	-0.130	-0.190	-0.160
	All economies	-0.150	-0.214	-0.185
Kuwait	SIDS and LDCs	-0.053	-0.073	-0.050
	Developing economies, LDCs and SIDS	-0.055	-0.075	-0.053
	All economies	-0.056	-0.076	-0.054
Sri Lanka	SIDS and LDCs	-0.121	-0.164	-0.155
	Developing economies, LDCs and SIDS	-0.097	-0.132	-0.121
	All economies	-0.099	-0.134	-0.123
Lithuania	SIDS and LDCs	-0.128	-0.179	-0.178
	Developing economies, LDCs and SIDS	-0.124	-0.173	-0.171
	All economies	-0.117	-0.163	-0.160
Latvia	SIDS and LDCs	-0.167	-0.240	-0.249
	Developing economies, LDCs and SIDS	-0.168	-0.241	-0.250
	All economies	-0.154	-0.221	-0.227
Morocco	SIDS and LDCs	-0.157	-0.228	-0.214
	Developing economies, LDCs and SIDS	-0.150	-0.217	-0.202
	All economies	-0.151	-0.218	-0.203
Madagascar	SIDS and LDCs	0.048	0.071	0.116
	Developing economies, LDCs and SIDS	-0.156	-0.212	-0.179

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 46		
		2030	2040	2050
	All economies	-0.162	-0.221	-0.188
Mexico	SIDS and LDCs	-0.072	-0.103	-0.106
	Developing economies, LDCs and SIDS	-0.066	-0.094	-0.095
	All economies	-0.066	-0.094	-0.095
Malta	SIDS and LDCs	-0.445	-0.684	-0.676
	Developing economies, LDCs and SIDS	-0.476	-0.726	-0.723
	All economies	-0.442	-0.675	-0.669
Mauritius	SIDS and LDCs	-0.116	-0.154	-0.134
	Developing economies, LDCs and SIDS	-0.146	-0.195	-0.177
	All economies	-0.147	-0.196	-0.178
Malaysia	SIDS and LDCs	-0.152	-0.185	-0.164
	Developing economies, LDCs and SIDS	-0.148	-0.179	-0.157
	All economies	-0.149	-0.180	-0.159
Namibia	SIDS and LDCs	0.029	0.049	0.070
	Developing economies, LDCs and SIDS	0.015	0.030	0.048
	All economies	0.014	0.029	0.047
Nigeria	SIDS and LDCs	-0.101	-0.138	-0.125
	Developing economies, LDCs and SIDS	-0.066	-0.085	-0.070
	All economies	-0.070	-0.090	-0.076
Nicaragua	SIDS and LDCs	-0.255	-0.339	-0.305
	Developing economies, LDCs and SIDS	-0.160	-0.207	-0.170
	All economies	-0.169	-0.219	-0.183
Netherlands (Kingdom of the)	SIDS and LDCs	-0.079	-0.108	-0.109
	Developing economies, LDCs and SIDS	-0.077	-0.105	-0.105
	All economies	-0.075	-0.102	-0.102
Norway	SIDS and LDCs	-0.035	-0.047	-0.045
	Developing economies, LDCs and SIDS	-0.035	-0.046	-0.044
	All economies	-0.035	-0.046	-0.044
New Zealand	SIDS and LDCs	-0.207	-0.279	-0.266
	Developing economies, LDCs and SIDS	-0.206	-0.278	-0.265
	All economies	-0.203	-0.273	-0.260
Oman	SIDS and LDCs	-0.217	-0.310	-0.295
	Developing economies, LDCs and SIDS	-0.227	-0.324	-0.311
	All economies	-0.225	-0.321	-0.308
Pakistan	SIDS and LDCs	-0.092	-0.128	-0.117
	Developing economies, LDCs and SIDS	-0.051	-0.073	-0.060
	All economies	-0.056	-0.079	-0.066
Panama	SIDS and LDCs	-0.197	-0.271	-0.256
	Developing economies, LDCs and SIDS	-0.207	-0.284	-0.271
	All economies	-0.197	-0.269	-0.256
Peru	SIDS and LDCs	-0.251	-0.349	-0.349
	Developing economies, LDCs and SIDS	-0.247	-0.344	-0.343

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 46		
		2030	2040	2050
	All economies	-0.248	-0.344	-0.343
Philippines	SIDS and LDCs	-0.136	-0.173	-0.163
	Developing economies, LDCs and SIDS	-0.133	-0.169	-0.158
	All economies	-0.134	-0.169	-0.158
Poland	SIDS and LDCs	-0.040	-0.054	-0.050
	Developing economies, LDCs and SIDS	-0.038	-0.052	-0.048
	All economies	-0.034	-0.046	-0.041
Portugal	SIDS and LDCs	-0.098	-0.131	-0.126
	Developing economies, LDCs and SIDS	-0.104	-0.140	-0.136
	All economies	-0.097	-0.130	-0.126
Paraguay	SIDS and LDCs	-0.123	-0.171	-0.163
	Developing economies, LDCs and SIDS	-0.105	-0.144	-0.133
	All economies	-0.107	-0.147	-0.136
Qatar	SIDS and LDCs	-0.262	-0.375	-0.344
	Developing economies, LDCs and SIDS	-0.264	-0.377	-0.346
	All economies	-0.264	-0.377	-0.346
Korea, Republic of	SIDS and LDCs	-0.155	-0.208	-0.201
	Developing economies, LDCs and SIDS	-0.153	-0.206	-0.198
	All economies	-0.150	-0.202	-0.193
Romania	SIDS and LDCs	-0.005	-0.003	0.005
	Developing economies, LDCs and SIDS	-0.001	0.002	0.011
	All economies	0.001	0.005	0.014
Russian Federation	SIDS and LDCs	-0.044	-0.059	-0.055
	Developing economies, LDCs and SIDS	-0.043	-0.058	-0.054
	All economies	-0.044	-0.059	-0.055
Saudi Arabia	SIDS and LDCs	-0.148	-0.205	-0.184
	Developing economies, LDCs and SIDS	-0.151	-0.209	-0.189
	All economies	-0.152	-0.211	-0.191
Singapore	SIDS and LDCs	-0.123	-0.151	-0.136
	Developing economies, LDCs and SIDS	-0.130	-0.161	-0.147
	All economies	-0.131	-0.161	-0.147
El Salvador	SIDS and LDCs	-0.205	-0.275	-0.260
	Developing economies, LDCs and SIDS	-0.171	-0.227	-0.210
	All economies	-0.174	-0.231	-0.214
Serbia	SIDS and LDCs	-0.016	-0.018	-0.011
	Developing economies, LDCs and SIDS	-0.006	-0.004	0.005
	All economies	-0.006	-0.004	0.005
Slovenia	SIDS and LDCs	-0.118	-0.170	-0.172
	Developing economies, LDCs and SIDS	-0.121	-0.174	-0.176
	All economies	-0.115	-0.164	-0.165
Sweden	SIDS and LDCs	-0.053	-0.073	-0.072
	Developing economies, LDCs and SIDS	-0.050	-0.069	-0.068

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 46		
		2030	2040	2050
	All economies	-0.049	-0.067	-0.065
Eswatini	SIDS and LDCs	-0.016	-0.019	-0.011
	Developing economies, LDCs and SIDS	-0.019	-0.022	-0.015
	All economies	-0.019	-0.023	-0.016
Syrian Arab Republic	SIDS and LDCs	-0.084	-0.139	-0.123
	Developing economies, LDCs and SIDS	-0.528	-0.751	-0.746
	All economies	-0.482	-0.690	-0.684
Thailand	SIDS and LDCs	-0.124	-0.159	-0.147
	Developing economies, LDCs and SIDS	-0.115	-0.146	-0.132
	All economies	-0.115	-0.146	-0.132
Trinidad and Tobago	SIDS and LDCs	-0.282	-0.374	-0.350
	Developing economies, LDCs and SIDS	-0.304	-0.403	-0.380
	All economies	-0.305	-0.404	-0.381
Tunisia	SIDS and LDCs	-0.153	-0.219	-0.202
	Developing economies, LDCs and SIDS	-0.141	-0.202	-0.184
	All economies	-0.141	-0.203	-0.184
Türkiye	SIDS and LDCs	-0.127	-0.176	-0.169
	Developing economies, LDCs and SIDS	-0.127	-0.176	-0.170
	All economies	-0.128	-0.177	-0.171
United Republic of Tanzania	SIDS and LDCs	0.372	0.512	0.554
	Developing economies, LDCs and SIDS	-0.066	-0.083	-0.058
	All economies	-0.081	-0.104	-0.079
Ukraine	SIDS and LDCs	-0.170	-0.231	-0.238
	Developing economies, LDCs and SIDS	-0.089	-0.121	-0.111
	All economies	-0.098	-0.133	-0.125
Uruguay	SIDS and LDCs	-0.170	-0.228	-0.230
	Developing economies, LDCs and SIDS	-0.173	-0.233	-0.235
	All economies	-0.164	-0.220	-0.221
United States of America	SIDS and LDCs	-0.031	-0.041	-0.039
	Developing economies, LDCs and SIDS	-0.031	-0.041	-0.039
	All economies	-0.031	-0.041	-0.039
Uzbekistan	SIDS and LDCs	-0.019	-0.027	-0.017
	Developing economies, LDCs and SIDS	-0.032	-0.047	-0.042
	All economies	-0.033	-0.049	-0.044
Venezuela (Bolivarian Republic of)	SIDS and LDCs	-0.052	-0.069	-0.065
	Developing economies, LDCs and SIDS	-0.048	-0.064	-0.059
	All economies	-0.049	-0.064	-0.060
Viet Nam	SIDS and LDCs	-0.392	-0.498	-0.443
	Developing economies, LDCs and SIDS	-0.208	-0.225	-0.122
	All economies	-0.224	-0.249	-0.149
Rest of Caribbean	SIDS and LDCs	-0.018	-0.022	-0.002
	Developing economies, LDCs and SIDS	-0.126	-0.168	-0.158

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 46		
		2030	2040	2050
	All economies	-0.130	-0.173	-0.164
Rest of Oceania	SIDS and LDCs	0.211	0.328	0.428
	Developing economies, LDCs and SIDS	-0.188	-0.238	-0.202
	All economies	-0.202	-0.258	-0.224
Rest of the world	SIDS and LDCs	-0.064	-0.090	-0.089
	Developing economies, LDCs and SIDS	-0.065	-0.091	-0.090
	All economies	-0.065	-0.091	-0.090
South Africa	SIDS and LDCs	-0.142	-0.193	-0.186
	Developing economies, LDCs and SIDS	-0.131	-0.177	-0.168
	All economies	-0.133	-0.180	-0.171
Zimbabwe	SIDS and LDCs	-0.089	-0.112	-0.098
	Developing economies, LDCs and SIDS	-0.056	-0.070	-0.059
	All economies	-0.062	-0.079	-0.068
Rest of developing economies in Europe and Central Asia	SIDS and LDCs	-0.051	-0.075	-0.071
	Developing economies, LDCs and SIDS	-0.044	-0.065	-0.060
	All economies	-0.044	-0.065	-0.060
Equatorial Guinea	SIDS and LDCs	0.013	0.035	0.052
	Developing economies, LDCs and SIDS	-0.018	-0.007	0.004
	All economies	-0.018	-0.008	0.003
Rest of Asia	SIDS and LDCs	-0.034	-0.047	-0.036
	Developing economies, LDCs and SIDS	-0.034	-0.047	-0.037
	All economies	-0.034	-0.048	-0.038
Rest of Asian SIDS and LDCs	SIDS and LDCs	0.384	0.543	0.670
	Developing economies, LDCs and SIDS	-0.070	-0.088	-0.045
	All economies	-0.084	-0.108	-0.067
Rest of American SIDS	SIDS and LDCs	-0.195	-0.262	-0.222
	Developing economies, LDCs and SIDS	-0.274	-0.377	-0.346
	All economies	-0.276	-0.379	-0.349
Rest of Europe	SIDS and LDCs	0.020	0.033	0.045
	Developing economies, LDCs and SIDS	0.022	0.036	0.049
	All economies	0.023	0.038	0.051
Rest of Middle East and North Africa	SIDS and LDCs	-0.111	-0.173	-0.160
	Developing economies, LDCs and SIDS	-0.098	-0.151	-0.138
	All economies	-0.100	-0.155	-0.142
Rest of landlocked economies in Africa	SIDS and LDCs	0.310	0.414	0.446
	Developing economies, LDCs and SIDS	0.033	0.047	0.063
	All economies	0.024	0.035	0.051
Rest of LDCs in Africa	SIDS and LDCs	0.088	0.102	0.144
	Developing economies, LDCs and SIDS	-0.118	-0.173	-0.153

GTAP Economy	Impact on GDP, revenue disbursement scheme	Scenario 46		
		2030	2040	2050
	All economies	-0.125	-0.182	-0.163
Rest of Western Africa	SIDS and LDCs	2.813	4.150	5.065
	Developing economies, LDCs and SIDS	0.416	0.665	0.880
	All economies	0.329	0.541	0.739

Annex 15. Supplementary tables in Microsoft Excel .xls format

The following tables are provided in a separate xls file. These tables are an integral part of the UNCTAD impact assessment.

- Table A1. Relative impact on maritime logistics costs of imports of States (percentage difference to BAULG)
- Table A2. Relative impact on maritime logistics costs of exports (percentage difference to BAULG)
- Table A3. Relative impact on imports, without disbursement of revenues (percentage difference to BAULG)
- Table A4. Relative impact on exports, without disbursement of revenues (percentage difference to BAULG)
- Table A5. Relative impact on gross domestic product, without disbursement of revenues (percentage difference to BAULG)
- Table A6. Relative impact on the consumer price index, without disbursement of revenues (percentage difference to BAULG)
- Table A7. Relative impact on the quantity of agricultural imports, without disbursement of revenues (percentage difference to BAULG)
- Table A8. Relative impact on the prices of agricultural imports, without disbursement of revenues (percentage difference to BAULG)
- Table A9. Relative impact of policy scenarios on imports, with disbursement of revenues (percentage difference to BAULG)
- Table A10. Relative impact of policy scenarios on exports, with disbursement of revenues (percentage difference to BAULG)
- Table A11. Relative impact of policy scenarios on gross domestic product, with disbursement of revenues (percentage difference to BAULG)
- Table A12. Relative impact of policy scenarios on the consumer price index, with disbursement of revenues (percentage difference to BAULG)
- Table A13. Relative impact of policy scenarios on the quantity of agricultural imports, with disbursement of revenues (percentage difference to BAULG)
- Table A14. Relative impact of policy scenarios on the prices of agricultural imports, with disbursement of revenues (percentage difference to BAULG)
- Table A15. Monetary inflows for the simulation of revenue disbursement in GTAP (million $)
- Table A16. Monetary outflows for the simulation of revenue disbursement in GTAP (million $)

ANNEX 2

COLLATION OF SUBSTANTIVE COMMENTS BY MEMBERS OF THE STEERING COMMITTEE AND RESPONSES PROVIDED BY UNCTAD

The following table collates substantive comments by members of the Steering Committee and responses provided by UNCTAD.

Comments/questions/remarks by Steering Committee		**Action to take**	**Response by UNCTAD**
Argentina			
1	The levy and the disbursement: We are surprised in technical terms at the conclusion that all scenarios with a levy would have less impact than those which do not in the long term. Having had some discussion on revenue disbursement, it is clear that the suggestion that such disbursement can minimize negative impacts because it would be out of sector, or destined to the regional household. Which most probably will not be the case. At the same time, there seems to be assumed that a levy can raise significant revenues, and for that, it has to be a high levy. At a SC meeting, Jan expressed there would never be enough revenue to compensate all negative impacts. In the report, it seems to assume not only that there will be enough revenue to allocate to States (beyond the other Ds), but also that it can be disbursed as fast as the negative impacts are felt and to the actors being impacted. On the other when presenting the "compensatory" side of a levy, the significant shock it causes to States is not presented. But more importantly, the GTAP cannot model distribution of revenues, so how can the report be so conclusive? With this, and this is with regard to Tuvalu's intervention, this is not criticism to the GTAP model, but concern at how some conclusions are derived from a model -chosen by us- but		Taking in turn: 1) we have added a new section that explains the influence of Task 2 results on Task 3, including that the differences in cost intensities in task 2 scenarios, which is an input to Task 3, can explain many of the comparative examples. We have also added a comparison of this report's findings to wider literature (Pereda et al., Sheng et al.) to show that the findings are consistent - Sheng et al. also model revenue distribution, 2) This point has been added to the limitations section, noting that the specification from the steering committee to UNCTAD was to model revenue distribution as it has been modelled in this report, 3) the magnitudes of revenues in this report come from Task 2, there is no additional assumption made in Task 3 about the magnitude of revenues that are raised in different scenarios, 4) The report's findings are consistent with the statement that there is not enough revenue to compensate all negative effects. The first key finding makes this point (all scenarios result in negative GDP), 5) the assumption regarding speed of disbursement is an important one, and had not been included, additional detail covering this limitation more specifically has been added in the main body of the report and the Executive Summary, 6) the shock is included from revenue disbursement - and is described in under the method section of the report, 7) GTAP can model revenue

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	that is not made to measure particular aspects, such as revenue disbursement.		disbursement, and this is described in method, which has been reviewed by third party experts. Modelling of revenue disbursement is also present in other literature (e.g. Sheng et al.) which is referenced in the report and comparisons are drawn. However, we have added language and restructured relevant text to further clarify that all of the findings and results need to be considered in light of the limitations and the uncertainty they induce.
2	What we are assessing* It is true we requested UNCTAD to assess scenarios with and without revenue disbursement, but at the same time, the report looks like an assessment of compensatory measures more than an assessment of impacts on States. Also, the with and without revenue distribution seems to have turned into a "levy non-levy" assessment. This is important because there will be a design of the measure, and ex-ante approaches can be followed in order to avoid or minimize negative impacts, which is what the 2023 Strategy states. The universe of possible ways to address negative impacts is not limited to the distribution of revenues. It is not like that in the Strategy and it is not like that in Circ. 885. The report should follow our framework. All the categories to be assessed following the strategy and circular 885 refer to impacts on States in relation to their trade. Those categories are referred to in section 6, but it is limited to indicating that this or that element, i.e. transport dependency, "might make the results vary", i.e. the impacts could be more pronounced. We believe this section is extremely limited as it could introduce important variations in the results. Also, it should be clearly linked to Task 4. Like the United States, we believe the limitations of the model regarding revenue distribution should be specified, but also this requires a refocusing of the report.		Taking in turn 1) there was an extensive discussion on the first draft of the final report on how best to structure the results of different scenarios (with and without revenue). Following these discussions and in accordance with the direction provided by the SC moderator, we have restructured the text, 2) we have added content in the report to clarify how we have derived the methodology and the approach applied, from Circ. 885 rev 1, 3). We have extended the section discussing the results in the context of the framework and the 8 impact categories, as well as some language referring to Task 4 at the beginning of this section, 4) we have significantly extended and moved around the section on limitations in the main body of the report and the Executive Summary, 5) we have further explained the method applied and the underlying data. We clarified aspects relating to the availability of other reviews and the transparency of the methodology used.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	Like Brazil, we have requested the underlying data in order to replicate the results, of course understanding the limitations due to confidentiality. *We also join the comments made by Brazil and as I said, the US, and we believe it is premature to approve this report but we thank the disposition of Jan Hoffman to continue to work on it*.		
3	One thing that is missing from UNCTAD's report, and which would not take a lot of time, is a table of who pays and how much they pay (the cost of a measure). There is only a table with what is charged (Table 19) and who is charged (Table 20). A summary table by country group and an annex with all countries, both how much each country pays and how much each country charges.		Tables to this specification have now been added as reflected in the final report.
4	Part of the Report Comment/request for clarification 3.6.1 (page 23 in fine): "GHG emission reduction measures can be of two broad natures: price mechanisms such as a levy on carbon emissions and regulatory measures such as a mandatory limit on emissions or a ban on fossil fuels". We do not believe it to be appropriate to indicate "such as a levy on carbon emissions" as it sounds somewhat policy-prescriptive in light of the fact that the MEPC has decided, at this stage, only that there will be a pricing mechanism. Of what type, the CIA results are supposed to help decide. We suggest deletion and mentioning only pricing mechanisms.		Revised as reflected in the final report.
5	Table 4 (page 21): When referring to the 11 commodities, other factors influencing the variation in costs are not considered.		A linkage to Task 4 has been added to the text.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	It would be important to mention this is to be read in conjunction with the Stakeholder Analysis, as they are complementary quantitative/qualitative analysis (also see our general comment at the end).		
6	5.1. page 32.: "The degree to which changes in maritime logistics costs are reflected in changes in the prices of imports and exports is dependent on their share of the value of exports and imports. As shown in Table 9, this share varies considerably across global commodity groupings. In agriculture, the maritime CIF-FOB margin, the variable used in GTAP as a measure of maritime transport costs, is relatively high in proportion to the value of imports, amounting to 5.3 per cent". It would be convenient to specify this refers to agricultural commodities and that the proportion is high due to the fact that they are goods of low unitary value.		The text has been revised to improve clarity as reflected in the final report.
7	5.2.2. (Page 36): "In 2030, the strongest impact on real GDP globally (-0.05 per cent) is observed for scenario 43 (Strive, TtW, flex, no levy, no feebate). In 2050, scenarios 21 and 22 (Base, WtW, noflex, no levy, no feebate), which do not include a flexibility mechanism, and scenarios 23 and 24 that do include a flexibility mechanism all lead to a -0.16 per cent reduction in global real GDP relative to the baseline BAULG scenario. Developed economies experience a relatively smaller reduction in their real GDP compared to the remaining economy groupings. In 2030, the real GDP decline is around -0.03 per cent across most scenarios. This reduction increases to approximately -0.12 per cent by 2050".		The text has been revised to improve clarity as reflected in the final report.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	Can you be more specific about "the remaining economy groupings"?		
8	5.3.1.1: "As a result, under all four policy scenarios with a levy, international trade in 2050 is estimated to be -0.23 per cent less than under the BAULG. Within scenarios, variation across 2030, 2040 and 2050 is less pronounced than variations within scenarios and across the three timelines relating the maritime logistics costs". The variations per country in Annex 2 do not seem to support this general statement. Could you please review and explain?		Provided for world trade, not individual countries.
9	5.3.2.2. (Page 48): "Generally, for scenarios which include a levy, the negative real GDP impacts are reduced in all analysed years, once the effects of revenue distribution are taken into account. The reduced negative impacts occur not only in the economies that directly receive the revenues disbursed but also in the ones that do not receive the disbursement, likely due to a stimulation of demand for their exports in response to the increased income abroad". Please explain how this can be generalized when there are questions of distance and elasticity of demand involved.		The text has been revised to improve clarity as reflected in the final report.
10	5.3.2.2. (Page 48): "By 2050, revenue disbursements mitigate/reduce the reduction in global real GDP caused by the policy measures that drive up maritime logistics costs. They also help mitigate/reduce the reductions in the real GDP of developing and developed economy groupings as well as the LDCs and SIDS. According to the simulation		We have added relevant language to further emphasize the limitations and the need to take these into account when considering the report and its main findings.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	results, the impact of the revenue disbursement is more effectively mitigated/reduced in the policy scenarios 26 and 46, which include a higher levy. When comparing the effects across groups of economies, in 2050, revenue disbursement offsets a considerable portion of the reduction in real GDP caused by the increase in maritime logistics costs in response to the GHG reduction measures, in developing more than in developed economies, and especially in LDCs". This statement is policy-prescriptive, and therefore unacceptable. Beyond favouring one particular measure, it is too general and should be more cautious. There is no modelling of whether the revenue disbursement would be in sector or out of sector. If in sector, that disbursement would very unlikely compensate for the negative impact. Also, the paragraph does not indicate that, for having a "compensation" by 2050, the transition with a high levy will be "shock" developing countries highly dependent on international trade of commodities to distant markets. It is also contradictory with "All in all, the negative impact, or the reduction in real GDP, of developing economies is larger than the impact on reduction in real GDP of developed economies" in the same paragraph. We recommend deletion.		
11	5.3.2.2. Results pertaining to imports and exports 6.1.1 By 2050, at the global (all economies) level, the total impact on real GDP, relative to the BAULG scenario: "Is consistently lower for scenarios that include a levy (scenarios 26, 31, 32 and 46) than scenarios that do not. The scenarios with a higher levy price have the lowest global impact (both relative to lower GHG price scenarios, and relative to all other scenarios). Distributing the		Scenarios with a levy can reduce negative GDP impacts when revenue distribution is considered due to the interconnected nature of the global economy. The overall increase in global income can stimulate demand for exports, benefiting both recipient and non-recipient economies.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	revenues only to LDCs and SIDS results in the smallest impact (i.e. reduction in percentage terms) on global real GDP (both relative to other distribution approaches and relative to all other scenarios)". What happens to exports of developing countries? (see comment at the end). Same comment as above (5.3.2.2). Deletion.		
12	6.1.2 For high levy price scenarios Developing countries are more negatively impacted than developed economies in 2030 (than in scenarios without a levy), but less negatively impacted in 2050 (than in scenarios without a levy). Same comment as 5.3.2.2. (Page 48), deletion.		The text has been revised to improve clarity as reflected in the final report.
13	6.5 Terms and further considerations under Task 3 See general comments below. Also, we believe some thoughts on the elasticity of demand should be introduced.		For inelastic goods (necessities), demand might not change significantly with income variations. However, for elastic goods (luxuries), increased income can lead to substantial increases in demand.
14	6.5.1: "However, countries that are most strongly impacted by increases in maritime logistics costs, are the structurally vulnerable economies of the LDC grouping." What are the 'structurally vulnerable economies'? It would be better to unify language as described in the introduction.		After further reflection, we considered that the assessment of the degree of structural vulnerability was beyond the scope of the report and did not add any significant value to the analysis. We have therefore dropped this characterization from the sentence.
15	6.5.2: "This suggests that the composition of a country's trade can significantly influence the impacts experienced under the different policy scenarios." It would be convenient to clarify that this factor is considered in Task 4, which is complementary to 3.		The text has been revised as reflected in the final report.
16	6.5.3 Transport dependency: Impact Summary: The results suggest that more maritime-transport dependent economies can be more impacted by increases in maritime logistics costs. However, this		We agree that the validity of this statement is, to some extent, dependent on whether disbursements are in-sector or out-of-sector. As suggested, we have removed the proposed sentences.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	relationship is not universal. Where transport dependency is a significant contributor that may drive impacts (whether positive or negative), scenarios with revenue distribution targeting these maritime transport dependent economies can mitigate some of those impacts. Methodologically, the assertion assumes there is going to be out of sector use of revenues. We do not believe this paragraph should be in the report. We recommend deletion from "However..".		
17	6.5.5. Food security Impact Summary: Food security has not been directly addressed. However, impacts on the maritime logistics costs of agricultural products have been considered. Scenarios that lead to large changes in maritime food imports and exports could potentially influence the ability of countries to meet their food security objectives. Can you explain how? And could you add considerations as to whether this could also relate to limitations in retrofitting ports used for exports/imports?		We have fundamentally extended this section, based on new modelling results presented in Sections 6.2.1 and 6.3.2, while also providing an explanation how changes in agricultural imports may impact on the food security situation in a country (first paragraph of Section 7.3.3). A discussion of the impact of specific actions such as retrofitting ports is not included to avoid giving the impression that this means an evaluation of specific policy measures.
18	6.5.8. Socio-economic progress and development: Impact Summary: Overall impacts on real GDP varied in magnitude and their incidence or actual effect will depend on the development status and size of economies. The analysis in the present report indicates that the level of development of economies broadly indicates susceptibility to negative impacts, with LDCs economies being most negatively affected. Scenarios generating and disbursing revenues can help mitigate and reduce the differentiated impacts on States.		The text has been revised to improve clarity as reflected in the final report.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	For the reasons explained above, the last assertion is too broad and is not policy-neutral. In particular, it incurs in suggesting that the negative impacts are linear and therefore easily financially compensated, when sometimes the best manner of addressing negative impacts (including their social component) is to avoid them. We recommend the deletion of the last sentence.		
19	6.6.3 "Some levy scenarios may lead to considerable changes in import and export volumes, potentially altering port-calling frequencies and connectivity for specific economies" It is suggested to make this more explanatory, such as linking this with distance to main markets and maritime transport dependency for foreign trade, and elasticity of demand, for example, some of which are aspects only mentioned at the end of the Report.		We have elaborated on this issue under the Limitations section as reflected in the final report.
20	6.6.5 "Developing economies and LDCs are expected to see a decrease in export competitiveness due to higher maritime logistics costs, leading to potential substitution of imports in their main markets." It would be worthwhile to explain that, unlike exports from developed countries, developing economies, including LDCs, export commodities with low unitary prices.		The text has been revised to improve clarity as reflected in the final report.
21	Section 3 - Methods applied (page 13, para. 4) "The modelled impacts (...) represent the direct impacts we expect from the implementation of different policy combinations (first-round effects), abstracting from any attempts by market actors to adjust their transport demand to the new cost structure and macro-economic environment (...) (second-round effects). The effects on maritime		The text has been revised to improve clarity as reflected in the final report.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	logistics costs, and hence on imports, exports, real GDP and consumer prices, in the second round of effects, can be expected to be small compared to the effects in the first round". The most concerning impacts of a mid-term measure are precisely the so called "second-round effects". If only the first-round impacts are modelled, how can it be concluded that the second-round effects "can be expected to be small compared to the effects in the first round"? In particular, take into account that between the initial "shock" (entry into force of the measure) and 2050, there will be only 22 years. Such an assertion needs to be demonstrated, but it is not modelled in this CIA. Also, we believe this type of quasi-conclusion is not appropriate to be included as a methodology. We recommend deletion.		
22	References to groupings of countries: The groupings developed/developing/SIDS and LDCs were consented by the Steering Committee for the purposes of modelling the impact of revenue disbursement. All along the report, there are references to these categories, which we do not object, as long as in every relevant instance the reference is complete. As an example, there are several paragraphs where reference is made to x impact on one or two categories, without specifying what happens with the others. There is at least one example of the use of "vulnerable" to qualify countries, which does not correspond to the sources cited at the beginning of the report. It should also be taken into account that SIDS and LDCs are subset of developing countries, that should be specified and taken		We have further clarified the country classification as reflected in the final report.

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	into account when making reference to them beyond the aspect of revenue disbursement.		
23	Terms and further considerations under Task 3: Under section 6.5., brief "impact summaries" are included on some specific aspects of the impact assessment that were stressed by Members of the SC, such as Geographic remoteness of and connectivity to main markets, Cargo value and type, Transport dependency, Transport costs, Food security, Disaster response, Cost effectiveness, and Socio-economic progress and development. Also, "views" are included about some "additional issues", such as Potential geographical specificities and route-related impacts, Possibility of transport modal shift with changes in maritime logistics costs, Potential changes in port-calling frequencies and changes in connectivity index, Impacts of the measures on final consumer prices, Potential loss of competitiveness of States in their main exports, as well as the consequent substitution of imports in their main destination markets, Magnitude of the impacts of the measures in comparison with other maritime cost or freight rate developments. While we understand the limitations in time, these are important layers of the CIA in line with the 2023 Strategy and Circ. 885 Rev.1. Some of them are addressed in the Stakeholder analysis, which provides the qualitative assessment. We would suggest the following: a) being less brief with regard to these layers, b) making clear reference to the fact that several of them (if not all of them) are addressed in Task 4. Here is where the complementarity of Tasks 3 and 4 are clear, that should be stressed for the benefit of all IMO Members.		The text has been revised to improve clarity as reflected in the final report.

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24	Systemic concern regarding presentation of levy/non-levy scenarios We wonder how it was possible for UNCTAD to arrive at the conclusion that all scenarios with a levy would have less impact than those which do not in the long term. We are afraid there seems to be a strong indication that disbursement with a high levy can minimize negative impacts. As an example, even in scenario 31, without disbursement, the impact appears to be smaller than others not entailing a levy. All this leads to think of the economic sense of presenting that impacts in 2050 would be higher in scenarios without a levy than in scenarios with a levy (even without disbursement of the revenues of the levy). We cannot understand how all levy scenarios are presented as having less impact than no-levy scenarios. The underlying assumption seems to be that a levy can raise significant revenues (for that, it has to be a high levy). On the one hand, at the SC, UNCTAD itself told us orally there would never be enough revenue to compensate for all negative impacts. In the report, it seems to assume not only that there will be enough revenue to allocate to States (beyond the other Ds), but also that it can be disbursed as fast as the negative impacts are felt and to the actors being impacted. On the other, and complementary to that, when presenting the "compensatory" side of a levy, the significant shock it causes to States is not presented. We are very concerned at this, and we believe the SC should address this issue. We had requested the underlying data in order to replicate the results, but that proved not to be possible. At this stage, we would like to stress the		The text has been revised to improve clarity as reflected in the final report.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	systemic problem of having clear assertions regarding the impact of revenue disbursement on impacts on States even when the GTAP can model only impacts, not revenue disbursement, with the consequent result of incurring in what looks like policy prescriptions with regard to a levy. The SC had decided to model scenarios "with revenue disbursement-without revenue disbursement", which is very different to model "with levy-without levy".		
25	1. We support the comments made by the United States on language, with one specific observation with regard to categories of countries: the CIA covers all countries, and refers in particular to developing countries, and SIDS and LDCs among them. This is not "in particular SIDS and LDCs". Consequently, all paragraphs summarizing the results with respect to one or two categories of countries, should refer to all categories in order to have a clear idea of the impacts on all. At the same time, we suggest keeping consistency with the definition of the categories of countries as specified in the report, avoiding the introduction of new categories, such as "vulnerable economies" or "climate-vulnerable economies". On page 15, the following new phrase should be deleted, as it uses language not arising from the IMO instruments ("decarbonize") and introduces the political question of the Paris Agreement: "The assumption that all sectors will decarbonize by 2050 is consistent with the Paris Agreement and implies that secondary impacts on emissions will not be significant. However, if other sectors do not all decarbonize in line with the Paris Agreement…" We also recommend when referring to impacts by 2050, to also specify impacts by 2030 and 2040. With regard to language, we suggest using less assertive		*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*

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	wording, in particular in light of the limitations of GTAP (i.e. do not say "Results relating to scenarios with a GFI requirement and higher levy prices have shown that some negative impacts on world GDP are reduced/offset to some extent"), on this see 4 below. 2. We also support the comments and observations of China, Brazil and Chile. In particular, as China expressed, we are not sure what tools were used to arrive at certain conclusions. The report in general looks as policy prescriptive, as it shows an inclination towards one type of measure over others. 3. It was explained by UNCTAD that impacts on GDP may be seen as small, but they are actually quite high. That would merit to be included in the report. 4. Argentina's main concern is one of methodology; since what is being compared remains unclear. We have made similar observations before, not only with regard to the limitations of the GTAP model for assessing revenue disbursement, but also with regard to the overall methodological approach which overemphasizes the potential of "compensation" of negative impacts of revenues (of a levy). Revenue disbursement appears as a category comparable to the different instruments in the basket of mid-term measures. But revenue disbursement is a "compensatory instrument" of the impacts of a measure, it is an ex post manner of addressing negative impacts. Therefore, it should be assessed in the context of all revenues originated by all proposed measures, including the IMSF&F.		

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	UNCTAD indicated that there is an assumption that measures different from a levy would not generate substantial revenues, and therefore such other scenarios are not modelled. We cannot find a justification for that assumption. While it is true that UNCTAD has followed decisions made by the SC, it is also true to state that the SC did not anticipate the methodological problem of modelling revenue disbursement as an instrument. Furthermore, it would have been impossible to anticipate that even when the GTAP model has its limitations for its assessment, clear conclusions would be drawn with regard to its capacity to mitigate negative impacts on States. It is clear that the impact of any measure would be lower if accompanied by compensation, but methodologically, the comparison should be made between measures without compensation or between measures with compensation, not between a measure with compensation and others without compensation. Also, the analysis of the mitigation effect was partial. Different forms of compensatory instruments were not evaluated, nor was the distributional impact -impact on income distribution- of compensatory instruments assessed. This implies looking at 'winners' and 'losers'. It is likely that sectors that did not bear the cost of the measure will end up receiving compensation. The issue of income distribution remains to be explained, i.e. that the results differ depending on the recipient of the disbursement. Since the disbursement would be paid to the State, it is likely to		

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	be earmarked for general revenue and not allocated specifically to the sector adversely affected by the measure. This affects the results of the model, which is not capable of modelling but out-of sector distribution. We believe this deserves not only to be considered in the analysis of the result but also to be assessed. We also suggest explaining better why the impact on the world is smaller with the disbursement of tax revenues to SIDS and LDCs than to no disbursement. It was explained that the GTAP has those limitations for modelling revenue disbursement. Nevertheless, from some unrealistic assumptions (page 15: instantaneous distribution, that any benefits to economies accrue instantaneously in the time step, that they are out of sector, etc) clear conclusions are drawn. The result is an over-emphasis on the potential of revenues to mitigate negative impacts on States. At the same time, no assessment was made of the fact that in order to generate high revenues some will have to bear the costs of the shock that a high levy would introduce. One aspect of income distribution between countries could be analysed from Table 23: it could present who "pays", who "collects" and the balance to review net contributors and net recipients. We are grateful for the explanations and caveats, but we do not believe they are enough to safeguard the results of an assessment drawn in spite of the already explained limitations. In light of this, we recommend a refocus of the report.		

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Australia			
26	In the final report, it would be useful to note that the model does not take into account the fact that other transport modes and sectors will also be decarbonizing.	It would be helpful to include limitations on accounting for other sectors' decarbonization actions in the final report	Limitations on capturing the transport sectors energy intensity until 2050 have been included in the limitations section on secondary impacts on emissions from the wider economy. A limitation to this effect has been added to the text of the final report.
27	It would be useful to have a more detailed explanation of how the model has reached the stated results, especially for States that are ostensibly in the same trade exposed position. For example, the impact on CPI for Australia vs New Zealand shows a relatively greater impact for Australia. Can you please help us make sense of this result?	It would be helpful to clarify how similar trade exposed states have different impacts, particularly on CPI	The text has been revised to improve clarity as reflected in the final report.
28	Besides providing the percentage change from the BAU baselines, the report should include headline figures (i.e. GDP) presented in absolute terms, in US dollars.	It would be helpful to include absolute numbers on the results	The text has been revised to improve clarity as reflected in the final report.
29	The report should include an annex with all assumption, along with the sensitivity tests undertaken.	It would be helpful to include in the Annex the sensitivity analysis and assumptions	The text has been revised to improve clarity as reflected in the final report.
30	On the disaggregated State data, Australia supports providing this data in Excel tables, rather than attaching to the final report as text.	Please provide the Excel files	UNCTAD will provide, as deemed feasible, the disaggregated data at the State level in Excel format.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
31	9. Some tables show 178 States, 126 and 114 (due to regional aggregation). It would be useful to include a note highlighting this for the tables where some State data is not available and only regional data can be reported.	Please report a note highlighting that some tables show 178 states, 126 states, and 114 states due to regional aggregation.	The differences are due to the availability of data. An explanation is now provided in the section on "methodology" contained in the final report.
32	For Table 2 (Value of time per ton-hour by commodity type) and Table 3 (Determinants of maritime logistics costs in the start year), are the values shown a global average for each commodity? If so, for each commodity group, does the GTAP model use the global average for the per unit maritime logistics costs for all voyages or are different maritime logistics costs used for each individual voyage segment?	Please explain the calculations on MLC as the global average of all voyages or for each individual voyage	The transport costs and shipping times are aggregated up to the level of bilateral trade flows and to the level of commodity groups associated with the 11 economic sectors used in GTAP simulation as described in Section 3.6 of the final report.
33	Do the maritime logistics costs determinants change for each year in the model? Is this done by the GTAP model itself after the start year values are entered?	Please explain MLC changes overtime	The maritime logistics costs change every 10 years as this is the time step used in GTAP simulation in line with the calculation output from DNV which is also every 10 years.
34	Is it possible to have Tables 2 and 3 on pages 18 and 19 broken down by GTAP economy?	Please provide Tables 2 and 3 broken down by GTAP economy	Table 2 represents the value of time for the global commodity, regardless of the economy group hence breaking down this table by GTAP economy is not possible. Due to the limited time, break down by GTAP economies will not be possible but we will provide a table with break down based on economic grouping or the development status of different economies.
35	For the tables showing the relative impacts on imports and exports compared to BAU, are the impacts for the volume or value of the imports and exports?	Please clarify as appropriate if impacts are measured by volume or value of imports/exports	Impacts are on volume. This has now been clarified in the final report.

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36	Why is the percentage change from BAULG significantly lower for the maritime logistics costs (MLC) compared to the maritime transport costs (MTC), when MLC is the sum of MTC and the cost-equivalent of the shipping time?	Please explain the relative changes in MLC, MTC and shipping time costs	Since MLC is a larger aggregate value due to the inclusion of shipping time cost, the same absolute change in MTC will result in a smaller percentage change when considered within the larger MLC.
37	Table 8: Does this show the share of maritime logistics costs to the landed product costs for each commodity group? If so, do these values change with each year in the model and does the model automatically determine the values for the years following the start year?	Please clarify as appropriate	Yes, it shows the share of maritime logistics costs relative to the values of the traded goods. However, this share of maritime logistics costs which is also referred to as the ad-valorem costs, are calculated based on GTAP database on transport costs.
38	Table 11: For developed countries, why is the negative impact smaller in magnitude for exports compared to imports, when the relative impact on maritime logistics costs is greater for exports compared to imports (i.e. opposite trend) as shown in Tables 6 & 7? Similarly, the effect is opposite between exports & imports compared to maritime logistics costs for developing countries.	Please explain impacts on Imports/exports relative to MLC	The text has been revised to improve clarity as reflected in the final report.
39	Table 13: Why is the CPI increase smaller for developing countries compared to developed countries, even though the negative impact on GDP is greater in magnitude for developing countries compared to developed countries?	Please clarify as appropriate	The unit is in percentage change relative to BAULG.
40	Also, why are CPI increases for SIDS much smaller in magnitude compared to developing countries, even though their GDP is more negatively impacted compared to developing countries in general?	Please explain changes in MLC for SIDS	On average, changes in maritime logistics costs for SIDS are lower. However, there is significant variation among the economies belonging to this group.
41	Table 15: Why is there revenue underdeveloped economies for Revenue Disbursement Scheme 2, which excludes developed economies? Is this because some SIDS fall underdeveloped economies?	Please clarify as appropriate	That is correct.
42	Similarly, why is there revenue in underdeveloped and developing economy columns for Scheme 3, which excludes these economies and is only for SIDS and LDCs?	Please clarify as appropriate	LDCs and SIDS are included in Developing and Developed groups of economies.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
43	Table 16: Why is the negative impact on imports greater with revenue disbursement compared to without as shown in Table 10?	Please explain the implications on imports	The revenue disbursement scenarios result in lower imports compared with the no revenue distribution scenario. As recipient countries have more money to spend for consumption (demand-side effect), prices rise owing to supply-side pressures. Higher cost of production then translates into higher import prices that in turn induces lower import demand. This is further explained in the final report.
44	Table 17: Why is the negative impact on exports greater with revenue disbursement compared to without as shown in Table 11?	Please explain the implications on exports	The revenue disbursement scenarios result in lower imports compared with the no revenue distribution scenario. As recipient countries have more money to spend for consumption (demand-side effect), prices rise owing to supply-side pressures. Higher cost of production then translates into higher import prices that in turn induces lower import demand. This is further explained in the final report.
45	Table 19: Why does revenue disbursement significantly increase CPI for developing countries, SIDS and LDCs, but not developed countries?	Please explain the implications on consumer prices	The disbursement of revenues has a larger impact on developing economies, LDCs and SIDS because it represents a larger share of their GDP and has, therefore, a larger inflationary impact.
46	Table A2 & A4: When ordered from largest to smallest percentage increase of maritime logistics costs for exports in Tables A2, Australia ranks 105th out of 175 economies (i.e. Australia fares better than many other economies). However, in Table A4, Australia is the 4th worst economy in terms of the largest negative impact on exports. Could you please explain why Australia has a much larger negative impact on exports when we have a relatively smaller increase in maritime logistics costs for exports compared to other economies?	Please explain the implications on MLC for exports to Australia	Please refer to the disaggregated results provided in a separate file.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
47	Tables 11 & 12 (impacts on import & export quantities) – It would be useful if these tables in the report included the results for all 10 policy scenarios (like Tables 7 & 8) for ease of comparison and not just the 6 non-levy scenarios.	Please provide results for all examined scenarios with and without levy	This order reflects a compromise solution that helps to balance out the different views expressed by the SC members.
48	For the Executive Summary, it would be useful to note that mode substitution has not been taken into account in the analysis, and because of this, the impact on States where substitution is possible is potentially overstated.	It would be helpful to include limitations on potential modal shift into the Executive Summary	Limitations have been included in the Executive Summary contained in the final report.
49	The executive summary should note that the UNCTAD model does not consider the avoided costs associated with doing nothing, (i.e. the costs from increasing emissions through global warming), nor does it take account of the benefits of action (e.g. the additional investment that will be prompted through the measures in terms of green fuels).	The executive summary should note that the UNCTAD model does not account for the avoided costs of inaction (such as the costs from increased emissions due to global warming) or the benefits of action (such as the additional investments in green fuels)	Regarding the "avoided costs", after some consideration, this was deemed to fall outside the scope of the report. A reference to this is made in the final report under the "cost-effectiveness" term. As regards the "benefits" arising, for example, from greener fuels, these have not been quantified under Task 2 which outputs have been used as input into Task 3. So, Task 3 is aligned with Task 2 on this aspect. That said, limitations of relevance to this topic have been included in the Executive Summary contained in the report. One of these limitations indicates that the GTAP model does not reflect potential technological change, for example, the impacts of climate change mitigation efforts in areas outside of the maritime sector, or other potential changes that result from potential developments such as climate change or geopolitical changes.
50	It would be worthwhile explaining in the Executive Summary or report that UNCTAD's modelling does not account for global trends in emissions reduction, broader technological development and changes in public climate policy (i.e. it is	It would be helpful to include limitations on global	Limitations on capturing global trends in GHG emission reduction have been included under the Limitations section contained the report.

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	Static). That is, UNCTAD's analysis does not account for the impact of the shipping sector decarbonizing amidst a global economy that is changing towards net zero by 2050	decarbonization trends into the Executive Summary	
Brazil			
51	c. Does the data used in Table 8 result from shocks in GTAP? It is not clear if this is an outcome or an input of the model. If the data from Table 8 are inputs, more details on their calculation, from Tables 6 and 7 to 8, would be helpful. d. We assume that maritime trade shares were used (by origin x destination x sector) to achieve the calculation of the data in Table 8. Please provide those shares to help to understand the calculations performed. Please provide this using the following template. e. Comparison of Costs: Provide a comparison between the maritime logistic costs calculated by DNV/UNCTAD and GTAP's CIF-FOB margin, presenting both costs in the BAU scenario in dollars per ton.	Please revise as appropriate	c: It is not a direct input/output. The shocks have been applied to the maritime trade cost margin of each sector/route combination. d: correct. e: GTAP has been fed the change in maritime logistic costs in % and not in $ per ton.
52	Nonsensical results: Firstly, concerning the results, we would like to understand why the scenarios with a levy present lower impacts (less negative) on GDP when compared to scenarios without a levy, e.g. scenarios 31 x 23 and scenarios 32 X 24, even before revenue disbursement.	Please clarify as appropriate	Please refer to Section 4.4.2: These results also show that in the scenarios with low levy price (scenarios 31 and 32), the GDP impact in the short run can be similar to other scenarios even when there is no revenue distribution. Another key finding is that, in the long run (2050), and including for analysis that did not include revenue distribution, scenarios that include a levy have a smaller impact (on world GDP relative to BAU). These findings are consistent with and explained by the differences in maritime logistics costs between scenarios, which are in turn consistent with and explained by Task 2

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			results. They are novel, in that existing literature (Sheng et al (2018), Pereda et al (2023)) has focused on understanding GDP impacts that occur due to carbon pricing, relative to BAU, but has not considered the relative impacts of carbon pricing, when compared to a fuel standard or any other measures achieving an equivalent GHG reduction trajectory.
53	Relevance of the technical note: Due to the concerns raised in point #1, we believe that a final technical note is crucial to enable an expert analysis to be carried out and should be provided as soon as possible to clear lay out assumptions and allow for the verification of the calculations that might have significantly impacted the final results.	Please provide a technical note	Due to the tight time constraint, it was not possible to submit a technical note.
54	Avoid policy prescriptive language: In many parts of the report, UNCTAD mentions that the impacts are "small". We would kindly ask UNCTAD to avoid using language that can be read as a value judgement: those impacts are very relevant in absolute terms. Any impact on GDP represents billions of dollars in current values. We request the removal of policy prescriptive language in the report.	Please revise as appropriate	The specific language has been revised as reflected in the final report.
55	Substantial changes of the impact results compared with previous versions of the report: The impact results differ tenfold (or higher) from its initial presentation in the 8th meeting of the SC to the 10th meeting. The explanation given at the 8th meeting of the SC by UNCTAD was that they "forgot to consider the share of maritime transport". They have applied the shock to the "CIF price of imports" without considering "the share of total imports transported by maritime mode". (i) If we understood it right, UNCTAD initially applied the shock to total trade, rather than just maritime trade. I.e.,	Please revise as appropriate	We have undertaken substantial QA/QC and updated and described the methodology as clearly as possible to ensure a high degree of transparency, including as regards how the shocks are applied. The report now includes a discussion of the results in comparison to wider literature and confirms that they are consistent (to the extent they can be directly compared).

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	initially the share was calculated as (maritime cost/CIF export price) and was afterwards corrected to (maritime cost/ FOB maritime export price – according to Table 9 footnote" The maritime CIF-FOB margin is calculated as [CIFmaritime-FOBmaritime]/FOBmaritime*100). Is this right? (ii) However, since maritime trade represents more than 80% of total trade, this argument does not justify such a substantial reduction in the magnitude of the results. Please clarify as appropriate.		
56	Limitations of the study: We would ask UNCTAD to avoid interpreting the sign of the bias of some limitations and not others, e.g., in general terms, possible positive signs in the bias derived from the limitations were listed, however very few negative signs were mentioned. In the final report and the executive summary, the limitation section could come before the text - as suggested by at least one other delegation at SC 10 - and should contain, at least, the following aspects: (i) forecasting errors on output variables: The latest version of the GTAP model refers to 2017 data. The farther the predictions are assessed, the higher is the probability of an error. Therefore, 2050 estimates have more imprecise estimates than 2030 estimates; (ii) underestimation of GHG emissions (1) – not reassessing GHG emissions: since global GHG emissions are not reassessed after the impact calculations, it is unclear if there will be carbon leakage as a result of the measures. Moreover, in the scenarios with revenue disbursement on the economies, distributing resources to the economies might increase emissions and, consequently, compromise	Please revise as appropriate	We have now ensured that the interpretation of bias is applied more consistently and that the main limitations in are all listed and clearly explained. In addition, a specific QA/QC effort was undertaken on the axs/ams sensitivity point mentioned here.

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	the achievement of IMO's reduction targets. It is not clear that the total decarbonization of the rest of the economy will take place in the short and medium term, so we would advise against underestimating the size of this bias; (iii) underestimation of GHG emissions (2) - lack of modal substitution: the elasticities of substitution between transport modes are not included in the modelling, meaning that the analysis might be underestimating the global emissions as a result of the measures' implementation; (iv) assumptions affecting results: Due to the time constraints, there was no time to perform sensitivity analysis on other modelling choices. The choice of 50% axs and ams has underestimated the negative results on trade. Simulation exercises we had access to show that shocking only "axs" would increase the negative effects of trade. Shocking only axs (as well as shocking ptrans, with a maritime shifter), which would be more suitable for the policies at hand, would likely generate more negative results; (v) no revenue distribution is the flexibility mechanisms scenarios: UNCTAD should point out that, despite generating revenues (which were calculated by DNV), there was no scenario with revenue distribution of flexibility mechanisms; (vi) aggregation biases: The aggregation of countries and, especially, sectors. We request that these limitations be clearly stated in the report as they greatly impact the results. There are many simplifications of assumptions that needed to be made to aggregate all the economy in 11 sectors.		

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57	Integration of different data sources: It is not clear how different data sources (DNV, MDST and Marine Benchmark) were integrated. In other words: (i) were the shipping time and distance of each individual trade flow voyage, derived from Marine Benchmark data, summed up, by vessel type, in order to verify if they were compatible with the total shipping time and distance estimated by DNV? Please provide this comparison; (ii) In the same way, was MDST's trade flow data summed up by mode of appearance (MoA) and compared to DNV and Marine Benchmark totals by ship type?; (iii) How was the cost data transformed into 15 GTAP sectors and 112 GTAP economies if it was calculated, in the previous step (derived from DNV+MDST combined), to 11 sectors and 19 regions? These steps (among others described in the technical questions section below) need detailed clarification.	Please provide additional information	Additional data and detail on the methodology used have now been added as reflected in the final report.
58	1.Data transparency: 1.a. MDST international trade data transparency: Despite Comtrade not providing the same level of data detail, it is necessary to provide MDST's data validation. As MDST is not the usual/public database utilized regarding international trade, it is necessary to provide MDST's summary descriptive statistics (mean, sum, variance) by commodity, ship type and origin / destination. This is a very sensitive point in the study.	Please provide additional information	We have asked MDST to provide additional information on this aspect. We will share when it is made available to us. In the meantime, for more background about the WCD, you may wish to note the following: The WCD has data on global containerized cargo from 1996 to the present for about 250 countries and territories which can be grouped into regions and sub regions. The country-to-country flows can be grouped into trade lanes, i.e. routes based on clusters of regions, which are connected by the usual service patterns of the majority of shipping services. WCD provides data for both directions on 27 trade lanes.

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			The WCD is generated by gathering quarterly trade data (tonnes) from most of the major economies of the world (each EU28 country separately, United States, Canada, China, Republic of Korea, Japan, Taiwan Province of China, Norway, Switzerland, South Africa, Hong Kong, China, Brazil, Argentina, Chile, Indonesia, Australia, Mexico, Philippines, Russian Federation, Türkiye, Thailand and India). This covers over 95% of unitized world trade (i.e. to or from one of these countries). For trade between other countries, data from the UN is used, increasing the global coverage of unitized world trade to 99.9%. The WCD tonnage data is translated into unitized tons and then into loaded maritime TEU using various lookup tables based on commodity, volume and the origin and destination countries. For 'backhaul' trades, the propensity of certain commodities to travel in containers is increased. The WCD provides data for SITC (Standard International Trade Classification) for 2-digit level with the possibility to drill down to the 5-digit level. Estimated containerized demand is produced for over 3,000 commodities for 250 countries' imports and exports. This information is available in TEU & Tons. The WCD provides quarterly forecasts for any period up to 2040.
59	1.b. Share of the maritime logistics costs in the CIF price: (i) What is the source to the CIF and FOB maritime value by country used to calculate the figures in Table 9?	Please clarify as appropriate	Information has been added the clarify the methodology as reflected in the final report.

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	(ii) It is not clear whether the share of maritime logistics costs in the CIF price (Table 9) was calculated using GTAP 2017 data and applied to DNV 2023 and MDST 2022 (corrected to 2023) data. (iii) Also, it is not clear if the mentioned shares are the same to all bilateral economy pairs, varying only by product group. (iv) Additionally, since maritime FOB and CIF prices in GTAP are derived from maritime cost margins (vtwr), it is possible to infer that they are based on fractional shares of the transport margin attributable to the water shipping mode. These points are very sensitive in the study and need clarification.		
60	Shipping time and maritime costs' shares: The maritime transport costs' share and shipping time costs share to maritime logistics costs are, approximately, 30% and 70%, respectively (Table 5). Concerning Table 5, it is necessary to explain: (i) How these shares were estimated? Which was the data utilized to estimate them? (ii) what is the source of maritime costs in Table 5? Were they calculated by Unctad based on DNV data? (iii) why is the shipping time share so high? At such a level the results underestimate their final impact on maritime logistics costs, and, consequently, underestimate the impacts on states. This assumption is very sensitive and needs clarification and data validation. Therefore, it is necessary to perform a	Please clarify as appropriate	(i) The aggregate shares of shipping time costs and maritime transport costs were calculated by dividing both the weighted average of maritime transport costs and shipping time costs by maritime logistics costs. The volume of goods transported over each of the routes is used as the weighting factor to do the aggregation on a global level. The data utilized to calculate these components of maritime logistics costs are maritime transport costs data and shipping time data compiled and calculated by MDST based on the output of DNV data and combined with AIS ship voyage data from Marine Benchmark. MDST database (World Cargo Database) provides maritime transport between 234 origin and destination economies globally and 11 EORA commodity sectors (resulting in 234x234x11 data points for maritime transport costs and shipping time for each scenario). (ii) UNCTAD calculated maritime logistics costs based on the work done by MDST which used DNV cost intensity

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	sensitivity analysis concerning these shares, e.g. considering 50% share to maritime costs and 50% share to ship time cost on maritime logistics costs.		data as input, as explained in the methodology section. (iii) the shares of shipping time costs in the maritime logistics costs are varied across origin, commodity, EORA sector globally. The time costs are calculated by multiplying the value of the time of a given commodity (USD/ton.hour) with their travel time for a given origin and destination pair. Hence, time costs are linearly correlated with the travel time associated with origin, and destination for a specific commodity. In our analysis based on MDST data, many shipments of goods with high volume take place between distant countries which result in high travel time. The other factor which contributes to the calculation of time costs is value of time which varies across commodities. Commodity which is sensitive to time such as electrical and machinery product and food and beverage typically have higher value of time. We have added an explanation on how the value of time is estimated in the report. Furthermore, the estimation result for the VoTs has been validated and verified using different steps. First, we compared the estimated VoTs with literature and second, we consulted an expert in freight transport modelling to verify our results. Both processes verified that the estimated values of time are well within the range for VoT of maritime transport as reported in the literature: Binsuwadan, J., De Jong, G., Batley, R. et al. The value of travel time savings in freight transport: a meta-analysis. Transportation 49, 1183–1209 (2022). https://link.springer.com/article/10.1007/s11116-021-10207-2 Given the time constraint, it was not possible to carry out the simulations using a different share for maritime time costs. Nevertheless, in our view, the validation process provides a sufficient indication of the reliability to the calculation results.

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61	1. Transparency of the shock: (i) It is possible to use the GTAP's maritime transport margin variable (PTRANS) to apply the shock through creating a slack variable (instead of exogenizing PTRANS) which enables the maritime logistics costs changes, considering the technological advancements in the shipping sector. Most of the papers in this incipient literature use the strategy to give a shock on maritime transport cost (see Lee et al., 2013; Avetisyan, 2018; CE Delft 2021; Pereda et al, 2023). (ii) Moreover, there is no argument for the choice of distribution of 50% of the shock between exporters (axs or txs) and importers (ams or tms). As we've mentioned in item (v) of this summary, simulations show that combining the shock reduces the effects on trade, while the most plausible assumption would be to shock axs, or txs (or ptrans). Therefore, we would really want to test how this affected the results by proposing two sensitivity analysis: (a) attributing 100% of the shock to exports (axs); and, (b) attributing 100% of the shock to maritime transport cost (using a slack variable, such as mentioned above). This could be performed for scenarios 21 and/or 22, for example. This is a very sensitive assumption in the study and, therefore, needs to count on sensitivity analysis. (iii) Additionally, we would like to understand whether the shock magnitude was calculated by applying the (maritime cost/FOB export price) share * FOB export price or (maritime cost/FOB export price) share * maritime cost? Or yet another option?	Please clarify as appropriate	Specifically, on (i), the method development considered the use of PTRANS and discusses the justification for not using this in this instance even considering the existing literature on (ii) we have now undertaken sensitivity analysis on this question of distribution of shock and included a description of this as a further QA/QC step undertaken (iii) we have added more detail in the final report,

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62	Illustration of the results: One of the advantages of using GTAP is to be able to look at the impacts by country in maps. Please include maps with the main impacts of the scenarios, such as those presented in former documents submitted by UNCTAD (see an example below). Being able to examine the spatial distribution of the impacts is crucial to understand the heterogeneity of the results. Figure 5 of the "Comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures - Task 3: ASSESSMENT OF IMPACTS ON STATES - Step-1 Modelling: Preliminary Results – UNCTAD - 7 May 2024"	Please provide additional information	We agree that maps can be helpful, but they are also divisive given they include definitions of countries' borders that are not always agreed. In this instance and tight timescale, we have not been able to produce something that would be robust and politically acceptable. With more time, we could explore this option further. In the meantime, the annex of per country results and online tools make it easy for readers of this report to produce their own maps independently.
63	Food insecurity: The GTAP model provides output for prices by country and sector. To understand the impacts on food insecurity, we advise UNCTAD to report changes in prices for the "Food and Beverages" sector. This should include domestic prices, import prices, and export prices for each country. Visualizing these results on a map would help illustrate the spatial distribution of the impacts.	Please provide additional information	We have added content relating to food security to improve the understanding as reflected in the final report.
64	Page 14: The Costs Workstream uses the data on maritime transport costs, shipping time and transport work compiled under Task 2 and combines them with Marine Benchmark data on individual vessel voyages and MDS Transmodal data on bilateral merchandise trade. The aim was to compile mean maritime transport costs and shipping time per ton of traded goods, differentiated by commodity group and pair of trading partners. Data validation: 1) It is necessary to provide descriptive statistics (mean, sum, variance) of time and distance provided by DNV compared to time and distance provided by Marine Benchmark by commodity type, ship type, origin and destination.	Please provide additional information	Marine Benchmark data can be aggregated by vessel type or trade. For smaller tankers and bulkers, some verification on the intake needed to be considered. The captains are very individual in how they update the draft information, and Marine Benchmark has an extensive verification and correction process related to the draft. However, so far, not for the smaller tankers and bulkers.

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	2) It is necessary to provide the total sum of shipping time of individual trade flow voyage, by ship type, derived from Marine Benchmark data and the total shipping time by vessel type estimated by DNV. 3) It is necessary to provide the total sum of shipping distance of individual trade flow voyages, by ship type, derived from Marine Benchmark data and the total shipping distance by vessel type estimated by DNV (variable A in equation 4).		
65	Page 15: Data on transport costs per distance (in nautical miles), time (in hours) and by vessel type are generated by DNV under Task 2. These data are combined with data on vessel traffic as well as data on volume and value of international merchandise trade to simulate both average maritime transport costs measured in dollars per unit of cargo carried and average shipping times measured in mean time in hours at sea. Data Validation: 1) Please provide descriptive statistics (mean, sum, variance) of the following variables: (i) transport costs per distance and (ii) time, both by vessel and commodity type. WCD provides a comprehensive origin-destination matrix in which commodities are classified according to their characteristics and the volumes moved between countries. These estimates have been calibrated against independent sources providing data on container movements. It is worth noting that the UN Comtrade does not provide the same level of detail compared to the WCD. Data Validation:	Please provide additional information	Marine Benchmark indicated that it would be very interesting to compare and correlate the DNV data and MB data. Having DNV data and MB data down to route time, distance, speed and e.g. AER values could be a way of performing a relevant comparison. As regards MDST data, we are currently in discussion with them to see whether and if so, what kind of additional data and information they could provide without infringing on the confidentiality clause. In the meantime, for more background about the WCD, you may wish to note the following: The WCD has data on global containerized cargo from 1996 to the present for about 250 countries and territories which can be grouped into regions and sub regions. The country-to-country flows can be grouped into trade lanes, i.e. routes based on clusters of regions, which are connected by the usual service patterns of the majority of shipping services. WCD provides data for both directions on 27 trade lanes.

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	1) Even if Comtrade does not provide the same level of data detail, it is necessary to provide MDST's data validation. Please provide MDST's international trade volume and values descriptive statistics by commodity, ship type and origin / destination.		The WCD is generated by gathering quarterly trade data (tonnes) from most of the major economies of the world (each EU28 country separately, United States, Canada, China, Republic of Korea, Japan, Taiwan Province of China, Norway, Switzerland, South Africa, Hong Kong, China, Brazil, Argentina, Chile, Indonesia, Australia, Mexico, Philippines, Russian Federation, Türkiye, Thailand and India). This covers over 95% of unitized world trade (i.e. to or from one of these countries). For trade between other countries, data from the UN is used, increasing the global coverage of unitized world trade to 99.9%. The WCD tonnage data is translated into unitized tonnes and then into loaded maritime TEU using various lookup tables based on commodity, volume and the origin and destination countries. For 'backhaul' trades, the propensity of certain commodities to travel in containers is increased. The WCD provides data for SITC (Standard International Trade Classification) for 2-digit level with the possibility to drill down to the 5-digit level. Estimated containerized demand is produced for over 3,000 commodities for 250 countries' imports and exports. This information is available in both TEU & Tons. The WCD provides quarterly forecasts for any period up to 2040.
66	Page 17: The average costs per nautical mile of the distance-dependent components in fleet segment i is calculated by dividing the sum of fuel costs, captured deposit expenditure and carbon regulatory expenses by the	Relates to providing data	We have asked MDST to provide more information on this aspect. We will share when it is made available to us.

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	total transport distance (A) of vessels in the fleet segment i according to the DNV data. Data Validation: 1) It is needed to provide validation between the variable A from DNV, with the total distance derived from all trade flow voyages summed up, derived from the Marine Benchmark. Secondly, as international merchandise trade recorded in WCD is subdivided by mode of appearance (MoA), depending on cargo type, differentiating between containers, dry bulk, liquid bulk, gas tankers and vehicle carriers, each MoA can be linked with certain ship types identified in the DNV dataset. Data Validation: 1) It is necessary to validate WCD data. Please provide descriptive statistics of international merchandise trade by MoA and cargo type in the initial year. The product groups that were initially coded according to SITC, are converted into 11 commodity groups associated with the 11 sectors used in the model for the simulation in the Macro-economic Workstream, maintaining their differentiation by MoA, to allow for the fact that a given good/commodity can travel by different MoA. Data Validation: 1) It is necessary to validate WCD data. Please provide descriptive statistics of the trade data by 11 commodity groups discriminated by MoA in the initial year.		
67	Page 24: With this approach, we effectively shock the maritime cost component of the CIF-FOB margin. An extensive sensitivity analysis, largely discussed at the	Please provide additional information	Specific details have now been added in a new QA/QC section as reflected in the final report.

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	annual scientific GTAP conference in June 2024, has been carried out to support this approach. Data Validation: 1) This is a very sensitive assumption in the modelling. In this sense, it is necessary to provide the sensitive analysis performed and mentioned in the sentence above.		
68	For example, a levy that increases maritime logistics costs by 2 per cent, when the share of maritime logistics costs for a particular economy pair and product is 10 per cent, would be simulated by a shock of txs and tms by 0.1 per cent respectively. 2) The distribution of 50% of the shock between exporters (txs) and importers is arbitrary and needs to be validated. Moreover, this assumption harms countries that are essentially exporters or essentially importers, in the sense that it underestimates the negative impacts. Therefore, it is necessary to perform two sensitivity scenarios: (i) attributing 100% of the shock to exports (axs); and, (ii) attributing 100% of the shock to imports (ams); using, for instance, scenarios 21 and/or 22.	Please provide additional information	Specific details have now been added in a new QA/QC section as reflected in the final report.
69	Page 27: Table 5. Relative impact on global maritime logistics costs and their two components. Data Validation: In table 5, the maritime transport costs share and shipping time costs share to maritime logistics costs are, approximately, 30% and 70% respectively. These shares are a very sensitive and idiosyncratic assumption and need	Please provide additional information	Please see answer provided relating to the source of data, process to calculate time costs, and to validate the estimation of value of time. Unfortunately, a sensitivity study on this parameter has not been possible given the time constraint.

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	validation. Please provide data validation of these shares. Sensitivity analysis: we'd like to ask for a sensitivity analysis using 50% shipping time cost share and 50% maritime cost share.		
70	Page 13: The modelled impacts on maritime logistics costs and generated revenues – and likewise the impacts on emissions, modelled in Task 2 – therefore represent the direct impacts we expect from the implementation of the different policy combinations (first-round effects), abstracting from any attempts by market actors to adjust their transport demand to the new cost structure and macro-economic environment. In theory, such adjustments can take place and in that case cause repercussions on maritime logistics costs, revenues generated, GHG emission levels as well as impact on States, thereby adding another layer of impacts (second-round effects). The effects on maritime logistics costs, and hence on imports, exports, real GDP and consumer prices, in the second round of effects, can be expected to be small compared to the effects in the first round. Their measurement would require a more extended modelling framework, including a re-run of Task 2 with adjusted transport demand, which is beyond the scope of the present analysis. Request: How can the study assume that the effects are small? They can be very heterogeneous by commodity and/or by country, jeopardising the attainment of IMO's GHG reduction targets. We request this limitation to be clearly stated in the report and in the executive summary.	Please clarify as appropriate	We agree that this is important to clarify. This limitation has been clearly stated in the final report and its Executive Summary.
71	Footnote 9: Other GTAP variables such as PTRANS were also considered but found less appropriate for the assessment of maritime logistics costs changes. Specifically, exogenizing PTRANS and endogenizing	Clarified	The footnote has been modified. A few supplementary inputs: In GTAP, a slack variable is typically used to break equilibrium conditions in a particular market, thus moving the model towards a partial equilibrium environment and

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	shipping productivity is unsuitable for long-term analysis because it implies technological regress in shipping, contrary to the assumption of technological advancements in the sector. Request: It is possible to use the GTAP's maritime transport margin variable (PTRANS) to apply the shock through creating a slack variable (instead of exogenizing PTRANS) which enables the maritime logistics costs changes, considering the technological advancements in the shipping sector. Please rewrite this footnote.		abstracting from overall economic (general equilibrium) feedback associated with a particular shock. The only exception to this is the CGDSLACK variable which is used to implement alternative cross-border investment mechanisms. It would be good for the Brazilian team to: (1) identify the complementary slackness condition associated with general equilibrium when a slack variable is used to shock PTRANS; (2) What happens to the market clearing condition that ensures equilibrium between global transport supply and demand, particularly maritime transport with which trade cost shocks are imposed? (3) Does this result in either an excess transport supply or demand at the global level? (4) If the global transport supply and demand equilibrium are inactive, then how did the team address the resulting leakage in the system? (5) What is the corresponding impact of this slack PTRANS variable on the total income and total expenditure of each regional household? (6) Is the equality between global investment and saving maintained?
72	Whilst some of the variations in maritime logistics costs come from variations in shipping time, the maritime transport costs (a product of the capital and operating/energy costs of the ships/fleet) are the main drivers of variations in total maritime logistics costs. Request: According to the figures shown in Table 5 (page 27), the main driver of variations in maritime logistics costs are the shipping time costs, which amounts to, approximately, 70% of total maritime logistics costs. Please rewrite this sentence.	Please clarify as appropriate	The writing remains as stated. The weighting difference 70-30 does not explain the contribution to variability, this also comes from the variability of each of the two components which does indeed vary more and explain the overall changes in maritime logistics costs, as per drafted language.
73	Modelling only the maritime transport mode/not accounting for potential modal shift	Please clarify as appropriate	This limitation is clearly stated in the Executive Summary contained in the final report.

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	Request: Since the study does not include modal shift elasticities, it does not account for potential carbon leakages for air or land transport modes. We request this limitation to be clearly stated in the report and in the executive summary.		
74	Not including secondary impacts on emissions from international shipping In the scenarios where the reduction in the volume of trade is greater, the emissions would likely see a stronger feedback effect that is reduced by a greater amount. This means that to achieve the IMO's GHG reduction targets, a less stringent package of policy measures (e.g. lower GFI stringency, or lower GHG price) would be needed, which in turn should result in lower impacts on States. This limitation has the effect of making the results of the analysis in this report conservative – not including this, if anything the estimated impacts are likely to be higher than if it had been included. Request: This affirmation is not accurate because DNV has projected maritime costs (in 2030, 2040 and 2050) in order to reach IMO's GHG reduction targets. In this sense, the derived reduction in emissions is exactly the expected consequence of the basket of measures included in each scenario. Therefore, it is not correct to speculate that a less stringent basket of measures will suffice to achieve the IMO's GHG reduction targets, or even, that the results in Unctad's final report are conservative. So, we request the removal of this paragraph in page 60.	Please clarify as appropriate	The cost intensity presented in DNV's report is an output of their modelling. As their results show, it is affected by the specification of the demand scenario and higher demand increases the transport cost (ceteris paribus). The logic in the limitation is consistent with the Task 2 method and findings.
75	One reference to guide this model decision is that governments have committed to the Paris Agreement, which requires significant carbon intensity reductions	Please revise as appropriate	Additional qualification has been added to the limitations section to acknowledge that the Paris Agreement's objectives are not guaranteed.

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	across all sectors by 2050. Using that guidance, rather than projecting each sector's respective rate of carbon intensity reduction, the approach taken is to assume that all sectors will decarbonize over the period of this impact analysis. The uncertainty of how different sectors' carbon intensities might evolve over time makes it hard to categorically assign this as a conservative or optimistic limitation. But with the assumption that all sectors' emissions will be significantly reducing over the period to 2050, the secondary impacts on emissions from the wider economy can also be expected not to be significant. Request: The statements in this paragraph are biased once the assumption that "all sectors will decarbonize over the period of the impact analysis" is too strong. Consequently, it is not possible to assume that "the secondary impacts on emissions from the wider economy can also be expected not to be significant." Therefore, we request the removal of this paragraph in page 60.		
76	Aggregating remaining revenues and distributing them to households Request: This limitation needs to specify that the revenues disbursement will represent an increase in spending, which stimulates and creates positive impacts on the economy, therefore, increasing GHG emissions. It is important to clearly postulate that in the scenarios with revenue disbursement: (i) probably the emissions will be higher in comparison to the IMO's GHG reduction targets; and, (ii) there will probably occur carbon leakage to other transport sectors. We request the addition of both important limitations in the above topic in page 60 and also in the executive summary.	Please revise as appropriate	We agree that these are important clarifications. The limitations relating to revenue disbursement have been expanded upon as reflected in the final report.

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77	Therefore, this limitation is likely to be optimistic, other variants of the assumption/decision would reduce the benefits and therefore reduce positive impacts of disbursement of revenues into economies. Request: The affirmation that the above limitation in page 61 is likely to be optimistic is biased once it is not possible to clearly state that other variants of the assumption would reduce the benefits of revenue disbursement. Moreover, it is necessary to state that any positive impact of revenue disbursement will increase GHG emissions, therefore compromising the achievement of IMO's reduction targets. We request the removal of this sentence in page 61.	Please revise as appropriate	See the revised text under the section on Limitations as reflected in the final report.
78	However, this also means that the modelling does not prejudge or presume any specific revenue uses and leaves specification of revenue use to IMO's further work and decision making. Request: But if IMO is going to specify different/specific sectors of revenue use after the final version of UNCTAD's estimations, the impact on States of specific revenue uses will not have been modelled. In this case, the study will not support IMO's decision making process as established. Therefore, we request the removal of this sentence in page 61.	Please clarify as appropriate	In accordance with the TORs as well as the additional guidance received from the moderator and the SC members, we have ensured that the findings are as agnostic as possible about the specifics of revenue distribution. We have expanded on the limitations associated with the way revenues are distributed. As discussed in SC 10, there is no constraint on further analysis being done over a longer time period, which we have specified could include more precise modelling of how revenues are disbursed.
79	6.5.1. Geographic remoteness of and connectivity to main markets Impact Summary: Geographic remoteness and connectivity to main markets have not been explicitly analysed. However, countries that are most strongly impacted by increases in maritime logistics costs, are the structurally vulnerable economies of the LDC grouping. For economies where remoteness and poor transport connectivity are significant factors that contribute in causing the negative	Please revise as appropriate	This text has been revised. After further reflection, we considered that the assessment of the degree of structural vulnerability was beyond the scope of the report and did not add any significant value to the analysis. Therefore, this characterization was dropped from the sentence.

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	impacts, revenue distribution targeting these economies can mitigate some of those impacts. Request: Despite factors such as the geographic remoteness and connectivity to main markets not having been explicitly analysed in the study, since the main focus of the study is maritime transportation of goods, it would be more adequate to present the results using a geographic criterion to aggregate the economies such as North America, South America, Europe, East Asia, Africa, etc. The geographic criterion considers the connectivity issues to main markets in a more appropriate way than the aggregation in developed, developing and LDCs. Therefore, we understand that it is not possible to state the affirmation above, once it derives from the countries' aggregation criteria utilized. We request the removal of the following in page 61: "However, countries that are most strongly impacted by increases in maritime logistics costs, are the structurally vulnerable economies of the LDC grouping. For economies where remoteness and poor transport connectivity are significant factors that contribute in causing the negative impacts, revenue distribution targeting these economies can mitigate some of those impacts."		
80	Transport dependency Impact Summary: The results suggest that more maritime-transport dependent economies can be more impacted by increases in maritime logistics costs. However, this relationship is not universal. Where transport dependency is a significant contributor that may drive impacts (whether positive or negative), scenarios with revenue distribution	Please revise as appropriate	Given the extent of analysis done, additional drafting was made to clarify that there was no conclusive relationship derived on this.

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	targeting these maritime transport dependent economies, can mitigate some of those impacts. Request: As mentioned in subsection 6.5.1, geographic remoteness and connectivity to main markets have not been explicitly analysed in the study. Therefore, it is not clear that the relationship between more maritime-transport dependent economies and higher impacts is not universal. In this sense, we request the removal of the sentence "However, this relationship is not universal."		
81	6.5.8. Socio-economic progress and development The analysis in the present report indicates that the level of development of economies broadly indicates susceptibility to negative impacts, with LDC economies being the most negatively affected. Request: The countries aggregation in developed, developing and LDCs countries (not including SIDs in this comment) lump together very different economies, especially in developing and LDCs, under very different economic conditions, maritime transport dependency, geographic remoteness and connectivity to main markets. These different conditions get all mixed up in the level of aggregation utilized. As the main driver of the study is maritime transport, it would be preferable to aggregate the economies using a geographic criterion such as North America, South America, Europe, East Asia, Africa, etc. Therefore, we understand that it is not possible to state the affirmation above, once it derives from the countries' aggregation criteria (developed, developing, SIDs and LDCs) utilized. We request the removal of the entire 6.5.8 subtopic in page 62.	Please provide additional information	We agree that some aggregation into different groupings e.g. continental would have been interesting, though we have not been able to do this in the time available. It is still possible to derive information from the groupings as they represent aggregations of countries at different income levels.

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82	Page 12: "The transport costs and shipping times are differentiated by vessel type and vessel age as simulated by DNV under Task 2. In its analysis, UNCTAD assigns these maritime transport costs and shipping times to individual vessel voyages and identifies the segment of international trade served by these vessel voyages. The transport costs and shipping times are aggregated up to the level of bilateral trade flows and to the level of the commodity groups associated with the 11 economic sectors used in the GTAP simulation." 1) It is not clear whether the study considered shipping times and distances for each individual vessel voyage from the DNV report or Marine Benchmark data. How did you estimate the time spent and distance travelled in each vessel voyage between origin and destination? Using which data source? Please clarify as appropriate.	Please provide additional information	We have asked MDST to provide more information on this point. We will share as soon as the information is made available to us.
83	As mentioned above, transport work is kept constant across scenarios in the present assessment. 1) As total maritime logistics costs change depending on the scenario being analysed, how is transport work (meaning cost per mile-tonne) kept constant across scenarios?	Please clarify as appropriate	This is in the context of the link between Task 2 and Task 3, there are changes to demand that occur within Task 3
84	This workstream also uses the results of simulation of the impact on real GDP without revenue disbursement which was previously generated under the Macro-economic Workstream. The use of these results was required to determine how revenues will be allocated across targeted beneficiary country groupings taking into account the Level 1 and 2 revenue disbursement criteria outlined in Section	Please provide Excel on revenue distribution	The relevant data will be submitted as an Excel file.

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	2.2 of this report and using as input the data on total accumulated revenues generated under Task 2, and the impact on real GDP without revenue disbursement to calculate revenue disbursement per country. These calculations are carried out outside of GTAP and their results are passed over to the Macro-economic Workstream so that the effects on economies after disbursement of revenues can be modelled in GTAP. 1) Please provide the calculations carried out using GTAP in an Excel file		
85	The Costs Workstream uses the data on maritime transport costs, shipping time and transport work compiled under Task 2 and combines them with Marine Benchmark data on individual vessel voyages and MDS Transmodal data on bilateral merchandise trade. The aim was to compile mean maritime transport costs and shipping time per ton of traded goods, differentiated by commodity group and pair of trading partners. 2) If Marine Benchmark data is utilized to estimate the distance and time characteristic of each bilateral trade flow voyage by vessel type, was this data validated in relation to shipping time and total distance (variable A in equation 4) compiled under Task 2? Please provide this validation. 3) If Marine Benchmark data is utilized to estimate the time and distance of each bilateral trade flow voyage, what were the variables shipping time and total distance, compiled under Task 2, used for?	Please clarify as appropriate	Most of these actions were made successfully under Task 4. It would be time consuming to use the same process for the global trade. Marine Benchmark has no information on how DNV compiled their data under Task 2, though distance and speed are calculated on actual voyages tracked via 10 minutes AIS sampling has been proven accurate in the cases used in Task 4.
86	WCD provides a comprehensive origin-destination matrix in which commodities are classified according to their characteristics and the volumes moved between countries. These estimates have been calibrated against independent	Please clarify as appropriate	We have asked MDST to provide more information on this aspect. We will share when it is made available to us. In the meantime, and in addition to the WCD, you may wish to note the following regarding the MDST Containership

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	sources providing data on container movements. It is worth noting that the UN Comtrade does not provide the same level of detail compared to the WCD. 1) Is WCD data available by country or by 19 subregions? If it is available by country, how many countries are covered in WCD data? 2) Does WCD data also presents the value of the commodities moved between countries? 3) The calibration mentioned needs to be shown. Please provide it. MDS Transmodal's Global Containership Database (GCD) records the deployment of all container ships, operators, port calls, distances covered and ship parameters. Is GCD data available by country or by 19 subregions? If it is available by country, how many countries are covered in WCD data?		Databank. The latter contains operational details of the world container carrying fleet and 30 fields of information for every vessel, including operator, service, route, TEU, service frequency, port rotation and much more. The service deployment of individual vessels in the fleet frequently changes. The Containership Databank, in its current format, has been produced since 2006.
87	In the case of bulk cargo, traffic designated as non-containerized within WCD on a country-by-country basis is linked to all those non-unit-load ships transporting merchandise between the same countries. Goods are allocated to different size classes of ships proportionally to their overall capacity. Traffic between landlocked economies is assigned to ships sailing from adjacent seaboard locations. In this way, a hypothetical cargo can be associated with each vessel movement and thereby costed out. 7) Why is it necessary to link bulk cargo to non-unit-load ships considering their sizes and overall capacity? In our understanding WCD data is originally broken down by product group volume, MoA and origin-destination matrix. Please clarify as appropriate.	Please clarify as appropriate	We have asked MDST to share more information on this aspect. We will share when it is made available to us. In the meantime, and in addition to the WCD, you may wish to note the following regarding the MDST Containership Databank. The latter contains operational details of the world container carrying fleet and 30 fields of information for every vessel, including operator, service, route, TEU, service frequency, port rotation and much more. The service deployment of individual vessels in the fleet frequently changes. The Containership Databank, in its current format, has been produced since 2006.

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88	In the case of unitised traffic, given that traffic is often loaded onto ships in other and adjacent countries (e.g. from the United States to Switzerland through ports in the Kingdom of the Netherlands (the Kingdom of), Belgium, France or Germany), cargo is consolidated into 'sub-regions' and liner services modelled based on the capacity supplied in twenty-foot equivalent unit (TEU) between each sub-region. The cost of each individual service is modelled and containerised cargo allocated proportionally to the capacity available. 1) What were the assumptions utilized to consolidate the unitised traffic (that is, the containerised cargo) into sub-regions? 2) What were the assumptions utilized to allocate containerised cargo proportionally to the capacity available? Why was it necessary to do this calculation if, according to page 15, the GCD database provides information for each leg of the journey?	Please clarify as appropriate	We have asked MDST to provide more information on this aspect. We will share when it is made available to us. In the meantime, and in addition to the WCD, you may wish to note the following regarding the MDST Containership Databank. The latter contains operational details of the world container carrying fleet and 30 fields of information for every vessel, including operator, service, route, TEU, service frequency, port rotation and much more. The service deployment of individual vessels in the fleet frequently changes. The Containership Databank, in its current format, has been produced since 2006.
89	The average costs per hour of the time-dependent components within the fleet segment i is calculated by dividing the sum of annualized capital and annual operational expenditure in that segment by the number of ships (N) and by the number of hours in a year: equation (3) 3) Does "fleet segment i" mean vessel type? 4) Is the average cost per hour calculated based solely on DNV data? If so, can we then understand that an average cost per hour per vessel type is allocated to pairs of trading partners (from MDST data) considering the most frequent vessel type utilized to transport the respective commodity?	Please clarify as appropriate	We have asked MDST to provide more information on this aspect. We will share when it is made available to us. In the meantime, and in addition to the WCD, you may wish to note the following regarding the MDST Containership Databank. The latter contains operational details of the world container carrying fleet and 30 fields of information for every vessel, including operator, service, route, TEU, service frequency, port rotation and much more. The service deployment of individual vessels in the fleet frequently changes. The Containership Databank, in its current format, has been produced since 2006.

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	Does the procedure combine DNV data and MDST data through the vessel type?		
90	The average costs per nautical mile of the distance-dependent components in fleet segment i is calculated by dividing the sum of fuel costs, captured deposit expenditure and carbon regulatory expenses by the total transport distance (A) of vessels in the fleet segment i according to the DNV data. 1) Is the total transport distance (A) derived from DNV data? If so, Please clarify as appropriate if the total transport distance calculated by DNV is compatible with the sum of each trade flow distance between the origin and destination country, in each fleet segment i, derived from Marine Benchmark data.	Please clarify as appropriate	Origin, destination, voyage distance and speed are available in the Marine Benchmark data set. It has been successfully used in task 4 stakeholder analysis where more or less every single voyage on the measured routes were identified. What Marine Benchmark has declared as experimental data is the intake on each leg. It is only verified and corrected for larger tonnage in tankers and bulk. Container is verified to be of accurate quality. Marine Benchmark estimates the net difference in each port based on draft on each voyage. For container vessels discharging and loading in each port, require another methodology.
91	These two cost components are linked to the observed ship movements from the exporting economy (o) to the importing economy (d), specifically to the total shipping time (T) and the total transport distance. They are added up to obtain the total annual cost of maritime transport costs from o to d per ship segment: 2) In other words, how was the total shipping time provided by DNV linked to each time ship movement between origin (o) and destination (d) or using Marine Benchmark data? In our understanding, it is necessary to multiply the average cost per hour of the time-dependent components (capex + opex) within the fleet segment i, by the time actually spent in each ship movement between origin (o) and destination (d). How did you do that?	Please clarify as appropriate	Origin, destination, voyage distance and speed are available in the Marine Benchmark data set. It has been successfully used in task 4 stakeholder analysis where more or less every single voyage on the measured routes were identified. What Marine Benchmark has declared as experimental data is the intake on each leg. It is only verified and corrected for larger tonnage in tankers and bulk. Container is verified to be of accurate quality. Marine Benchmark estimates the net difference in each port based on draft on each voyage. For container vessels discharging and loading in each port, require another methodology.
92	Furthermore, the countries in WCD are grouped into 19 subregions to address the specific conditions of landlocked	Please clarify as appropriate	We have asked MDST to provide additional information on this aspect. We will share when it is made available to us.

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	economies and the fact that neighbouring economies often use each other's ports. 3) If countries are grouped in only 19 subregions in WCD data, how did you analyse each ship movement between each pair of origin and destination country? Did you utilize an average distance and average time between the 19 subregions? 4) How did you allocate the WCD data which is discriminated in only 19 subregions into GTAP's 112 countries? What were the assumptions to do that?		
93	The product groups that were initially coded according to SITC, are converted into 11 commodity groups associated with the 11 sectors used in the model for the simulation in the Macro-economic Workstream, maintaining their differentiation by MoA, to allow for the fact that a given good/commodity can travel by different MoA. 5) How did you allocate the WCD data which is discriminated in only 11 commodity groups into GTAP's 32 sectors? What were the assumptions to do that?	Please clarify as appropriate	The text has been revised to improve clarity as reflected in the final report.
94	Correction factors are applied to adjust the data for the fact that not all container ships are represented in the MDST database as maritime transport is imperfectly covered and not all international trade is maritime. 6) What kind of correction factors? How was this correction applied? What were the assumptions used? Please detail. 7) What proportion of the maritime international trade is not covered by MDST?	Please clarify as appropriate	We have asked MDST to provide additional information. We will share these when made available to us. In the meantime, for more background about the WCD, you may wish to note the following: The WCD has data on global containerized cargo from 1996 to the present for about 250 countries and territories which can be grouped into regions and sub regions. The country-to-country flows can be grouped into trade lanes, i.e. routes based on clusters of regions, which are connected by the usual service patterns of the majority of

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			shipping services. WCD provides data for both directions on 27 trade lanes. The WCD is generated by gathering quarterly trade data (tonnes) from most of the major economies of the world (each EU28 country separately, United States, Canada, China, Netherlands (the Kingdom of), Japan, Taiwan Province of China, Norway, Switzerland, South Africa, Hong Kong, China, Brazil, Argentina, Chile, Indonesia, Australia, Mexico, Philippines, Russian Federation, Türkiye, Thailand and India). This covers over 95% of unitized world trade (i.e. to or from one of these countries). For trade between other countries, data from the UN is used, increasing the global coverage of unitized world trade to 99.9%. The WCD tonnage data is translated into unitized tonnes and then into loaded maritime TEU using various lookup tables based on commodity, volume and the origin and destination countries. For 'backhaul' trades, the propensity of certain commodities to travel in containers is boosted. The WCD provides data for SITC (Standard International Trade Classification) for 2-digit level with the possibility to drill down to the 5-digit level. Estimated containerized demand is produced for over 3,000 commodities for 250 countries' imports and exports. This information is available in both TEU & Tons. The WCD provides quarterly forecasts for any period up to 2040.

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95	Using the GCD, the total container shipping capacity in TEU is estimated for any inter-regional trade and differentiated by the proportion provided by each separate service. It is assumed in this calculation that, for each rotation, capacity is used once in each direction. 1) Why was it necessary to estimate the total container shipping capacity for inter-regional trade if, according to page 15, "MDS Transmodal's Global Containership Database (GCD) records the deployment of all container ships, operators, port calls, distances covered and ship parameters. This database has the advantage of linking together the different individual legs of complex liner 'strings', so that for shipping lines offering liner service calling at various maritime regions (e.g. from Europe and the Mediterranean over the Arabian Gulf and the Indian Subcontinent and the Far East, up to North America), the database provides information for each leg of the journey."	Please clarify as appropriate	We have asked MDST to provide more information on this aspect. We will share when it is made available to us. In the meantime, and in addition to the WCD, you may wish to note the following regarding the MDST Containership Databank. The latter contains operational details of the world container carrying fleet and 30 fields of information for every vessel, including operator, service, route, TEU, service frequency, port rotation and much more. The service deployment of individual vessels in the fleet frequently changes. The Containership Databank, in its current, format has been produced since 2006.
96	All liner services are modelled based on their total rotations (e.g. China to Northern Western Europe and returning to China including typically around 10 port calls). For example, for a container shipped from Shanghai to Colombo and further from Colombo to Genova, costs will effectively be attributed once. 2) In the example given above, costs will be 50% attributed to China (Shanghai) and 50% to Italy (Genova)? Is this what you mean by "costs will effectively be attributed once"? How about Sri Lanka (Colombo)?	Please clarify as appropriate	We have asked MDST to provide more information on this aspect. We will share when it is made available to us. In the meantime, and in addition to the WCD, you may wish to note the following regarding the MDST Containership Databank. The latter contains operational details of the world container carrying fleet and 30 fields of information for every vessel, including operator, service, route, TEU, service frequency, port rotation and much more. The service deployment of individual vessels in the fleet frequently changes. The Containership Databank, in its current format, has been produced since 2006.
97	The mean cost for container services in each region-to-region movement can therefore be established by summing up the cost of each relevant service. The so derived shipping capacity is contrasted with shipping demand, in	Please clarify as appropriate	We have asked MDST to provide more information on this aspect. We will share when it is made available to us. In the meantime, and in addition to the WCD, you may wish to note the following regarding the MDST

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	terms of cargo volume, as sourced from WCD, for each service, with a ship size category attached, in the relevant market. By matching the DNV dataset, the cost of each service deployed through its ship size and sea miles can be simulated. 3) Why is it necessary to contrast shipping capacity with shipping demand, if GCD data provides information for each leg of the journey? 4) Is container cost estimated in a region-to-region level (instead of country-to-country level)? Does this mean that you have used the average distance and time in a region-to-region level (and not country-to-country level)?		Containership Databank. The latter contains operational details of the world container carrying fleet and 30 fields of information for every vessel, including operator, service, route, TEU, service frequency, port rotation and much more. The service deployment of individual vessels in the fleet frequently changes. The Containership Databank, in its current format, has been produced since 2006.
98	The costs in 2022 are calibrated to match DNV costs by vessel type reported for 2023. 5) How did you do the mentioned calibration? Based on which parameters?	Please clarify as appropriate	We have asked MDST to provide additional information on this aspect. We will share when it is made available to us.
99	Table 3 provides the VoT in dollars per ton-hour of 11 groups of commodities corresponding to the sectors used for the simulations under the Macro-economic Workstream. They have been estimated using a multinomial logit model, a specific type of discrete choice model (de Jong, 2007), run on data from the UN Comtrade database (UNCTAD, 2021). 1) Does the VoT estimated refer specifically to maritime transportation? As mentioned in page 15, UN Comtrade does not provide the same level of detail compared to the WCD, meaning that it is not an accurate data to analyse maritime transported goods. Therefore, it seems that it is possible to conclude that UN Comtrade data is not adequate to estimate the monetary value of a unit transport	Please clarify as appropriate	The text has been revised to improve clarity as reflected in the final report.

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	time (VoT) for each unit of goods transported by ships. Please clarify as appropriate.		
100	The magnitude of the shocks is calculated from the share of the maritime logistics costs in the CIF price in GTAP and the change of these costs for each bilateral economy pair and product group. 1) Does this mean that the magnitude of the shock was calculated as maritime logistics costs/CIF price * change in maritime logistics costs? Is the share of the maritime logistics costs in the CIF price in GTAP the figures presented in Table 9 (page 32)?	Please clarify as appropriate	This is explained in the methodology section of the report.
101	In this application, the underlying database is aggregated to 15 sectors and 112 GTAP economies. Most SIDS and LDCs are unfortunately not represented as single economies in GTAP but are part of a composite one. 2) How was the cost data transformed into 15 GTAP sectors and 112 GTAP economies if it was calculated, in the previous step (derived from DNV+MDST combined), to 11 sectors and 19 regions? This step needs detailed clarification.	Please clarify as appropriate	This is explained in the methodology section as reflected in the final report.
102	Page 27: However, there are some small differences between scenarios long run impacts detectable both in small differences in maritime transport costs and shipping time. In 2050, scenarios with a levy (26/31/32/46) have lower increases in maritime transport costs than scenarios without a levy (21/22/23/24/36/43). Whereas scenarios with a levy result in slightly higher shipping time costs (e.g. indicating that the levy induces small decreases in operating speeds) than the no levy scenarios. These two effects counter each other when the two components are combined to calculate changes in maritime logistics costs.	Please clarify as appropriate	An additional section has been added to the final report. It explains how the results in Task 3 are significantly explained by the Task 2 costs intensities, including the results discussed in this comment.

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	This has led to a relatively low difference in costs between levy and no-levy scenarios. 1) Firstly, it seems logical that the minimal impact in a scenario with a levy, all else being equal, would mean that the economy behaves as if there were no levy (and not that it would behave even better), in terms of cost effects (excluding revenue distribution). What we know about the effects of the levy: (i) A carbon levy is applied to the emissions of each ship and, according to calculations from various studies in the literature, for example, a levy of USD 50 per ton of CO_2 increases, on average, the global average cost of maritime transport by 17% (without considering other changes, i.e., ceteris paribus); (ii) if the levy leads to a reduction in speed, it indeed reduces fuel costs, but it increases the operational costs of ships and the cost of travel time, which ultimately leads to an increase in the final cost. In this sense, the explanation does not align with the logic of the existing literature. Please explain and rewrite.		
103	Table 5. Relative impact on global maritime logistics costs and their two components: 2) In table 5, the maritime transport costs' and shipping time costs share to maritime logistics costs are, approximately, 30% and 70% respectively. How were these shares estimated? Which was the data utilized to estimate them? These shares are a very sensitive assumption and need validation. Please provide it.	Please clarify as appropriate	See above response.
104	Page 28: Table 6. Relative impact on maritime logistics costs, by commodity, in 2050: 1) Please provide Table 6 to 2030 and 2040.	Please provide additional information	Additional tables for the impact on maritime logistics costs by commodity, in 2030, and 2040 have been generated and are included in the appendix of tables.

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105	1. Table 4 - Data and Interpretation: We believe that the equations provided by the report do not allow for an optimal understanding of the results. For example, we understand that, in Table 4, the maritime logistic cost variation is a weighted average of the variation of maritime transport cost and shipping time cost. Could you confirm that? If it is indeed a weighted average, there appears to be a discrepancy between the reported approximately 70% weight for shipping time costs in the current report versus the approximately 60% weight in the previous report. The high weight for shipping time costs substantially reduces the total variation in maritime logistics costs and, consequently, the estimated impacts. Explaining the rationale for this increase in the current version of the report is necessary.	Revise as appropriate	The discrepancy in the weight of the time costs in the current report versus the previous report reflects the different aggregation methods used in the current and the previous reports. The current report uses the weighted average to calculate maritime transport costs and time costs, whereas the previous report used a simple average for calculating transport costs and time costs across all the bilateral trades. For consistency, the final report has adopted the same approach (using weighted average) in calculating all the impact indicators.
106	2. Table 5 - Data and Interpretation: Does the data from those tables come from the weighted averages by product or simple averages (if weighted, by what variable?) Please include a total, or global average, comparable to Table 4 results. Please provide the weight of each commodity to global averages.	Revise as appropriate	Data in Table 5- relative impact on maritime logistics costs by commodity is calculated using weighted average where the sum of the total cargo volume is used as the weighting factor. This explanation has been added to the text. An additional indicator for the global average has been added to the table as reflected in the final report.
107	3. Tables 6 and 7 - Data and Interpretation: a. Are the data from those tables weighted averages by product or simple averages (if weighted, by what variable?) b. Were the data behind Tables 6 and 7 used as shocks in GTAP? If the data from those tables are inputs of the shock, more details on how they were translated to ams and axs variables are needed. From our understanding, ams and axs, the GTAP variables used for the regulatory shocks, are not available by transport mode. They are available by bilateral trade flows (origin, destination) and sectors (total trade). In this sense, some adjustments would be needed, and the report is not clear on that. Please clarify as appropriate.	Revise as appropriate	Regarding data in table 6, these are weighted averages across all bilateral trades both for maritime transport costs and time costs. The volume of trade for each bilateral trade is used as the weighting factor. This explanation has now been added in the final report. Regarding the second point (b). yes, the calculated changes in maritime logistics costs were used as inputs for specifying the shocks in GTAP.

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108	4. Table 8 - Data and Interpretation: The source and calculation method of the data presented in Table 8 need to be clarified. For instance, a. Does the table indicate that maritime transport accounts for 9.39% of total trade value in the Agriculture commodity group? i. Is this a weighted average (if yes, weighted by what variable) or a simple average? b. How does the maritime logistic cost compare to the maritime (CIF - FOB) margin? We understand that the maritime (CIF - FOB) margin does not include shipping time costs. Is this right? Would you please provide those datasets (maritime logistic cost and maritime CIF - FOB margin) by bilateral trade flow and sector for the start year in Excel spreadsheets.	Revise as appropriate	a: Yes, the value is the CIF/FOB maritime margin. A note has been added to the table as reflected in the final report. It is a weighted average. b: Maritime logistics costs are comparable with CIF-FOB margin. CIF-FOB margin represents costs of insurance and freight shipment. Cost of freight shipment typically includes the depreciation costs and interest rate which grow bigger along with the longer transit time.
109	Due to the time constraints, we believe that SC should have access to the data. Please provide the specific cost data (in USD) and maritime trade (in %) for 15 sectors vs. 112 GTAP economies (origin) vs. 112 GTAP economies (destination) for all scenarios, in an Excel file, such as the example below:	Revise as appropriate	UNCTAD will not be able to provide the requested data. The SC has been informed previously that some data provided by our external providers cannot be publicly shared (at least the raw data). The underlying intermediate data used for GTAP modelling will be shared.
110	5. GTAP Shock Data: Once the comments above are elucidated, please provide the specific shock data for all 15 sectors across 112 GTAP economies (origin and destination) for all scenarios in an Excel file. Due to the time constraints, we believe that SC should have access to data. Please provide the specific shock data, 15 sectors X 112 GTAP economies (origin) X 112 GTAP economies (destination) for all scenarios, in an Excel file, such as the example below:	Revise as appropriate	The text has been revised as reflected in the final report.
111	6. Division of the Shock (50% Export, 50% Import): This assumption seems arbitrary and may significantly distort the results, particularly for countries that are primarily	Please clarify as appropriate	Dividing the shocks into half for exports and imports is the most sensible approach since it results in a balanced analysis of winners and losers from trade cost changes.

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	exporters or importers. In this sense, we recommend a sensitivity analysis considering scenarios where 100% of the shock is borne by exporters and, alternatively, 100% of the shock is borne by importers. This sensitivity analysis could be done for one basic scenario, such as scenario 21, or scenario 22.		This also insulates the modelling results based on subjective judgements on how costs and rents are distributed between exporters and importers. Indeed, recent surveys of literature on non-tariff measures (NTMs) by Webb et al (2020) and Walmsley and Strutt (2021) suggest that exporters and importers equally benefit from trade cost changes associated with NTMs.
112	7. Explanation of United States of ams/axs instead of ptrans: We understand that most of the literature focus on a different variable, that is specific for maritime transport margin (ptrans). The way UNCTAD is shocking transport costs is applied to total trade, not to maritime trade. We strongly advise UNCTAD to present a sensitivity analysis comparing the shock on ams/axs with the shock on maritime transport cost. This sensitivity analysis can be done for one basic scenario, such as scenario 21, or scenario 22.	Please clarify as appropriate	A footnote has been added in section 4.6.1 as reflected in the final report.
113	8. External Data Transparency and Validation: a. Improve transparency by providing detailed data validation and descriptions of external data, such as the MDS Transmodal's World Cargo Database (WCD). How does it reconcile with AIS total trade data? How does it reconcile with the UNCTAD data for maritime trade, which is collected for some countries? b. Pag 13: Please explain more details about the calibration mentioned " " c. Page 13: Marine Benchmark Data Validation: Please validate the data on vessel voyages from Marine Benchmark. Could you please provide total emissions of the baseline year using these data and data from DNV to validate with the fourth IMO GHG Study.	Please clarify as appropriate	UNCTAD did not procure CO_2 emissions data from the Marine Benchmark. Marine Benchmark advised that it was not possible to align with the fourth IMO GHG. The IMO GHG4 contains old data, and not for the year of relevance i.e. 2022. Marine Benchmark estimation of global CO_2 is slightly lower than IMO's fourth GHG study. MB notes that its model is granular and accurate but does only contain the IMO fleet, and not gross estimation on smaller tonnage from each country register or other domestic vessels. This can be done, but requires another methodology with estimation on vessel group level. It is not a part of Marine Benchmark standard mythology, but available as an estimation.

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	"Data on vessel voyage from Marine Benchmark that record all voyages of the relevant non-container ships for 2022, identified by IMO vessel numbers, the distances travelled, time and speed, as well as ports of departure and arrival and whether they were laden or in ballast."		
114	9. Transport Mode Substitution: We strongly advise the inclusion of calculations on transport mode substitution. Here is a reference study on how to calculate transport mode substitution for some sectors* which might simplify its consideration within the modelling: Misak Avetisyan, M. and Hertel, T. Impacts of trade facilitation on modal choice and international trade flows. Economics of Transportation 28 (2021) 100236. The GTAP sectors with substitution from water to air estimated by this reference are: · Animal products nec, Fishing, Minerals nec, Dairy products, Food products nec, Textiles Chemical products, Metal products, Computer, electronic and optic, Machinery and equipment nec, Manufactures nec; · The elasticities average is 0.016, with the greatest elasticity coming from Machinery and equipment nec (0.031), which means that for those products a 10% increase in maritime transport cost would lead to an increase of 0.3% in transportation by air (which emits 50 times more than maritime transportation). If UNCTAD decides not to consider transport mode substitution, we would suggest that the report clearly states this limitation, such as "Transport mode substitutions are	Please clarify as appropriate	Implementing modal substitution possibilities with elasticities less than 1.0 as those identified above would not materially impact the overall results. Elasticities identified above are very inelastic (0.016 and 0.031) and close to zero, hence not significantly different from the default GTAP specification. This limitation has been indicated in the "Limitations" section.

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	not considered in the analysis, which might underestimate the global emissions as a result of the measures implementation".		
115	10. Maritime Emissions Evaluation: We strongly advise UNCTAD to recalculate maritime emissions after the impact assessment since trade will be impacted and we might have important second order effects on maritime emissions that are relevant to assessing whether the measures deliver on the achievement of the IMO emissions reduction goals. In case maritime emissions are not reassessed after the impact assessment, we advise the explicit inclusion of a caveat in a limitation section: "Maritime emissions were not assessed after the calculations of the impacts and we acknowledge that, in this sense, the final results might not necessarily be aligned to the goals of the 2030 strategy."	Please clarify as appropriate	Due to the time constraint, UNCTAD would need additional time to perform an assessment of GHG maritime emissions.
116	11. Global emissions evaluation: We strongly advise UNCTAD to calculate global emissions after the impact assessment since all economies will be impacted and we might have important second order effects on emissions that are relevant to assessing the potential occurrence of carbon leakage. By using satellite data (co2.har) and adapting the GTAP model, it is possible to calculate global emissions, even without using GTAP-E. If global emissions are not reassessed after the impact assessment, we advise the explicit inclusion of that in a limitation section: "Global emissions were not reassessed after the impact calculations, which might not capture the occurrence of carbon leakage as a result of the measures."	Please clarify as appropriate	Due to the time constraint, UNCTAD would need additional time to perform an assessment of maritime GHG emissions.
117	12. Illustrative Analysis: Would you please present illustrative analyses on key decisions, such as how translating DNV costs to CIF and FOB differences? Maybe	Please clarify as appropriate	The time constraint prevented the conduct of some additional analyses. The graphical scope provided in the report is therefore not very extensive.

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	using 2-3 illustrative general cases, with DNV, UNCTAD and GTAP data reported, would be very important for readers to understand the technical approach adopted by UNCTAD.		
118	13. Ship data to sector data: Please provide more details on how ships were allocated to sectors by bilateral trade flow. If there are time constraints, we ask you to share with the SC Excel files detailing the distribution of ships by bilateral trade flows (and sectors) used in the analysis. Find below a suggestion on how the data can be shared:	Please clarify as appropriate	The text has been revised as reflected in the final report.
119	14. Presentation of the results of the states: Please present maps for the main impacts (real GDP, consumer prices, exports and imports) and scenarios, as they allow policymakers to visualize the spatial distribution of the impacts.	Please clarify as appropriate	Due to the time constraint, the graphical scope provided in the report is not very extensive.
120	15. Include a "Limitation" subsection: highlighting the above mentioned points, such as a lack of recalculation of maritime and global emissions, transport mode substitution, and other research assumptions. a. On other research assumptions, we advise that UNCTAD acknowledge the limitations related to: · the regional aggregation which can lead to aggregation bias, where the aggregated results may not accurately reflect the impacts on individual countries or industries within those aggregates, · the sectoral aggregation (which can disguise important industry specific effects and lead to less precise results for some sectors), · the division of the maritime shock into imports and exports, · the maritime trade share estimated by GTAP;	Please clarify as appropriate	A section on limitations has been added as reflected in the final report.

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	b. GTAP model has also some limitations, such as: · Being a static model, which limits its ability to capture the time-dependent effects of policy changes or shocks. · The base year dataset is the year of 2017, so the results rely on the structure of the economy of that year, even when the model is updated by GDP, population and labour force, · Its simplified representation of technological change: technological change is typically represented as a shift in productivity parameters, which may not fully capture the complexities and dynamics of technological changes and diffusion. · Policy Simplifications: The GTAP model simplifies complex policy measures, which may lead to oversimplified representations of actual policies. For example, tariff and non-tariff barriers are often modelled in a simplified manner that may not capture all nuances of trade regulations. c. Please also reflect these limitations in the executive summary of the report.		
121	Specific Comments: SSP Scenario: Specify which SSP scenario was considered (Page 22). Variable Type: Clarify in the report whether real or nominal variables are used throughout the report. For example, specify "real GDP" every time GDP is mentioned if that is the case. Table 2 Estimation: Why didn't UNCTAD run Table 2 results using WCD data, which is the baseline data used in the report? Please better detail the multinomial logit model estimation.	Please clarify as appropriate	Comments have been addressed in the final report.

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	Revenue Disbursement: Make sure that revenue disbursement is based on "impact," not "change" (Page 19). Scenario D1: Explain why the modelling did not include a scenario considering the disbursement of D1. Equation 5 Calculation: Clarify how Equation 5 links origin and destination to each ship segment and whether it uses WCD or DNV data (Page 15). Table 4 Analysis: Explain the increase in shipping time costs to approximately 70% of total maritime logistics costs (Page 25). Exports of SIDS: Clarify why exports of SIDS increase in all scenarios and years (Page 26, Table 11). Revenue Disbursement: Explain in more details why developed and developing countries receive revenues in schemes intended for developing economies, LDCs, and SIDS (Page 32, Table 15). Impact on Imports: Address the counterintuitive results showing better impacts for developing countries without revenue disbursement (Page 33, Table 16). Impact on Exports: Explain the counterintuitive results showing worse impacts with revenue disbursement (Page 34, Table 17). Impact on GDP: Clarify why results are better for developing countries without revenue disbursement (Page 34, Table 18).		

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	By addressing these points, we aim to enhance the clarity, accuracy, and reliability of the impact assessment.		
122	"At global level, the impact of all modelled scenarios on real GDP is consistently negative, albeit small relative to both absolute GDP and projected GDP growth rate over the period modelled." We suggest avoiding the term "small" to describe these impacts. They should be expressed in dollar terms, as what might be perceived as a "small" GDP impact could be significant in absolute terms. For example, a 0.16% negative impact on global GDP translates to over 160 billion dollars in losses, which could be highly significant for countries more adversely affected than others, based on 2022 values.	Please revise as appropriate	Revised as reflected in the final report.
123	Figure 2: Convert to 2023 or 2024 dollars.	Please clarify as appropriate	Added note with value in 2024 US$ as reflected in the final report.
124	Spatial distribution of the impacts We request the use of maps of the GDP impacts and impacts on exports across countries of the extreme scenarios (more optimistic and less optimistic) also in the executive summary. Please use GDP numbers in dollars for 2023/2024.	Please provide additional information	See the response to the above comment relating to maps.
125	The need for data validation and clarification: Magnitude of the shock: the share of the maritime logistics costs in the CIF price decreased substantially from the report on 27 June (Table 8) to the report on July 24th (Table 12) across all commodities groups. Additionally, the source of the data utilized to calculate the shares in the table and the equation behind them are not specified. It is unclear whether the share of the maritime logistics costs in	1. Please explain why the table changed but the results did not. 2. Please explain which data sources were	*Comment received after the 11th meeting of the Steering Committee: due to the time constraint and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*

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	the CIF price was multiplied by the maritime cost or to the CIF price of exports and imports or to the FOB price of exports and imports.	utilized to calculate the figures in Table 12 above. 3. Please clarify if the share of the Maritimes costs in the CIF price was multiplied by the maritime cost or to the CIF price of exports and imports or to the FOB price of exports and imports.	.
126	Data validation/transparency: there is still a lack of validation for MDST international trade data and the linkage between DNV data, MDST data and Marine Benchmark data.	1: Please provide descriptive data on all external data sources used in the report and compare them to GTAP data, as well as aggregate numbers of other sources.	*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*
127	The need to understand the sensitivity of the methodological choices: a. Implementation of the shock: the report states that "following relevant literature, it was decided to divide the	1. Please provide a sensitivity analysis using GTAP's maritime transport margin	*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments*

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	shock equally between importers and exporters, allocating 50 per cent of the shock from the increase in maritime logistics costs to the variable axs and 50 per cent to the variable ams". However, the mentioned literature is not provided. The literature that analyses the impacts of maritime transport cost changes on trade or other economic variables using GTAP models typically perturbs transportation costs, not trade prices (see Lee et al., 2013; Avetisyan, 2018; CE Delft 2021; Pereda et al, 2023). As we mentioned in former versions of the comments, it is possible to use the GTAP's maritime transport margin variable (PTRANS) to apply the shock by creating a slack variable (instead of exogenizing PTRANS), which enables changes in maritime logistics costs considering technological advancements in the shipping sector. This is the approach taken in the aforementioned literature to analyse changes in maritime transport costs. As mentioned in our previous comments, changing this assumption can influence the results, making them different from the relevant literature. Only a sensitivity analysis would clarify the sensitivity of the results to this assumption. b. Shipping time and maritime costs' shares on maritime logistics costs: the shipping time cost share is approximately 70% and maritime cost share is approx. 30% (Table 8 in the 24 July report). The high share adopted to shipping time cost – without explanation or references - underestimates the final impact on maritime logistics costs and consequently underestimates the impacts on States. Sensitivity analysis is a method used in rigorous research to determine how variations in key parameters or assumptions influence the results and conclusions of a study. For example, it might reveal that using ams-axs	variable (PTRANS) instead of ams/axs and tms/txs. This can be done for scenarios: 22, 24, 26, 32, 36, 43, and 46* and year 2050 2. Please provide a sensitivity analysis using a different combination of ams and axs and txs and tms: 100% allocated to exports (axs and txs) instead of 50-50%. This can be done for scenarios: 22, 24, 26, 32, 36, 43, and 46* and year 2050 3. When data validation shows that external data used is different from other official data, explore	*that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*

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	and/or tmx-txs to calculate the shock would generate an average reduction of A% in GDP, whereas using a slack shock of Ptrans for maritime transport might reduce GDP by B%. If the (A-B) show minimal change when the assumptions are altered, it suggests that the impacts are robust to those assumptions. Conversely, if the results vary significantly, it indicates that the outcomes are highly sensitive to the assumptions made.	sensitivity analysis using alternative external data. 4. Please provide sensitivity analysis using different shares of shipping time cost and maritime costs (50-50, for example; or based on academic literature shares) for scenarios: 22, 24, 26, 32, 36, 43, and 46* and year 2050 5. Please provide sensitivity analysis using modal substitution using elasticities calculated by Avetisyan and Hertel (2015) and Avetisyan (2018) for	

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		scenarios: 22, 26, 32, 36, and 43 and year of 2050	
128	Adjustment of language issues that are relevant to prevent policy prescriptive wording, as well as affirmations without supported evidence: We agree with the points raised by the U.S. in July 25th's meeting. We have also identified some language issues where arguments are not supported or where policy prescriptive language is used. We provide some examples: i. "Many of those limitations are common to all scenarios and should have a minimal consequence on the comparative analysis of scenarios." It is not possible to rule out that the consequences are "minimal". This can only be confirmed if a sensitivity analysis is presented (calculation of the differences), showing that the differences are minimal. We do not see evidence that these analyses were performed in the current version of the report. In addition to excluding the word "minimal", the limitations might affect the results very differently. For instance, forecast uncertainty increases over time, making changes for the year 2050 much less precise. and therefore, the results for those years are less comparable due to the higher errors. ii. Page 23: Results relating to scenarios with a GFI requirement and higher levy prices have shown that some negative impacts on world GDP are reduced/offset to some extent. iii. Page 28: In the scenarios where the reduction in volume of merchandise trade is greater, the emissions would likely see a stronger feedback effect, that is be reduced by a	1. Please carefully revise the language and cite the literature, or the report results, that support the text provided. 2. The limitation sector (both in the report and in the executive summary) also needs language polishing	*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*

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	greater amount. This means that to achieve the IMO's GHG reduction targets, a less stringent package of policy measures (e.g. lower GFI stringency, or lower GHG price) would be needed, which in turn should result in smaller impacts on States. This limitation has the effect of making the results of the analysis in this report conservative – not including this, if anything, the estimated impacts are likely to be higher than if it had been included. iv. Page 29: Whilst it is possible in GTAP to capture the energy/carbon intensity of other sectors and therefore quantify these secondary impacts, in practice there would be higher uncertainty in any modelled result because of the unknown change in each sector's carbon intensity over the period to 2050. One reference to guide this model decision is that governments have committed to the Paris Agreement, which requires significant carbon intensity reductions across all sectors by 2050. Using that guidance, rather than projecting each sector's respective rate of carbon intensity reduction, the approach taken is to assume that all sectors will decarbonize over the period of this impact analysis. The uncertainty of how different sectors' carbon intensities might evolve over time makes it hard to categorically assign this as a conservative or optimistic limitation. But with the assumption that all sectors' emissions will be significantly reducing over the period to 2050, the secondary impacts on emissions from the wider economy can also be expected not to be significant.		
129	Improvement of data visualization: a. Illustration of the results: maps with the main impacts of the scenarios: Maps similar to those presented in former documents submitted by UNCTAD are still lacking. The use		*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments*

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	of maps in the main sections and in the executive summary would improve the visualization of the distributional impacts. In response to our previous comment, UNCTAD mentioned the tight timescale to produce maps, but we believe that with the current decisions, there will be enough time to produce maps and improve the visualization of the results. b. GDP Figure – Executive summary: Thank you for providing Figure 3 of the executive summary in dollars, but we apologize for the lack of clarity in our request. We meant that the figure should report "change in $ dollars, not absolute terms. c. Minor issues: Please present the results always in the same order of the scenarios as the initial table, i.e. scenarios 21 to 46		*that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*
130	Acknowledgement of limitations, without diminishing the relevance of the points raised: We identified some language issues, as mentioned above, in the limitation section (and also in the executive summary). Since some of the language issues were mentioned in our previous comment, here we focus on the issue with the arguments provided in the limitation sections: Forecasting uncertainties: The static nature of GTAP implies uncertainties in forecast impacts until 2050. We do not fully agree with the text provided. One reason is that forecasting errors affect the precision of the baseline data, especially by country. Therefore, as the report studies trade behaviours, the relative results by bilateral trade flow might also be impacted. We understand that the baseline data was calculated by shocking the static GTAP using at least	In this sense, we believe that the paragraph should be rewritten and this limitation acknowledge as relevant.	*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*

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	predictions of GDP growth (or total factor productivity growth) and population growth until 2050 (from SSP2 scenarios, for example) by country. In this sense, if some measures present different impacts on specific bilateral trade flows (for example, a levy might increase the costs for countries that are distant from each other), and if the errors differ by country, this might generate different relative results by measure. Research reveals significant variations in forecasting errors across countries for economic variables and population: Buettner and Kauder (2009) show that forecasting precision differs among OECD countries; Dovern and Weisser (2009) for G7 countries; Senhadji (1999), analyzing data from 90 countries, also concludes that African countries have the largest unexplained errors, as well as developing regions when compared to developed countries. These studies (among others not cited here) highlight the complexity of economic forecasting and how it is difficult to affirm that forecasting errors do not impact relative results. Let us contribute to the analysis by bringing some relevant scientific data on this issue. Avetisyan and Hertel (2015) state that "reduction in modal cost of transport results in modal substitution" and Avetisyan (2018) shows that carbon taxes on transport emissions are likely to have a significant impact on the modal choice, overall volume of international trade and contribution of transport sectors to global emissions using a GTAP-E model. They also acknowledge that "To date, climate change policies have not adequately addressed the issue of modal substitution." (page 533) and also ", as mentioned by Cristea et al. (2013), under GHG taxation of transport sectors changes in modal use will be substantial" (page 534). In the paper of		

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	Avetisyan and Hertel (2015), they present the following elasticities, and Avetisyan (2018) also applied them to the context of GHG taxation using GTAP. Cristea et al. (2013) also show that under carbon taxation of transport sectors these changes will be more significant, affecting the fuel United States across different modes of transport, and thus the modal choice and aggregate transport emissions		
131	Modal shares: In the current version of the report (without modal substitution), the report states that "The model simulations only consider changes in maritime transport costs, excluding potential modal shifts to alternatives like air or land transport, leading to conservative impact estimates. This is appropriate since reliable economic estimates of modal shifts are limited"	In this sense, we believe that the paragraph should be rewritten, acknowledging this very relevant piece of evidence from the academic literature.	*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*
132	Carbon leakage and Paris agreement: The report states that "The assumption that all sectors will decarbonize by 2050 is consistent with the Paris Agreement and implies that secondary impacts on emissions will not be significant." Despite the society willingness to achieve its climate goals, this is unfortunately not the current reality according to today's research. The Paris Agreement's effectiveness in achieving its climate goals has been extensively studied by the academic literature, which highlights significant challenges. These include insufficient national ambition, a lack of clear reporting standards, and the need for increased transparency (Raiser et al., 2020). The agreement's institutional structure faces a trilemma of balancing broad participation, deep commitments, and satisfactory compliance rates (Dimitrov et al., 2019). A key challenge lies in facilitating the rapid ratcheting-up of	Eliminate this sentence	*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*

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	nationally determined contributions while maintaining high compliance rates. Overall, the literature indicates that achieving the Paris Agreement's goals remains challenging.		
133	Aggregation bias: The aggregation of sectors was not mentioned in the limitations. It is possible that many simplifications of assumptions needed to be made to aggregate all the economy in 11 sectors.	Please clearly state this limitation in the report as they impact greatly the results.	*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*
Chile			
134	In page 21 UNCTAD refers to the Definition of developing countries. The report defines "developing countries" as all economies classified by the World Bank in 2024 as low, lower-middle, or upper-middle income countries. We understand this definition is for analysis purposes only. We remind the 2023 IMO Strategy considers the "developing countries" concept as a general one and does not classify the countries in different levels. This is important to be as a disclaimer or caveat in the report.	We have moved the definition of developing economies, SIDS and LDCs into a dedicated subsection in the new section "Assumptions and limitations" at the beginning of the report, assign a standard disclaimer that this definition is meant for statistical convenience only.	Additional information about the country grouping categorization and the use of the World Banks' classification was provided in the final report.

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135	In page 25 UNCTAD indicates the following: "However when comparing the no-revenue and with-revenue scenarios, caution is required since the shocks are not identical. The no-revenue simulations represent a regulatory change while the revenue simulations constitute a mix of regulatory and levy change. Strictly speaking, the same scenario with and without revenue distribution could only be compared if two scenarios, one with and one without levy, would have exactly the same maritime logistics costs changes. Either a levy generates revenue that is to be distributed or not. However, scenarios that generate revenue in the simulations with revenue distribution, can still be compared with other scenarios that have no revenue. The results for the scenarios with revenue without distribution of revenue are shown because they are needed to assess how States are affected by changes in maritime logistics costs." Considering there is a need for caution, how does UNCTAD ensure that comparisons between no-revenue and with-revenue scenarios are feasible and we are not comparing different shocks and different results that are not comparable?	Please clarify as appropriate as appropriate	Scenarios 26, 31, 32, and 46 are modelled with three different revenue disbursement schemes based on the outputs of Task 2 and the selection of the SC. These scenarios always include a revenue generation component (a levy). However, for modelling the revenue disbursement, UNCTAD had to treat these four scenarios as if the levy were only a regulatory change with no revenue generated. Therefore, we advise caution when comparing these scenarios, with and without, revenue generation.
136	In Figure 3 (page 37) is difficult to see the different scenarios. Are they all the same?	Please clarify as appropriate	The figure shows the real GDP value in 2030, 2040 and 2050 for the scenarios listed in the legend.
137	In page 39 UNCTAD explains that: "Policy scenarios that include a levy (26, 31, 32, 46) are simulated to lead to a reduction of global international trade of goods and services, in constant prices (Table 15). The magnitude of this reduction gradually increases over the period from 2030 to 2050, as the effects on maritime logistics costs increase. As a result, under all four policy scenarios with a levy, international trade in 2050 is estimated to be -0.23 per cent less than under the BAULG. Within scenarios,	Please clarify as appropriate	The revenue disbursement scenarios result in reduced imports compared with the no revenue distribution scenario. As recipient countries have more money to spend for consumption (demand-side effect), prices rise owing to supply-side pressures. Higher cost of production then translates to higher import prices that in turn induces lower import demand. Although trade is lower than under the BAULG scenario, consumption and investment are growing.

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	variation across 2030, 2040 and 2050 are less pronounced than variations within scenarios and across the three timelines relating the maritime logistics costs." Can UNCTAD further explain why under all four policy scenarios, international trade is estimated to be 0.23 less than under the BAULG but at the same time those scenarios in 2050 are the ones with the lowest global impact?		
138	In page 48, UNCTAD indicates: "The reduced negative impacts occur not only in the economies that directly receive the revenues disbursed, but also in the ones that do not receive the disbursement, likely due to a stimulation of demand for their exports in response to the increased income abroad." Can you further elaborate on this idea and if this applies to every country that does not receive any disbursement or are some that do not have that kind of demand?	Please clarify as appropriate	This is true for many economies that do not receive any revenues.
139	In Figure 4 (page 50) is difficult to see the different scenarios. Are they all the same?	Please clarify as appropriate	The figure shows the real GDP value in 2030, 2040 and 2050 for the scenarios listed in the legend.
140	In page 50, "5.3.2.4. Results pertaining to consumer prices" and "Table 24. Impact on the consumer price index after disbursement of revenues" Table 24 indicates that the largest increase in consumer prices is generated in the LDCs, with revenues disbursed to SIDS and LDCs only, in scenario 26 (12.85% / 19.43% / 21.42%) and in scenario 46 (10.52% / 14.53% / 15.78%). Could UNCTAD do an analysis to be incorporated into the document that could explain the reasons for this result?	Please clarify as appropriate	GTAP indeed typically assumes perfect competition, implying that no single entity has significant control over market prices and that there are no barriers to entry or exit in the market. Therefore, UNCTAD could not single out in sector out of sector impacts of the examined policy measures.

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141	GENERAL COMMENT: In chapter 6, the key findings we suggest having an order of the impacts, the periods and the comparisons. It is difficult to understand the findings if they talk to different things and periods and we don't have some sort of order. For example, what happen in 2030, about impacts, trade, etc., what in 2040, what in 2050. After that, we can see the possible revenues.	Please revise as appropriate	The text has been revised as reflected in the final report.
142	In page 53 UNCTAD states: 1. Second bullet: "It is concluded that the total impact on real GDP has "ranges from a maximum of -0.16 per cent, to a minimum of -0.09 per cent, depending on the policy combination". Could UNCTAD explain why the ranges are so small if the impact on global maritime logistics costs, where it is possible to observe increases of more than 34 percent by 2050 in all scenarios? How does UNCTAD ensure these results are not going to be higher?	Please clarify as appropriate	We acknowledge that the ranges are small, but UNCTAD examined several proposed scenarios while conducting sensitivity analysis and quality control to forecast variations in the results.
143	In page 53 UNCTAD states: 2. Third bullet: "Is highest in scenario 22, which assumes a Base emission trajectory, a WtW GFI scope, without flexibility mechanism, levy nor feebate, and lowest in scenario 26, the corresponding scenario with a levy of 150-300 $/$CO_2$eq, where revenues are disbursed to SIDS and LDCs only". Can we compare these two scenarios if in page 25 UNCTAD indicated we need to be cautious on comparisons? Additionally, for 2050, could UNCTAD indicate how much higher it is in scenario 22 indicated, and how much lower it is in scenario 26 indicated?	Please clarify as appropriate	The caution only applies to scenarios with revenue disbursement (26, 31, 32 and 46) when modelled without revenue disbursement.

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144	In page 53 UNCTAD states: 3. The fourth bullet: "Is consistently lower for scenarios that include a levy (scenarios 26, 31, 32 and 46) than scenarios that do not. The scenarios with a higher levy price have the lowest global impact (both relative to lower GHG price scenarios, and relative to all other scenarios). Distributing the revenues only to LDCs and SIDS results in the smallest impact (i.e. reduction in percentage terms) on global real GDP (both relative to other distribution approaches, and relative to all other scenarios)" Here UNCTAD is comparing the levy scenarios with other that do not have the levy and also the distribution. Can UNCTAD further explain the comparison it is doing?	Please clarify as appropriate	See the explanation above.
145	In page 53 UNCTAD states: 4. The last bullet "Is consistently lower for scenarios that include a levy (scenarios 26, 31, 32 and 46) than scenarios that do not. The scenarios with a higher levy price have the lowest global impact (both relative to lower GHG price scenarios, and relative to all other scenarios). Distributing the revenues only to LDCs and SIDS results in the smallest impact (i.e. reduction in percentage terms) on global real GDP (both relative to other distribution approaches, and relative to all other scenarios)". This is difficult to understand. On one hand it says that the impact in 2030 is higher for levy scenarios, but it also says that impacts are similar for scenarios with levy and with no levy scenarios. Could you further explain? Additionally, for 2050, could UNCTAD expressly indicate (1) how much lower for scenarios that include levy, (2) how	Please revise as appropriate	The text has been revised to improve clarity as reflected in the final report.

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	much lower impact in scenarios with higher levy prices, and (3) how much lower impact for distribution of revenues only to LDCs and SIDS?		
146	In page 53 UNCTAD states: 5. The questions indicated in points 2 and 4 previously, with respect to the year 2050, are reiterated for the bullets relating to 2030.	Please clarify as appropriate	The text has been revised to improve clarity as reflected in the final report.
147	In page 54 UNCTAD states: 6. Second bullet: "In scenarios without a levy, there is little variation in magnitude of distributional impact – including a flexibility mechanism, feebate mechanism varying between TtW and WtW, changes the magnitudes of real GDP impact experienced across different economy groupings." Could UNCTAD further explain the idea behind? Are the other scenarios better because of this little variation?	Please revise	The text has been revised as reflected in the final report.
148	6.1.2 Distributional impacts" UNCTAD also refers in that section to greatest or smallest. Could UNCTAD expressly indicate by what percentage is higher or lower the scenario that is discovered as having a greatest or smallest impact, respectively?	Please revise	The aim of this section is to generally describe the magnitude of the outcomes and trends. Specific results have been described in the final report.
149	In 6.1.3. Import and export volumes, the second bullet it is concluded that "Import volumes see variations of between –1.2 per cent (developed economies) and +18.7 per cent (LDC grouping) in 2050. The largest increases and reductions occur in scenario 26, with revenues disbursed only to SIDS and LDCs." Besides this general conclusion, in the report, we can see greatest impacts than the ones reflected in this bullet. In fact, the two scenarios with the greatest impact on the quantity of imports are scenarios 26 and 46, with revenues disbursed only to SIDS and LDCs. In scenario 26, variations of up to +18.7 per cent are observed in LDCs and in scenario 46 variations of up to +13.55 per cent are also observed in LDCs (Table 21).	Please clarify as appropriate	The aim of this section is to generally describe the magnitude of the outcomes and trends. Specific results have been described in the final report.

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	In the same line, the greatest impact on the quantity of exports is also scenarios 26 and 46, with revenues disbursed only to SIDS and LDCs. In scenario 26, variations of up to -35.77 per cent are observed in LDCs and in scenario 46 variations of up to -28.34 per cent are also observed in LDCs (Table 22). Is it possible to conclude that unlike the impacts on GDP, which are marginal (-1% in all scenarios), the impact on the volume of imports and exports is extremely high on LDCs in scenarios 26 and 46, with revenues disbursed only to SIDS and LDCs? If so, is it possible to say that this shock "strongly distorts both their domestic economy and international trade in general"?		
150	In page 55 UNCTAD states: Fourth bullet: "Export volumes go down compared to BAULG across all scenarios with no levy (21/22/23/24/36/43), with the exception of SIDS which consistently sees small increases in their export volumes. LDCs consistently experience the largest reductions in their exports (up to –0.5 per cent in 2050, scenario 22). Does this mean that export volumes do not go down in levy scenarios?	Please clarify as appropriate	No. However, please note that the picture for the export volumes in levy scenarios is more complex with mixed patterns at play. In some scenarios the volumes increase for some economy groupings and in certain time steps (developed economies, SIDS each have instances of increase as well as a decrease). But it is rarely uniform e.g. export volumes might increase in 2050 for SIDS (scenario 31) and decrease in 2040 and 2030 in the same scenario/revenue distribution.
151	For section "6.1.4 Consumer price index", second bullet, it is concluded that "the largest increases in the global CPI by 2050 occur in scenarios with a levy and a high levy price (26)". In table 24 the two scenarios with the greatest impact on the increase in consumer prices are also scenarios 26 and 46, with revenues disbursed only to SIDS and LDCs. In scenario 26, variations of up to +21.42 per cent are observed in LDCs and in scenario 46 variations of up to	Please clarify as appropriate	The text has been revised to improve clarity as reflected in the final report.

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	+15,78 per cent are also observed in LDCs. Is it possible to say that this shock strongly distorts their domestic economy?		
152	In page 57 UNCTAD states: 11. "The long run (2050) global impact on real GDP is very similar across all no-levy scenarios (S21, S22, S23, S24, S36, S43), regardless of whether no flexibility, flexibility or feebate are specified in the policy parameters. This contrasts with the levy scenarios which are consistently lower impact in the long run, but also more variable in impact." What does UNCTAD mean by "more variable in impacts"?	Please clarify as appropriate	While results across the no levy scenarios appear to have similar impacts on real GDP for each of the examined time periods, the levy scenarios have more variable (some increases as well) impact depending also on the group of beneficiary economy for the revenue disbursement.
153	In page 58 UNCTAD states: 12. "Therefore, this limitation is likely to result in the findings and outcomes being on the conservative side. From theory, the results presented here should rather overestimate than under-estimate the magnitude of the negative impact on GDP, as adjustments in transport demand can be expected to be done by market actors with the aim to reduce costs." What does UNCTAD mean by "conservative side"? What does over-estimate/under-estimate mean? Could the impacts be also under-estimated?	Please clarify as appropriate	The text has been revised to improve clarity as reflected in the final report.
154	In page 61 UNCTAD states: 13. 6.5.1. "However, countries that are most strongly impacted by increases in maritime logistics costs, are the structurally vulnerable economies of the LDC grouping. For economies where remoteness and poor transport connectivity are significant factors that contribute in causing the negative impacts, revenue distribution targeting these economies can mitigate some of those impacts." What does UNCTAD mean by "structurally vulnerable economies"? What happens to remote economies that do not receive revenues?	Please clarify as appropriate	After further reflection, we considered that the assessment of the degree of structural vulnerability was beyond the scope of the report and did not add any significant value to the analysis. We have therefore dropped this characterization from the sentence.

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155	14. 6.5.3. "The results suggest that more maritime-transport dependent economies can be more impacted by increases in maritime logistics costs." How does UNCTAD define "More maritime transport dependent economies"?	Add empirical evidence based on a suited measure.	The text has been revised to improve clarity as reflected in the final report.
156	In page 63 UNCTAD states: 15. 6.6.3. "Some levy scenarios may lead to considerable changes in import and export volumes, potentially altering port-calling frequencies and connectivity for specific economies." Which are those scenarios and which are the specific economies affected?	Please clarify as appropriate	The text has been revised as reflected in the final report.
157	1. Additional clarifications in all the results presented, and particularly for those scenarios with levy that have less impact than scenarios without levy and how they affect all the States, so the reader can clearly understand the rationale behind them and can compare the scenarios; particularly those before disbursement, that show the real impact on States. 2. A clearer and more detailed presentation of the results without revenue disbursement for all the scenarios and all the items analysed, considering this is an analysis on impacts on States. 3. Detailed explanations, in the executive summary and in the report, of all the scenarios analysed and the impacts, stating in a clear way the impacts on maritime logistic costs, export quantity, import quantity, consumer price index, before and after disbursement, as well as indicating to which scenario those impacts applies. As an example in the executive summary, in the "impacts on trade" subsection, the second paragraph states that "A reduction in export		*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.* .

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	volumes is observed across most scenarios by 2050, with reductions reaching up to 36 per cent in the case of LDCs, the exceptions being the scenarios 26 and 46, in which revenues are disbursed to SIDS and LDCs only, leading to slightly positive effects (up to 0.08 per cent) on the developed economies' total export volumes." The phrase in highlighted in yellow indicates 36% of reductions but does not state clearly which scenario is referring to. Other examples that have to be explicit in the executive summary and in the report are the following: a. Scenarios 26 and 46 have the impacts around 35% and 28% in the export quantity after revenue disbursement for developing states (table 24). b. Scenarios 26 and 46 have the impacts around 21% and 15% in the consumer price index after revenue disbursement for developing states (table 27). c. Scenarios 26 and 46 have the impacts around 19% and 23% in the maritime logistic costs after revenue disbursement for developing states (table 11). The rationale behind this is to inform the reader not only of the GDP impacts that are already in the report but also of valuable information in the tables that help the reader to better understand the impacts in the different aspects analysed. These detailed explanations should be applied to maritime logistic costs, export quantity, import quantity, and consumer price index, before and after disbursement. 4. In section 7, further development on the impacts on geographic remoteness and transport dependency; as well as the other items listed in the Term of reference.		

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	5. The addition of figures or graphics, like the one presented for the real GDP impact in 2050 (figure 3), for the impacts on maritime logistic costs, export quantity, import quantity, consumer price index, before and after disbursement, for all the scenarios. In the first draft report (dated 7th May step 1) there were valuable graphics/figures that showed the impacts on different scenarios. 6. The addition of maps such as the ones presented in the first draft report (dated 7 May step 1) page 23. 7. The presentation of the results considering the impacts on all the States, avoiding the emphasis on certain groups of countries only.		
China			
158	Throughout the report, the scenario analysis before revenue disbursement is described as "hypothetical scenario", such as "Four out of the 10 scenarios include four different revenue disbursement options, including the hypothetical option of none-disbursement of revenues." " A fourth simulation was run on a hypothetical scenario in which no revenue is disbursed." "This hypothetical scenario also enables an indicative assessment of..." We strongly oppose such a description. Scenario analysis before revenue disbursement is the genuine impact analysis which focused on the measure itself. And the impact assessment should focus on the impact of the measure, rather than the impact after revenue distribution. Therefore all such descriptions should be deleted, and replaced by the words of "such scenario reflects the genuine impact of the mid-term measure itself."	Please clarify as appropriate	The nature of computational general equilibrium modelling is that it needs to reach equilibrium across all the modelled economic parameters. A scenario that generates significant revenues is not in equilibrium unless these revenues have been disbursed. However, to reach the equilibrium solution there is an intermediate step in which the model is first run without the revenues included, which is how these 'before revenue disbursement' results are produced. To improve clarity and respond to this comment while taking into account comments received at the SC11, the term "hypothetical" is now used as deemed appropriate in connection with "revenue distribution".

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
159	Section 3.5. Simulate revenue disbursements It should be added to explain in section "3.5. Simulate revenue disbursements" the reasons why scenarios with flexibility but no levy was not modelled for its revenue distribution. It can be recalled that in "Proposal for the selection of Task-2 scenarios modelled in Step 2" proposed by UNCTAD on 1 May that for flexibility mechanism only scenarios, "only one simple revenue distribution scenario is modelled." It should be added to explain why such simple RD is not modelled.	Please clarify as appropriate	A dedicated wording is added to the 'Limitations' section of the final and its Executive Summary.
160	Section 5.2.2.3.: "Overall, the impact on the real GDP of developed economies caused by the Policy measure after revenue disbursement does not vary much across the four scenarios and distribution schemes. In contrast, the negative impact on the real GDP of developing economies (that is the declines in their real GDP) is slightly moderated when revenues are disbursed to SIDS and LDCs only. Generally, for scenarios which include a levy, the negative real GDP impacts are reduced in all analysed years, once the effects of revenue distribution are taken into account. The reduced negative impacts occur not only in the economies that directly receive the revenues disbursed, but also in the ones that do not receive the disbursement, likely due to a stimulation of demand for their exports in response to the increased income abroad. By 2050, revenue disbursements mitigate/reduce the reduction in global real GDP caused by the policy measures that drive up maritime logistics costs. They also help mitigate/reduce the reductions in the real GDP of developing and developed economy groupings as well as the LDCs and SIDS. According to the simulation results, the impact of the revenue disbursement is more effectively	Please clarify as appropriate	An extensive set of modifications have been made to the final version report in response to this comment. They include: 1) explicit comparison of the model method to the circ. 885 specification for how this analysis should be undertaken, 2) clearer methodology and further increases in transparency as regards the underlying data and method responding to all detailed requests for clarification, but also greater description of the QA/QC undertaken in order to validate and verify the assumptions, as well as description of the transparency of method in general and in specific relation to GTAP, 3) increased caveat language/wording on limitations in the Executive Summary and the main body of the report, 4) expanded and moved around the section on Limitations. The list of limitations was expanded and made more prominent in the report so that reader is clear as to the underlying limitations and the need to bear in mind these limitations when reading and interpreting the results.

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	mitigated/reduced in the policy scenarios 26 and 46, which include a higher levy." We are not sure how such conclusions can be made. The main findings given in the current report are merely descriptions of numerical results, and the connection between the conclusions and their strong assumptions has not yet been given. In the current version, these findings are not strongly supported by quantitative analysis model tools. The assessment uses models for quantitative analysis. Therefore, the model results are heavily dependent on a large number of basic parameters and strong assumptions in the model. The description of the model mechanism in the report still has many black boxes and strong theoretical assumptions. Since the GTAP model is a general equilibrium model, there is still a large gap between the description of the economic system in these models and the actual situation. Whether the assumptions are reasonable and true is the most important basis for the credibility of the model results. At present, the report does not provide a transparent and convincing description of the model tools and the setting of basic parameters and other important core elements. Therefore, we suggest the deletion of such conclusions.		
161	Section 6.1.1: "By 2050, at the global (all economies) level, the total impact on real GDP, relative to the BAULG scenario: Is highest in scenario 22, which assumes a Base emission trajectory, a WtW GFI scope, without flexibility mechanism, levy nor feebate, and lowest in scenario 26, the corresponding scenario with a levy of 150-300 \$/CO_2eq, where revenues are disbursed to SIDS and LDCs only. Is consistently lower for scenarios that include a levy	Please clarify as appropriate	For concerns that are common to the previous comment, please see the preceding response. In relation to the explanation that when revenues are disbursed only to SIDS and LDCs, the world economic impact is smallest, this was discussed in the SC, but a more detailed explanation has now been added to the final report.

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	(scenarios 26, 31, 32 and 46) than scenarios that do not. The scenarios with a higher levy price have the lowest global impact (both relative to lower GHG price scenarios, and relative to all other scenarios). "For the same reason stated in the previous point, the results are not convincing. Also, these are very policy prescriptive conclusions and will lead to the favouring of some particular measures. Suggest deletion. Also, "Distributing the revenues only to LDCs and SIDS results in the smallest impact (i.e. reduction in percentage terms) on global real GDP (both relative to other distribution approaches, and relative to all other scenarios)" Why that revenues distributed to LDCs and SIDS only will have smallest impact on global real GDP? This is hard to understand that revenues distributed to LDCs and SIDS only will lead to even smaller impact on for example China, who does not receive the revenues. In the report, no explanations are given for such results, and the mere explanation of "The reduced negative impacts occur not only in the economies that directly receive the revenues disbursed, but also in the ones that do not receive the disbursement, likely due to a stimulation of demand for their exports in response to the increased income abroad." is not convincing at all. Suggest deletion of these words as well.		
162	Section 6.1.2. Distributional impacts: It should be clarified what Distributional impacts mean. Does it mean Revenue Distribution impacts? "For high levy price scenarios Developing countries are more negatively impacted than developed economies in 2030 (than in scenarios without a levy), but less negatively impacted in 2050 (than in scenarios without a levy)." What are negatively impacted mean here? GDP or imports exports or consumer prices?	Please clarify as appropriate	The term 'distributional' has been removed as the final reflected in the final report. The wording has been replaced with clearer and plain English. The language around reduced impact is now clarified to be specifically related to GDP impacts.

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163	Section 6.2.3. Sensitivity of flexibility versus no flexibility and feebate: The last sentence in the third point is not finished. The fourth point should be deleted, as it is not policy-neutral, and will lead to the favouring of some particular measures.	Please clarify as appropriate	The sentence has now been completed and the language checked/revised in relation to 'policy prescriptive'.
164	Sensitivity analysis and uncertainties presented Sensitivity scenario has not been conducted in this report, and the impact of changes in relevant factors on one or a group of key indicators has not been studied from a quantitative analysis perspective. It is requested in SC 8 by some SC members to add a dedicated section in the report, documenting the results of quality assessments and sensitivity analyses, outlining the uncertainties of the presented results, and discussing the expected effects of scenarios modelled under Task 2 that have not been included in the modelling under Task 3.	Please clarify as appropriate	We included in the final report, a discussion of the sensitivity of the impact to changes in specific policy parameters. This helps inform about the simulated impacts that we would expect if the simulations could be run for other DNV scenarios. However, a sensitivity analysis for the estimation of the accuracy of the applied model would require more time and resources and is beyond the scope of this assessment.
	Germany		
165	Impacts are presented for 'snapshot' years. If you see any chance to compare the scenarios also on a cumulative basis (maybe assume linear developments between the years analysed?) this would be very helpful.	Please clarify as appropriate	The results are presented on a cumulative basis. The results in 2050 reflect the changes that happened in 2030 and 2040.
166	Import/export impacts are presented in volumes only. As suggested earlier, insights into the impacts on the value of imports/exports would also be very useful. If time does not allow for adding this to the report, maybe you could still present it according to the numbers in the Excel file?	Please clarify as appropriate	Presenting data in values can be misleading due to the complexities of inflation adjustments, changes in the quality of goods and services, and other dynamic economic factors. Focusing on volumes ensures a clearer and more accurate representation of trade activity, avoids the potential inaccuracies associated with constant price adjustments over long periods, and maintains the consistency of the analysis.

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167	6.1.1 Impact on real GDP: main findings: 2050 GDP impacts , First bullet point 'at an aggregate level' is related to country groups?	Please clarify as appropriate	The text has been revised as reflected in the final report.
168	6.1.2 Distributional impacts Header of 6.1.2 Since you mention distributional impacts here for the first time, it would be helpful if you explained that this is still about the impact on GDP.	Please clarify as appropriate	The text has been revised as reflected in the final report.
169	6.1.3. Import and export volumes Last bullet point: "…and SIDS the largest drop." Is this about impacts in absolute terms? Tables 11 and 22 seem to suggest that LDCs see the largest drop in relative terms.	Please clarify as appropriate	The text has been revised as reflected in the final report.
170	p.9 "With regards to the imposition of a levy, two scenarios…" Does 'imposition' have a negative connotation?	Revise as appropriate	The text has been revised as reflected in the final report.
171	Figure 3 and Figure 4 Given the scale, the lines overlap and the value added to the figures seems to be limited. Or is the aim to show that there is a large overlap?	Please clarify as appropriate	The aim is to show the minimal difference.
172	p.7 Figure 2 Since the lines are overlapping, Figure 2 is not helpful for the understanding of the results.	Please clarify as appropriate	The graph aims to present the magnitude of impacts compared to the BAULG
173	p.9 "Distributional impacts shown indicate that different countries and groups of countries are impacted to a different extent." An analysis of the distributional impacts shows…? Please explain that this is also related to the GDP impacts.	Please revise the text as appropriate	The graph aims to present the magnitude of impacts compared to the BAULG
174	Figure 3 Please explain that the dots depict the individual economies (at least this is my understanding).	Please clarify as appropriate	The text has been revised as reflected in the final report.
175	Figure 3 Why are only 4 scenarios presented?	Please clarify as appropriate	The example is illustrative for some indicative scenarios.
176	Figure 3 If you present this figure in the ES, I would expect it to also be part of the main body of the report.	Please clarify as appropriate	Yes, the Executive Summary is already included in the final report.
177	p. 10 3.3 Impacts on trade: "By 2050, global import volumes decrease between -0.23 per cent and -0.97 per cent compared to the BAULG scenario, with the largest reduction in scenario 26. By 2030, reductions range from -	Please revise as appropriate	The text has been revised as reflected in the final report.

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	0.05 per cent to -0.51 per cent." Please add 'on average' and explain that the range depends on the policy scenario.		
178	p. 10 3.4 Impacts on consumer prices: "All policy scenarios modelled to increase the consumer price index (CPI relative to BAULG) for all analysed years (2030, 2040, and 2050) and across all economy groups." Doesn't Table 24 in the main body of the report suggest that in scenario 26, the CPI in developed economies decreases?	Please revise as appropriate	The text has been revised as reflected in the final report.
179	p. 10 3.4 Impacts on consumer prices: "Revenue disbursement roughly doubles the CPI increase globally compared to scenarios without revenue disbursement." Please explain the underlying reason.	Please clarify as appropriate	As recipient economies have more money to spend for consumption (demand-side effect), prices rise owing to supply-side pressures.
180	For the disbursement scheme presented in the middle of table 21 (i.e. revenues disbursed to developing economies, SIDS and LDCs), the findings for SIDS and LDCs are exactly the same. I would actually expect the impacts on LDCs to be different and to be positive (like for the other 2 disbursement schemes).	Please review	The table has been corrected, as reflected in the final.
Egypt			
181	1- The modelling of the Impacts of the levy scenarios (26,31,32,46) on Agricultural imports in tables A13 (quantity) and A14 (prices) are with revenue disbursements, however impacts of the mentioned scenarios results without revenues disbursement were not included. For analysis and comparison purposes between the levy and non-levy scenarios in modelling the impacts on Agricultural imports, presenting the missing data for the levy scenarios without revenue disbursements remain crucial and essential. Therefore there is a need to have an impact on agricultural imports for the 10 scenarios compiled		*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	without the revenue disbursements as per the methodology followed in other impacts modelling. 2- Pages 66 and 67 included analysis on scenarios without levy on agricultural imports (as shown for scenarios 21,22,23,24,36,43 in tables A7 and A8) showing the impacts in scenarios without levy. However, the analytical part of the levy scenarios remains missing. Providing results as raised in the previous comment on the missing data of levy scenarios without revenue disbursements would help address this deficiency. 3- Paragraph 7.3 document for the sake of simplicity, we suggest sticking to the language used in the earlier version (for simplicity and not to create confusions) "the following sets out a summary view of how the terms below are reflected in the overall assessment." Instead of the current phrasing, "the following sets out a summary view of how the terms below are reflected in the overall assessment in Task. 4. The quantitative outputs of the modelling in Task 3 have focused on general impacts (impacts on GDP, trade and CPI) as requested in the Terms of Reference. Only limited inference can be made here based on those outputs. The terms below are also the basis of analysis in Task 4 and so this section can be read in conjunction with the Task 4 report to provide further insights". 5. On 7.3.2 Cargo value and type; we suggest retaining back the following phrase from the previous version submitted by UNCTAD "Agricultural goods, for instance, are likely to see larger price increases as their maritime logistics costs increase more than other cargo types".		

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	6. On 7.3.3 Food security; we are of the view to keep the opening phrase as in the previous version which reads as follows: "Food security has not been directly addressed. However, impacts on the maritime logistics costs of agricultural products have been considered." 7. We consider the phrase "there may be some implications for food security" on the last line of page 98, contradict the beginning of the same paragraph. Consequently, we suggest inserting instead of that phrase the following "Scenarios that lead to large changes in maritime food imports and exports would influence the ability of countries to meet their food security objectives", which is the same phrase used by UNCTAD in the earlier version. 8. The last paragraph on 7.3.3 Food security which reads as follows "As regards increases in containerised trade, UNCTAD has estimated that consumer prices would be 1.5 per cent higher in 2023 than they would have been without the container freight rate surge. Higher freight rates overall hit hardest at the (least developed countries and small island developing states) which rely more on imports of containerized goods", we suggest replacing the phrase between brackets with the (Net Food Importer Developing Countries NFIDCs), as consistent with the used literature and agreed language when tackling on Food Security issues.		

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		India	
182	Graphical Figure 1 makes it clear what "Change" and "Impact" in the context of GDP of a policy measure means. However, the explanatory formula given in the para above the figure on page 10 is not clear. The same may be reviewed.	Please clarify as appropriate	The text has been clarified as reflected in the final report.
183	It is not clear what the figures given as logistic cost for various commodity groups in Table 3 represent. Are these given as example of logistics cost per pair of ports or world average. This may be clarified.	Please clarify as appropriate	The figures in the table present the components of maritime logistics costs in the base year, 2023, by type of commodity. They represent the average maritime logistics costs for each commodity included in the study. These figures are calculated based on the MDST database which provides the transport costs and shipping time for these commodities between 227 origin and destination economies globally measured from the port of origin to the port of departure. The figure for average maritime transport costs, and shipping time are calculated using weighted average approach, where the volume of goods transported over each of the routes is used as the weighting factor.
184	It is not clear how revenue disbursement improves the GDP of a country. What assumptions have been made in UNCTAD modelling? This may be clarified in detail to the extent possible.	Please clarify as appropriate	UNCTAD's analysis through GTAP simulates the impacts of revenues disbursement through their allocation to the regional households. The regional household collects all factor incomes and levy revenues generated within an economy, then allocates all income across three types of expenditure, private consumption, government consumption and savings, to maximize the welfare for each country or region. In some of the scenarios examined positive impacts on real GDP were observed. That is because revenues increased the households' disposable income that can respectively improve private consumption, boost government consumption and enhance savings. These factors collectively drive economic activity and contribute to higher GDP.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
185	Graphical Figure 1 makes it clear what "Change" and "Impact" in the context of GDP of a policy measure means. However, the explanatory formula given in the para above the figure on page 10 is not clear. The same may be reviewed.	Revise as appropriate	The text has been revised as reflected in the final report.
186	It is not clear what the figures given as logistic costs for various commodity groups in Table 3 represent. Are these given as example of logistics cost per pair of ports or world average. This may be clarified.	Revise as appropriate	The text has been revised as reflected in the final report.
187	It is not clear how revenue disbursement improves the GDP of a country. What assumptions have been made in UNCTAD modelling? This may be clarified in detail to the extent possible.	Revise as appropriate	The text has been revised as reflected in the final report.
188	The report does not cover the impact on developing countries as adequately as that on SIDS/LDCs. Comparison is made Report needs more valid justification and details where it is in variance with written literature and as example: i. It is important to consider the effects of lag in revue distribution and utilization compared to the collection (as stated on Page 15). In our opinion this can lead to considerable variation in the output and the same has to be adequately addressed. ii. There appears to be a significant inconsistency in the report as if the economy's circumstances differ significantly, then the disaggregated result is more likely to be less reliable. This is particularly important when interpreting the impacts when revenue distribution is done to SIDS and		*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.* .

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	LDC's only and the negative impact is seen reduced on developing countries. iii. The report is not comprehensive and does not cover all scenarios, as detailed in the DNV Report and makes it difficult to understand the impact of different scenarios. As an example, scenario 26, that is, with a high levy and low reward cannot be compared to any other scenario to understand the impact with and without flexibility when all other conditions remain the same. iv. We do not understand as to why the impact on developing countries is lower when the revenues are distributed to SIDS/LDCS only and it is required to be corroborated with trade data. v. Page 16 states "Developing economies and LDCs are simulated to experience on average relatively higher impacts on their imports' maritime logistics costs. LDCs are simulated to face, on average, higher impacts on the maritime logistics costs of their exports relative to the developing economies, developed economies, and SIDS, but what about the impacts on exports of LDCs under similar conditions? The comparisons must not be selective. There are significant inconsistencies in the report regarding the reliability of disaggregated results under differing economic circumstances. This issue is particularly pertinent when interpreting the impacts of revenue distribution to Small Island Developing States (SIDS) and Least Developed Countries (LDCs) only. Such inconsistencies need to be carefully examined to avoid misleading conclusions.		

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	Furthermore, the development of carbon capture and storage (CCS) technologies is crucial for the transition. This development requires substantial investment in research and development, as well as in segregation, storage, and sequestration infrastructure. The report does not sufficiently address the need for higher revenue allocation for these activities, which is essential for the sector's deployment of funds. The report is not comprehensive and does not cover all scenarios, as detailed in the DNV Report. This omission makes it difficult to understand the impact of different scenarios. For example, scenario 26, involving a high levy and low reward, cannot be compared with any other scenario to understand the impact with and without flexibility when all other conditions remain the same.		
Netherlands (the Kingdom of)			
189	7.2 This section gives insights that will be very helpful in the selection and design of the measures. As currently stated, the section reports observed effects, without explaining how these effects come about. Would it be possible to provide more background? Please also ensure consistency with previous sections in starting with 2030 before moving to 2050.	Please revise as appropriate	The text has been revised as reflected in the final report.
190	7.4.5 Food security Given the debate about food security, could this section be expanded by reporting on the modelled changes in trade in agricultural trade and impacts on import prices of agricultural products?	Added charts and narrative on simulation results about impact on	We have added into the final report additional analysis that helps assessing food security risks.

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	Can references be made to other UNCTAD studies on this issue?	quantity and prices of agricultural imports in Sections 6.2.1 and 6.3.2 as well as related country level tables. Extended the discussion on food security in Section 7.3.5 based on these findings.	
191	7.4.5 "Scenarios that lead to large changes in maritime food imports and exports could potentially influence the ability of countries to meet their food security objectives." Please include references to scenarios as done in other parts of the report.	We have outlined the scenarios that lead to relatively strong imports and agricultural imports, based on the new analysis added to Sections 6.2.1 and &.3.2.	Comment has been implemented as reflected in the additional analysis on food security in the final report.
192	Comments from The Netherlands (the Kingdom of) on the additional paragraphs suggested by the United Kingdom: "The final report on Task 3 has benefited from the constructive comments provided by members of the Steering Committee and QA/QC reviewers. However, it should be noted that there has been limited time available for members of the Steering Committee and QA/QC reviewers to review the final report, and it has not been	Please revise as appropriate	The report was revised in line with all these comments, including not to specifically mention the short-term measures, but we have added a limitation that is worded in a more general way - that the modelling does not include any future national/international regulation.

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	feasible to fully address all of the feedback received. In addition, it should be noted that members of the Steering Committee and the QA/QC reviewers have not been provided with access to all underlying data, modelling tools and disaggregated results, and have not therefore been able to replicate all the results presented in the final report." "The comparisons being made between the policy scenarios in this report may be influenced by the limitations of the Task 2 modelling. For example, in its final report on Task 2, DNV explains that: "Annual required GFI limits are determined by iteration, and the resulting GHG emissions align within ±5% to the required GHG trajectories. The differences in the GHG trajectories will affect the other results, including the differences in the estimated cost-intensity changes between scenarios." [we can accept this paragraph as is] "The modelling of revenue disbursement in Task 2 and Task 3 also has a range of other limitations, which may affect the comparisons between the modelled policy scenarios. For example, it is assumed that no revenues are allocated to "research, development and deployment (RD&D)". If this assumption does not hold in practice, there would be lower revenues available for other purposes than has been assumed in this modelling. Time lags between the collection and disbursement of any revenues, and the administrative costs of collecting and disbursing any revenues, are also not factored into this modelling. [we can accept this paragraph as is] ~~Finally, the IMO is currently reviewing its short-term GHG reduction measure. The modelling undertaken in Task 2~~		

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	~~and Task 3 does not consider the implications of any potential changes to the short-term GHG reduction measure. Therefore, a limitation of Task 3 is that it does not provide evidence on how potential changes to the short-term GHG reduction measure may affect the comparisons between the modelled policy scenarios."~~ [we don't consider that this paragraph is needed because the modelling has been done in general on the basis of the current regulatory framework, not taking into account any future changes to either national or international regulations]		
193	Page 21: "Since higher maritime logistics costs disproportionately affect trade over longer distances, higher volume and lower value products, and highly trading nations, the cost changes are not proportional and affect economies differently." Is 'proportional' the right word or should it be 'uniform' or 'equal'?	Please revise the text as appropriate	The word uniform is more appropriate to describe the impacts we observe.
194	Page 24: Table 5: what is the unit?	Please include the unit	The unit is in percentage change relative to BAULG.
195	Page 27: Tables 8 and 9: are the percentages the same across all scenarios?	Please explain the magnitude of results for MLC Of exports and imports	Changes at the global level are the same by definition (with a possible small exception due to iceberg costs). Other percentage changes are often similar but mostly not equal. For example, for LDCs they vary significantly.
196	Page 29: Table 12: what do the figures mean? E.g. impact on world GDP of scenario 46 in 2050: will the global GDP be 0.154% less in 2050 than in BAU, or is the growth rate 0.154% lower?	Please clarify as appropriate the term impact	It is the growth rate that is lower not the global GD level.
197	General: wouldn't it be better to start with impact on GDP, and then imports, exports and CPI?	Please restructure the report	The structure has been revised as reflected in the final report.
198	Table 6 is the difference between commodities exclusively attributable to differences in the value of time or are other	Please revise as appropriate	The difference in the maritime logistics costs between commodities are caused by many factors which vary

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	factors at play? Can the differences be explained in the text?		across origin, and destination. Nevertheless, some of the most prominent factors are value of time and travel time of each commodity. Commodity which is sensitive to time such as electrical and machinery product and food and beverage typically have relatively higher value of time compared to low value commodities. We have added an explanation on how the value of time is estimated in the report. In our analysis based on MDST data, many shipments of goods with high volume take place between distant countries which result in high travel time and consequently high time costs. Other factors are the economy of scale and operational costs which also vary across commodities, these factors are reflected in the maritime transport costs calculation.
199	4.3 "LDCs experience consistently larger increases in their exports' maritime logistics costs compared with the remaining economy groupings (Developed, Developing, SIDS and World)." Is this due to different shares of commodities in the mix, or are there other factors? Can you explain the differences?	Please revise as appropriate	This is mostly caused by mix of commodities exported by LDC but also due to relatively higher average maritime transport costs and shipping time from LDC which is calculated based on MDST' World Cargo Database.
200	6.1.1 The impacts in 2050 and 2030 are presented. For completeness, I suggest presenting (possibly with less detail) also something for 2040.	Please revise as appropriate	Revised to include interim impacts.
201	6.1.2, "Looking at impacts across different aggregations of economies (developing/ developed/ LDCs/ SIDS), the following findings are observed: In scenarios without a levy (21/22/23/24/36/43), for any point in time 2030-2050, the impact on real GDP, relative to the corresponding BAULG, is greatest for LDCs and SIDS, and smallest for developed economies. The developing economies including developing SIDS and LDCs, as a group, are consistently impacted more than developed economies but less than the SIDS and LDC groupings who both experience the highest	Please clarify as appropriate	This is now included. However, a new section on variability of impacts between countries that uses box and whisker plots to show distributions and sensitivity of distributions has also been added as reflected in the final report.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	impacts." Please also analyse whether the regressive impact holds in general. In other words, when plotting impacts on countries against GDP per capita, is there a downward trend? How good is the correlation? And how many countries don't follow the trend and by how much? In light of what the 2023 Strategy states about addressing disproportionally negative impacts, as appropriate, and about contributing to a just and equitable transition, it is important to provide more detail than a country group analysis, especially when country groups are overlapping.		
202	6.1.2 "In scenarios without a levy, there is little variation in magnitude of distributional impact – including a flexibility mechanism, feebate mechanism varying between TtW and WtW, changes the magnitudes of real GDP impact experienced across different economy groupings." The relation between the two parts of the sentence is not clear to me. Is the second part a clarification of the first, or does it indicate a nuance? Should the second part be preceded by 'although', or be followed by 'but not the distribution'?	Please revise as appropriate	Addressed as reflected in the final report.
203	6.1.2 "For low levy price scenarios (31/32), with revenues disbursed to all countries or all developing economies, the pattern is the same as in scenarios without a levy (LDCs and SIDS see the largest reductions in real GDP, developed economies experience the smallest reductions). However, the spread/range of impacts between LDC and developed countries is reduced relative to the no-levy scenarios." See the comment above about the regressiveness at a country level (as opposed to a country group level).	Please revise as appropriate	See the response above, we have tried to use box and whisker plots to present these relationships and added them into a dedicated new section on variability at the economy level.
204	6.1.3 "Relative to the BAULG scenario, at the global level, world import/export volumes see reductions in 2030 …" Is this about volumes (tonnes, cubic meters) or value? Or is there no difference because prices are constant? Is it	Please clarify as appropriate	It is about volumes as per the title and in text.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	possible to maintain one order of chronology in the presentation of the results?		
205	6.2.1 "The long run (2050) global impact is very similar for comparable TtW and WtW scenarios e.g. for scenarios 21/22, 23/24." Please note that this is because the model has been set up to reach the same GHG emissions pathway. The DNV report states: "Applying a tank-to-wake (TtW) scope with sustainability criteria or a well-to-wake (WtW) scope did not result in any significant differences in cost intensity as the scenarios follow the same WtW GHG emission trajectory. " (page 6) I assume that when scenarios result in a different GHG emissions pathway because of the WtW/TtW choice, the impacts will also diverge.	Please clarify as appropriate	We have revised to improve clarity as reflected in the final report.
206	6.2.2 "The long run (2050) global impact is not consistently higher for strive scenarios than their corresponding base parameter specifications" Please explain that this is because emissions are zero in both base and strive scenarios	Please clarify as appropriate	The text has been revised. Both trajectories include the ambition to reach net-zero GHG emissions by or around 2050.
207	6.3 "The time trends in the target variables" Do I understand this paragraph correctly that this is actually not a limitation because you are not reporting, e.g., GDP but the difference in GDP between the policy scenarios and BAU? If my understanding is correct, this paragraph should perhaps not be the first one in this section.	Please revise as appropriate	The text has been revised. Both trajectories include the ambition to reach net-zero GHG emissions by or around 2050.
208	6.3. "The implication for this limitation is that impacts on these economies might be underestimated or overestimated." Am I correct that countries with both poor trade data and a higher-than-average reliance on maritime transport would have higher impacts than reported, and countries with both poor trade data and a lower-than-average reliance on maritime transport would experience	Please clarify as appropriate	The text has been revised. Both trajectories include the ambition to reach net-zero GHG emissions by or around 2050.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	lower impacts than reported? If so, please explain this in the report.		
209	6.3 "Therefore, this limitation is likely to result in the findings and outcomes being on the conservative side. From theory, the results presented here should rather overestimate than under-estimate the magnitude of the negative impact on GDP, as adjustments in transport demand can be expected to be done by market actors with the aim to reduce costs." Are these two sentences linked? Does 'conservative' in the first sentence mean that the impacts are overestimated rather than underestimated? Or do these two sentences express two different issues?	Please clarify as appropriate	The text has been revised as reflected in the final report.
210	6.5.1 "However, countries that are most strongly impacted by increases in maritime logistics costs, are the structurally vulnerable economies of the LDC grouping." Are the 'structurally vulnerable economies' a subset of LDCs or are LDCs characterized as 'structurally vulnerable economies'? the sentence is not clear. If 'structurally vulnerable economies' are a subset, please explain what 'structurally vulnerable' means.	Please revise as appropriate	After further reflection, we considered that the assessment of the degree of structural vulnerability was beyond the scope of the report and that it did not add any significant value to the analysis. We have therefore dropped this characterization from the sentence.
211	6.5.7 Please include a statement that costs (either macro-economic costs or costs of compliance) could not be compared to effects (GHG reductions) as the latter was beyond the scope of the report.	Please revise as appropriate	The text has been revised as reflected in the final report.
212	6.6.3 "However, building on past experience with shipping regulatory measures, the COVID-19 pandemics, the war in Ukraine and disruptions to maritime chokepoints such as the Suez Canal or the Panama Canal, shipping networks and patterns can be volatile." 1. Has this really been the case for 'shipping regulatory measures'? if so, which? 2. I agree that unexpected developments like the ones mentioned have significant impacts on shipping networks. However, the policy scenarios studied in this report are not unexpected and shipping companies will be able to	Please revise as appropriate	The text has been revised as reflected in the final report.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	anticipate their impacts. I therefore think the comparison is inappropriate and should be deleted.		
213	6.6.3 "Some levy scenarios may lead to considerable changes in import and export volumes, potentially altering port-calling frequencies and connectivity for specific economies" Please quantify 'considerable'.	Please revise as appropriate	The text has been revised as reflected in the final report.
214	6.6.5 "Developing economies and LDCs are expected to see a decrease in export competitiveness due to higher maritime logistics costs, leading to potential substitution of imports in their main markets." 1. LDCs are a subset of 'developing economies' and not a separate category, so 'and' should be replaced by 'including', or 'in particular' or something similar. 2. Why do only developing economies experience a decrease in export competitiveness? Isn't this the case for all economies? Exporters from developed countries using maritime transport will also see freight rates increase.	Please revise as appropriate	The text has been revised as reflected in the final report.
215	6.6.6 Can the cost increase also be compared to: 1. The cost increase due to the 2020 sulphur regulation; 2. Cost changes brought about by oil price fluctuations?	Please revise as appropriate	The text has been revised as reflected in the final report.
216	Page 3 "DNV's report defines two GHG emission trajectories to 2050: Base and Strive"	Please add that both emission pathways are defined on a well-to-wake basis (even though the policy scenarios are either WtW or TtW + sustainability criteria)	The text has been revised as reflected in the final report.
217	Page 4 "For each of the scenarios featuring a levy, the impacts of four different revenue disbursement schemes	Suggest to specify "For each	The text has been revised as reflected in the final report.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	are considered" Suggest to specify "For each of the scenarios featuring a levy, the impacts of four three different revenue disbursement schemes are considered, as well a control case" and make consequential amendments to the remainder of the paragraph.	of the scenarios featuring a levy, the impacts of four three different revenue disbursement schemes are considered, as well a control case" and make consequential amendments to the remainder of the paragraph.	
218	Section 2 "methodology: In my view, this section doesn't need to be in the executive summary. However, if it is retained, it should have a proper lead in, such as e.g. "The impacts of the policy measures on GDP, imports, exports and consumer prices, were modelled as follows:"		The text has been revised as reflected in the final report.
219	Section 2 "methodology": If this section is retained, it should make a reference to Circ.885/Rev.1, and specifically to paragraph 18 ("The assessment of impacts on States consists in translating the impacts on the fleet to impacts on States (e.g. trade and GDP changes), ideally using a computable general equilibrium (CGE) model combining economic trade modelling and transport/logistics modelling with a shipping module, if available.")		The text has been revised as reflected in the final report.
220	Page 5, paragraph starting with "Changes in shipping time are subsequently converted into …": This paragraph should specify that the macro-economic workstream deployed the GTAP model, a CGE model.		The text has been revised as reflected in the final report.
221	Page 5-6 paragraph starting with "For scenarios that lead to the accumulation of revenues, …": Suggest not to refer to sections in the report, as the executive summary should		The text has been revised as reflected in the final report.

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
	be a self-standing document. "For scenarios that lead to the accumulation of revenues, the Revenue Workstream needs to be run. The revenues remaining after rewarding eligible fuels were allocated to eligible countries according to the magnitude of the negative impacts of the measures without revenue disbursement and the income per capita. Three disbursement scenarios distinguished three groups of eligible countries: all countries; all developing countries; and SIDS and LDCs.'		
222	Page 6 "The above actions are executed for every selected policy scenario (Table 1), where applicable with the four different revenue disbursement schemes,": As per above: "The above actions are executed for every selected policy scenario (Table 1), where applicable with the four three different revenue disbursement schemes,"		The text has been revised as reflected in the final report.
223	Caption below Figure 2 Do I understand correctly that the SSP2 scenario is used as BAU? If so, please specify: "The BAU growth assumptions follow forecasts by the International Institute for Applied Systems Analysis (IIASA), SSP2, released in January 2024."	Please revise as appropriate	The text has been revised as reflected in the final report.
224	Figure 3 This figure needs a caption. That caption should, amongst others, explain that scenarios 26 and 32 are combined with a revenue distribution scenario in which revenues are disbursed to all developing States. '(developing)' should then be deleted from the agenda, because it is confusing without explanation.	Please revise as appropriate	The text has been revised as reflected in the final report.

	Comments/questions/remarks by Steering Committee	Action to take	Response by UNCTAD
	Saudi Arabia		
225	The report by UNCTAD acknowledges that the selected scenarios aim to represent the diverse perspectives of the Steering Committee members. However, it is important to note that the four policy scenarios analysed in the report are based on the levy. We're concerned that this might not be a fair basis to compare different scenarios, and we would like to highlight the importance of considering other elements like IMSFNF in the analysis to ensure a comprehensive and balanced comparison of different scenarios.	Please clarify as appropriate selection of scenarios	Step 2 of UNCTAD's analysis simulated the impacts of scenarios without the levy as per agreement with the SC.
226	We would like to reiterate China's suggestion to include in the executive summary a paragraph stating that the modelled revenue distribution is focused on the out-of-sector perspective only. And highlight that the In-sector revenue distribution has not been modelled due to time constraints and the limitations of the model used.	Include limitations in the Executive Summary	Limitations have been included as reflected in the final report.
227	1- The country classification should be the UNFCCC classification, not the World Bank classification. 2- More emphasis on the negative impact of the levy on developing countries.		*Comment received after the 11th meeting of the Steering Committee: due to time constraints and given the fact that some comments are similar to those comments received prior to SC 11, UNCTAD was able to address many editorial comments as well as the substantive comments that could be implemented in a straightforward manner i.e. not requiring significantly additional time and action.*

Comments/questions/remarks by Steering Committee		Action to take	Response by UNCTAD
United States			
228	The report should include a copy of the terms of reference (as an annex).	Please provide additional information	The text has been revised as reflected in the final report.
229	Page 17 – what are the "correction factors" applied and what are the assumptions/basis that guide these correction factors?	Please clarify as appropriate	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us. In the meantime, and in addition to the WCD, you may wish to note the following regarding the MDST Containership Databank. The latter contains operational details of the world container carrying fleet and 30 fields of information for every vessel, including operator, service, route, TEU, service frequency, port rotation and much more. The service deployment of individual vessels in the fleet frequently changes. The Containership Databank, in its current format has been produced since 2006.
230	There needs to be a sensitivity analysis for scenarios with revenue disbursement that consider a situation where not all revenues are disbursed, meaning a situation where only 50% or 30% of annual revenues are effectively disbursed. The model assumes 100% effectiveness in the disbursement of revenue, an assumption that is not usual for any existing MDB fund.	Please provide additional information	Due to the time constraint, it was not possible for UNCTAD to model a smaller percentage of revenues disbursed to States to the effectiveness of the allocation mechanisms. Although we expect that trends would remain similar.

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ANNEX 3

COLLATION OF COMMENTS BY EXTERNAL QA/QC REVIEWERS AND RESPONSES PROVIDED BY UNCTAD

The following table collates the comments on the first and second part of UNCTAD's draft final report, received from the five external quality assurance and quality control (QA/QC) reviewers nominated for Task 3 (Impacts on States) by members of the Steering Committee from China, Japan, Singapore, United Kingdom and United States, as well as the responses provided by UNCTAD.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
	Reviewer 1 - Singapore	
	Round 1 – First part of UNCTAD's draft report	
1	Section 2.1: Please give more detailed explanations of the selection of 10 scenarios modelled by DNV, considering the specific requirements in the revised work plan of Task 3 (including 8 items on impacts and 6 aspects in the modelling results).	The text has been revised as reflected in the final report.
2	Section 2.2: When introducing the four revenue disbursement schemes in the last paragraph, please describe the disbursement schemes according to population, per capita GDP, or other key indicators.	The analysis on simulations of revenue disbursements according to population and % change in GDP has been described in section 3.5 of the final report.
3	Section 3.2, "UNCTAD modifies the maritime trade costs recorded in GTAP for each bilateral trade flow by commodity group.": Please elaborate on the modifications made and how these cost figures were further updated from 2017 to 2023, as the GTAP database records the data for the year 2017.	The GTAP data are first updated, starting from a base year of 2017 (GTAP version 11) to the year 2023 using the GTAP recursive dynamic model (Aguiar et al., 2017) with capital accumulation mechanism. This step entails imposing economic projections to a future year based on actual real GDP, labour force, and population growth. From 2023 to 2030, 2040, and 2050, an interim baseline is created based on the Shared Socioeconomic Pathways SSP "Middle of the Road" scenario with specific assumptions on the development of labour force, real GDP, and population. The baseline does not impose any trade costs changes, i.e.,

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
		trade costs associated with delivering goods from one country to another move in proportion to trade changes and are also affected the interaction between supply and demand for transport services. This is further described in relevant section of the final report. The share of maritime costs in the price of goods is not updated from 2017 to 2023. The report may have been misleading and has been changed.
4	Section 3.2, "These second-round effects are small compared to the first-round effects": Please give more evidence on the relative size between first-round effects and second-round effects using simulation or relevant studies reported in the literature. What would be the potential risks or uncertainties on the impacts on desired indicators (e.g. GDP, imports/exports, price).	The text has been revised to improve clarity as reflected in the final report.
5	Section 3.3: Different recent years are mentioned in different sections, such as 2017, 2022, and 2023. Please make sure the actual starting year (2022/2023) used for future projections (2030, 2040, and 2050) is consistent in the data treatments and impacts analysis using the CGE/GTAP model.	The test has been amended to ensure that the referenced points in time are well reported as reflected in the final report.
6	Section 3.3: This is a very important data treatment using the data from Task 2. A flow chart would be helpful in guiding the scope and coverage of the different data treatments discussed in this section.	The test has been revised to improve clarity on methodology as reflected in the final report.
7	Section 3.3: For the "Goods are allocated to different size classes of ships proportionally to their overall capacity", are there any specific treatments on typical goods transported by specific ships, such as crude oil by oil tankers and LNG gas by LNG tanker?	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us.
8	Section 3.3, paragraph after Eq. (5): What are the mapping tables of the 19 subregions and 11 commodity/sectors with the most detailed country and commodity levels? How significant are the correction factors applied in the adjustment? What are the least representative container ships in the MDST database?	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
9	Section 3.4: In the paragraph before Table 2, please explain the features of the data (e.g., variables, time period, etc.) and give the multinomial logit model in the main text. The reference cited (de Jong, 2007) is not listed in the reference unless it should be de Jong (2014).	Citation has been corrected; the specification of multinomial logit model has been added to the text as reflected in the final report.
10	Section 3.5, "We assume that revenues collected in the period up to a snapshot year, xxx, are disbursed in equal proportions each year over that period": What are the justifications for assuming such revenue disbursed periods? Why not disburse yearly or using a small time period, e.g. 5 years (2027-2030, 2031-2035, etc)?	The calculated annual revenue streams passed to Task 3 from Task 2 have been reported in equal proportions for the respective time periods. Therefore, the average over any time period would be also in the same proportion.
11	Section 3.5, Eq. (7): What are the available revenue disbursement options considered? See, for example, the methods used by Sheng et al. (2018; Energy Economics 74, 107-119). Why did the authors select the one in Eq. (7) in the analysis? Shall we consider other options, and how will the selection affect the impact analysis results?	The revenue disbursement options considered in this report were agreed by the SC members.
12	Section 3.6: With the high cost of international shipping due to levy, there is the possibility of shifting the transport mode to land transport (such as truck and train) and even internal sea transport. How does the GTAP/CGE model conduct the analysis in such an issue, which is highlighted in the revised work plan – results (point 2)?	Please refer to Section 6.3 of the final report. We do not model the modal shift from say sea to land. See limitation section 6.3. We do not have domestic trade. GTAP only captures international trade.
13	Section 3.6.1, for the sensitivity analysis: Please elaborate on the key focus of the sensitivity analysis conducted. What are the key variables or aspects being considered in the sensitivity analysis?	The text has been revised to improve clarity as reflected in the final report.
14	Section 3.6.1: To better reflect the analysis for SIDS and LDCs, it is preferred to maintain the high resolution of country and sector levels in the impact assessment. Why did the authors aggregate the 160 economies in the GTAP into 116 economies, and which of these around 40 economies are aggregated?	Aggregating to 112 was necessary because the model did not converge to a new equilibrium. It provided for several economies corner solutions mostly for some smaller economies. Also, some European economies were grouped to ensure convergence. The aggregation is shown in the accompanying excel file.

Comments/questions/remarks by QA/QC external reviewers		Response by UNCTAD
15	Section 3.6.1: When updating the base year 2017 in the GTAP database to the more recent year 2023, what are the key variables used by economies and sectors? Due to the impacts of COVID-19, data accuracy in the starting year 2023 needs to be cross-validated.	The GTAP data are first updated, starting from a base year of 2017 (GTAP version 11) to the year 2023 using the GTAP recursive dynamic model (Aguiar et al., 2017) with capital accumulation mechanism. This step entails imposing economic projections to a future year based on actual real GDP, labour force, and population growth. From 2023 to 2030, 2040, and 2050, an interim baseline is created based on the Shared Socioeconomic Pathways SSP "Middle of the Road" scenario with specific assumptions on the development of labour force, real GDP, and population.
16	Section 3.6.1: For the interim baseline from 2023 to 2030, 2040 and 2050, please list the key variables/assumptions used from the SSP "Middle of the Road" scenario on labour, GDP and population, and others (e.g. capital and trade) by country in the CGE modelling analysis.	The GTAP data are first updated, starting from a base year of 2017 (GTAP version 11) to the year 2023 using the GTAP recursive dynamic model (Aguiar et al., 2017) with capital accumulation mechanism. This step entails imposing economic projections to a future year based on actual real GDP, labour force and population growth. Moreover, from 2023 to 2030, 2040 and 2050, an interim baseline is created based on the Shared Socioeconomic Pathways SSP "Middle of the Road" scenario with specific assumptions on the development of labour force, real GDP and population.
17	Section 3.6.2, "the same scenario with and without revenue distribution cannot be compared" and "scenario that generated revenue in the simulation with revenue distribution can be compared with other scenarios that have no revenue": the discussions in this paragraph are quite confusing. Can the authors elaborate more on how the comparison should be done to assess the impact of revenue disbursement, using the actual scenarios conducted as an example?	What is meant is that scenario 26 has a levy and needs to be modelled with revenue distribution because there is revenue generated. But, to assess the impact of 26 on countries and determine how much they will get as a share from the total revenue, artificially we needed to model 26 without generating and distrusting revenues. The latter is artificial and cannot be compared with scenario 26. But scenario 26 (with revenue distribution) can be compared with e.g. scenario 21 (which had no revenue distribution).
18	Section 3.6.2, "The international maritime sector is not modelled in great detail in GTAP, as in other global CGE model, xxx": Can the authors explain further the potential impacts of such limitations of modelling the international maritime sector in the global CGE model?	This has been discussed in Section 6 of the final report. The only limitation is that the revenue cannot be provided to, for example, the port infrastructure used for international shipping. This is because the port infrastructure for international shipping is not a variable that can be changed in GTAP. It can be expected that if it could be given to "in-sector", the increase in trade costs would be slightly lower but the impact on GDP

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
19		would be slightly more negative because now the money is used most efficiently. The impact is very small (except perhaps for some LDCs and SIDS) because for most countries the revenue is not high in relation to their trade and GDP.
19	Section 3.6: The baseline does not assume any mitigation effects done by various countries to fulfil their NDC and net-zero commitments. What will be the interactions between domestic mitigation impact and the impacts of measures that happened in international shipping?	This has been discussed in Section 6 of the final report.
Round 2 – Second part of UNCTAD's draft report		
20	Section 4.1, Table 5: For the results on shipping time cost, why did the levy scenarios 26/46 and 31/32 have quite different impacts? Does it mean the levy levels have a significant impact on the results?	Yes, levy levels have impacts on ship speed where higher levy levels cause ships to have a stronger reduction in their speed to reduce operational costs. In turn, this stronger speed reduction also results in higher shipping time costs in scenarios with higher levy levels.
21	Section 4.1, Table 5: It is quite interesting to know the impact results for the years 2030 and 2050 are different. Could the authors add more explanations on the change of impact levels between 2030 and 2050 across scenarios?	The magnitude of the impact of the measures on maritime logistics costs, generally increases throughout 2030 until 2050 across all scenarios. This is primarily driven by the increasing stringency of the measures to comply to the GHG emission reduction trajectory towards 2050, which are also captured in all scenarios.
22	Section 4.1, Table 6: I like this table as it shows the impacts at the commodity level, which gives clearer explanations of the aggregate results, as shown in Table 5. Could the authors also include the commodity-level results for 2030 and 2040 in the report or at least in the Appendix?	Additional tables have been produced for the year 2030 and 2040.
23	Section 4.2, Table 7: For the impact on the logistics cost of imports, the results of SIDS are very close to those of developed countries, while the results of LDCs are very close to those of developing economies. In the consequent results, such patterns changed a bit. Could the authors add more discussions on such patterns? Similar commodity-level results (e.g. for the year 2050) as those in Table 6 would be useful for the explanations.	Discussion elaborating on the pattern is added to the final report. However, given the tight timelines and the pressure to finalize the report UNCTAD was not able to provide commodity level results now.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
24	Section 4.3, Table 8: Could the authors link the results on imports (Table 7) and exports (Table 8) together in the explanations? Similar commodity-level results (e.g. for the year 2050) as those in Table 6 would be useful for the explanations.	We have added additional explanation to link the two impacts as reflected in the final report. Nevertheless, to avoid speculation, more investigation which takes more time might is required to better explain the patterns.
25	Section 5.1, Table 9 and Table 10: These two tables show the average values of CIF-FOB margins by commodity group and trade in the GTAP database. Could the authors include the range of these values across countries/regions, such as the minimum and maximum values, in the table for comparisons?	Table updated as reflected in the final report.
26	Section 5.2, Table 11: It is quite surprising to see the increase in export quantity in the SIDS, quite different from other groups. Could the authors include the impact results at the commodity level (similar to Table 6) to show why certain commodities increase the export quantity in SIDS versus other groups?	It was not possible to address this comment given the time constraint.
27	Section 5.2, Table 12, 13 and 14: Could the authors add more detailed results at the commodity-level (similar as Table 6) to supplement the discussions at the aggregate level?	It was not possible to address this comment given the time constraint.
28	Section 5.3: The current report discusses the impacts for scenarios before and after revenue disbursements in two subsections (5.3.1 and 5.3.2), which are not easy to compare the impacts of results by revenue disbursements. Would it be better to combine them together, including the tables shown in these two subsections?	This order has been decided to achieve a balance between different views expressed by the SC members.
29	Section 6.1.1: Pleases discuss the findings for 2030 first and then 2050, and add some explanations (if possible) to the changes happened in 2030-2050.	Reversed order and added a section on differences between 2030 and 2050, as reflected in the final report.
30	Section 6.1.4: Please also include the discussions for year 2030 and the changes happened in 2030-2050.	Text has been added to this effect, as reflected in the final report.
31	Section 6.2: I didn't find the sensitivity results in the final report. Can the authors include them in the Appendix of the report and link the findings with the specific tables/figures shown in the Appendix on sensitivity analysis?	There are no specific sensitivity studies undertaken, these findings are drawn from comparing the scenarios modelled given they feature systematic variations. Clarification of this and the approach taken has been inserted into the final report.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
32	Section 6.3: This section is well-written. The authors are suggested to add the feedback loops between DNV's analysis and UNCTAD's analysis, as DNV's results will not be further updated based on the impacts/findings reported in UNCTAD's analysis. Besides, the different revenue allocation schemes or designs might also affect the study results as well.	Now included as reflected in the final report.
33	Section 6.5 and 6.6 (should it be Section 6.4 and 6.5?): When discussing the terms/results covered under Task 3, it would be better to explain how the current analysis helps to address certain portions of various terms/results specified under Task 3's revised work plan, and follow with the parts that can't be covered due to various constrains.	Text has been revised as reflected in the final report.
Reviewer 2 – United States		
Round 1 – First part of UNCTAD's draft report		
34	3.1."we mostly calculate" - is there an exception?	The text has been revised as reflected in the final report.
35	Equation 1. subvariable "i" not defined. Is it 'interest? Is it impact?	Equations and explanations have been revised as reflected in the final report.
36	the example is not intuitive. Partially because GDP is not labelled on the axis in figure 1. It should also be highlighted earlier in the paragraph that in the given example, GDP is the Y i,s,t or dependent variable. Also, should connect the values in the paragraph to their subsequent variables in the equation.	Equations and explanations have been revised as reflected in the final report.
37	Figure 1. 'change' looks like a constant. Indicate with two vertical lines or shaded areas.	The example is illustrative.
38	Figure 1. Why not use 2030. 2040, 2050 in the x axis?	The example is illustrative.
39	Ad-valorem is not a commonly known term	The text has been revised as reflected in the final report.
40	pg. 11 is there an assignment based on a voyage ID? What is defined as a voyage?	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us.
41	Why is there modification needed to GTAP for maritime trade costs? What step in the GTAP modelling is it modified?	The text has been revised to improve clarity as reflected in the final report.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
42	Why was inflation the method?	The text has been revised to improve clarity as reflected in the final report.
43	What is the literature to back up the claim that "second-round effects are small compared to the first-round effects" or was it a preliminary result?	The text has been revised to improve clarity as reflected in the final report.
44	For better understanding I suggest moving the last paragraph on pg 11 to the second paragraph, since it outlines the structure of the modelling framework	The text has been revised to improve clarity as reflected in the final report.
45	pg 13 - can there be. Link to Marine Benchmark's website/methodology? Curious to know how they define laden and ballast	Marine Benchmark defines laden and ballast for tank and bulk based on Intake calculated from draft with the Marine Benchmark ship specific methodology. Marine Benchmark then compares Intake with Marine Benchmark calculated ship individual max cargo capacity in ton and set the vessel to loaded if exceeding 77%.
46	Suggestion to add a context bullet for WCD like the other databases here	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us.
47	please define the difference between route and voyage	The text has been revised to improve clarity as reflected in the final report.
48	how is a fleet defined? By ship type? By route type?	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us.
49	Does by hour by fleet accurately determine costs? That seems that it would artificially increase the denominator and therefore deflate the cost.	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us.
50	there is no direct connection to the term 'fleet segment" in Task 2, and multiple versions of segmentation within the task 2 report.	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us.
51	pg. 14 'captured deposit expenditure'	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us.
52	Equation 4	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us.
53	3.4 - reason why tons and not metric tonnes?	The text has been revised to improve clarity as reflected in the final report.
54	3.4 Define 'shippers' - ship owners? Brokers?	We have asked MDST to provide more information on this aspect. We will share when additional information is made available to us.
55	Table 2 - is their elasticity in these figures?	If table 2 is related to the Value of Time, we have added an additional explanation for the model used to estimate the value of time which is consistent with the literature and only results in a single value for each

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
		commodity instead of a range. To derive a range for VoT for global commodities will require dedicated research which is out of the scope of the current project.
56	Equation 7 - I do not understand variable r	The text has been revised to improve clarity as reflected in the final report.
57	Equation 7 - population size - is this standard practice for a denominator? It will be biased	The methodology has been agreed during the SC meetings.
58	Level 1 and Level 2 criteria should be defined, at least in a footnote if its common practice	The text has been revised to improve clarity as reflected in the final report.
59	Equation 9 + 10 define subvariable j	The text has been revised to improve clarity as reflected in the final report.
60	The equation for total disbursement (R) considers the summation across countries, but it's not entirely clear how it relates to the constant "a". It might be helpful to show how "a" is derived or determined to ensure the total disbursement adds up as intended.	The text has been revised to improve clarity as reflected in the final report.
61	From what I know about the GTAP, it assumes perfect competition, meaning no entity has significant effect over the market. Isn't this not the case when we single out the shipping industry?	Indeed, and this is why it was hard to single out in-sector and outdo sector impacts of the examined policy scenarios in GTAP.
62	A brief sentence on iceberg costs would be helpful	Modelling trade costs via the iceberg method was introduced by Samuelson (1954) based on the idea that the value melts away during transit. The iceberg method results in lower effective volume of goods arriving in the destination country relative to those sent by the exporting country. A note has been added to the final report.
63	Equation 4/5 - what's definition of o and d point	Origin and Destination points. Export and Importer.
64	Equation 5 – is/are the C variable's (cost) being multiplied by the T / A variables?	C variables are divided by A distance.
65	Table 14 - Billions?! Also shouldn't there be a note that the 2030 is only 2027-2030	2030 is the expected change of the end of the period 2023 to 2030.
66	Table 4 - please report out the BAULG from DNV amounts and impact amounts before translating to percent difference	Revised as reflected in the final report.

Comments/questions/remarks by QA/QC external reviewers		Response by UNCTAD
67	I will be presuming the BAULG value is the 9620 billion in aggravated costs from table D-21. therefore table 4, the Maritime transport cost under scenario 26 for 2030 is 13275.6 billion.	The text has been revised to improve clarity as reflected in the final report.
68	I would like to try and back calculate the costs, but I would need access to the breakdown by fleets for the numerators for the two cost equations (eqn 4 and 3). Also identify how the Marine Benchmark is close to/ different to DCS or AIS like the comparison in Table E1 (DNV)	All Marine Benchmark data are based on vessels' individual parameters and AIS positions every 10 minutes. Marine Benchmark creates a ship individual digital twin of all vessels in the work fleet. Marine Benchmark does not have access to DCS.
Round 2 – Second part of UNCTAD's draft report		
69	Pg 13 UNCTAD highlights they modify GTAP for baseline scenarios - please identify which step in GTAP is specifically modified	The GTAP data are first updated, starting from a base year of 2017 (GTAP version 11) to the year 2023 using the GTAP recursive dynamic model (Aguiar et al., 2017) with capital accumulation mechanism. This step entails imposing economic projections to a future year based on actual real GDP, labour force and population growth. Moreover, from 2023 to 2030, 2040 and 2050, an interim baseline is created based on the Shared Socioeconomic Pathways SSP "Middle of the Road" scenario with specific assumptions on the development of labour force, real GDP and population.12 Starting from this baseline, the trade costs in the GTAP model are shocked based on the maritime logistics costs effects caused by the GHG emission from ships reduction measures under the various scenarios for each 2023–2030, 2030–2040 and 2040–2050. The trajectory between the three periods is not assessed; information is only provided for the final point of each period, not for every year within these periods. The results from these scenarios are then compared relative to the BAULG scenario.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
70	Section 3.3 WCD, GCD, and Marine Benchmarks are three separate datasets that are attached with Task 2 data and fed into GTAP. How are we supposed to ensure the accuracy of the final output if we don't have the input data to review?	We have asked MDST to provide additional information. We will share when made available to us.
71	pg. 16 Omitting cruise and miscellaneous fishing from the data set means it will skew the economics for smaller island states that depend on those industries.	We have asked MDST to provide additional information. We will share when made available to us.
72	pg. 17 - correction factors for non-maritime transport? Why is this needed? What is this correction factor?	We have asked MDST to provide additional information. We will share when made available to us.
73	Per my previous comment, I would like to know the methodology of Marine Benchmark determination of laden and ballast voyages.	Marine Benchmark defines laden and ballast for tankers and bulk carriers based on Intake calculated from draft with the Marine Benchmark ship specific methodology. Marine Benchmark then compares Intake with Marine Benchmark calculated ship individual max cargo capacity in ton and set the vessel to loaded if exceeding 77%.
74	Equation 7 Is there literature precedent, or a reasoning for the revenue distribution scheme to be based simply on change of GDP and population size?	The revenue distribution schemes were agreed during several SC meetings.
75	Equation 9 and 10, please specify the variable 'j' (currently looks like a mix up with 'i')	Equations have been revised. j is the index of the countries included in the sum of equation 11
76	3.6.1. the termed 'shocked' is used several times - how is this different from impact?	The term shock is used in CGE modelling when an exogenous variable is changed. Other terms could be changed or modified. The impact is the result of a shock/change.
77	3.6.1 "Starting from this baseline, the trade costs in the GTAP model are shocked based on the maritime logistics costs effects caused by the GHG reduction measures for maritime transport under the various scenarios for each period," - is this the step that is modified for maritime logistic costs as mentioned in 3.2. ? if that's the case is it shocked or modified that should be used here?	Both, shocked or modified are correct in our view. What we mean is that trade costs are (indirectly) changed by changing / shocking / modifying exogenous variables that impact trade costs.
78	Figure 3. and Figure 4. Look as though they are faulty since there should be several lines visible according to the legend.	Due to the very small % difference in real GDP impacts of the examined scenarios and the BAULG, the differences are almost not visible in the figures.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
	Reviewer 3 - China	
	Round 1 – First part of UNCTAD's draft report	
79	Need to add explanations of some acronyms, e.g., txs, tms, etc., to enhance readability	It is not an acronym but the "name" of a variable in GTAP. Some delegates wanted these technical details. The meaning of these variables/names are explained in 4.6.1. of the final report.
80	What is the main basis for "the number of model runs has been restricted to 22."described in P7	Decision based on agreement with SC.
81	P7 focuses on the low-growth scenario, which is a relatively strong assumption and generally results in optimistic results and conclusions, which need to be emphasized later when drawing conclusions.	The text has been revised to highlight the BAU low growth implications as reflected in the final report.
82	Suggested additional details to supplement explanation the consideration of "P8 table 1 for the GFI set specific values to obtain is the upper limit(120%) or lower limit(80%)",because this scenario in the parameter settings have a greater influence on the final result.	The text has been revised as reflected in the final report.
83	In the description of the four scenarios in the second paragraph on P9, it is not clear whether the specific allocation principles in each scenario are applied sequentially or whether only one principle is utilized in each scenario.	Ther text has been revised as reflected in the final report.
84	The definition of "Impact" and "change" in P9 are not clear. Need to emphasize that one is a deviation from the baseline and the other is a deviation from the base year, and to explain that deviations from the baseline focus on assessing the effects of policy measures and deviations from the base year focus on assessing the effects of measures before and after their implementation	The text has been revised as reflected in the final report.
85	The fourth paragraph in P11 needs to emphasize that the assessment of this study is a static impact	The text has been revised as reflected in the final report.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
86	P14 Footnote 3 is in the wrong place, it should be the footnote that follows that definition	The text has been revised as reflected in the final report.
87	P15 the fifth paragraph suggests specificity in the form of examples to increase readability, otherwise it is too specialized.	The text has been revised as reflected in the final report.
88	P19 the order of sectors in table3 is recommended to be consistent with table2, otherwise it may lead to confusion or ambiguity.	The text has been revised as reflected in the final report.
89	P19 3.5 the definition of developing countries utilizes the WB definition, however, this work is primarily a response measure under the UNFCCC and it is recommended that the country classification be aligned with the subgroups under the UNFCCC.	The text has been revised as reflected in the final report.
90	The first paragraph of P22 is poorly readable and it is suggested that the core points be given in concise language	The text has been revised as reflected in the final report.
Round 2 – Second part of UNCTAD's draft report		
91	Insufficiently concise summary of report conclusions: The main conclusions provided in the current report are merely descriptions of numerical results. The connection between these conclusions and their strong underlying assumptions has not been adequately explained. In the current version, these conclusions lack strong support from the quantitative analysis model tools.	The overall synthesis and discussion of the results section contained in in the final report as well as the limitations have been extended to explicitly link the conclusions to the assumptions and the quantitative analysis.
92	Overly simplistic design of important allocation mechanisms: The conclusion in section 6.1.1, "The scenarios with a higher levy price have the lowest global impact (both relative to lower GHG price scenarios, and relative to all other scenarios)," contradicts the common-sense conclusion that "higher carbon tax prices have a greater economic impact." This discrepancy indicates that strong assumptions have been made in the model mechanism, which do not align with reality, leading to ambiguous conclusions. The theoretical basis for the income distribution setting in model equation (7) has not been elaborated in detail. Why was this distribution method chosen? What are the	We acknowledge the concerns raised about the assumptions and the design of the allocation mechanisms within our model. However, modelling of the examined scenarios derives as a consequence of outputs of Task 2. Changes in transport costs between the examined scenarios modelled in Task 2 showed that transport cost increases for scenarios with a levy were smaller than scenarios without levy. As per Task 2, this is due to D4 reward for eligible fuels and that scenarios with a levy have a relatively larger uptake of e-fuels and a relatively lower use of onboard CCS.

Comments/questions/remarks by QA/QC external reviewers		Response by UNCTAD
	conclusions of other distribution methods? It is not credible to arrive at the conclusion of a smaller impact based on a single income distribution method.	
93	Overly simplistic selection of global impact indicators: The main finding in section 6.1.1 discusses the results of the policy implementation's impact on the global economy, indicating that the policy will have a negative effect. However, it does not provide conclusions on the impact of this policy on per capita income or per capita GDP. This omission leads to an incomplete conclusion, as the impact on the global economy's distribution range may not be consistent with the impact on per capita GDP.	The text has been revised as reflected in the final report.
94	The conclusion is biased and lacks detailed economic feedback mechanisms: The conclusions throughout the paper are based on low-growth trade scenarios. This underlying assumption needs to be clarified in the conclusions, as the current expression might cause misunderstandings, suggesting that imposing high carbon taxes and then redistributing them can offset negative impacts. The GTAP model's depiction of international shipping costs is rather simplistic. The quantitative analysis in this paper is based solely on static simulation results. However, an increase in international shipping costs will inevitably affect the substitution effects of other transportation modes, leading to further economic feedback.	The text has been revised as reflected in the final report.
95	The conclusions section of this final report is crucial. However, the current version lacks effective summarization and refinement. The results derived from quantitative analysis tools heavily depend on the model's assumptions. The conclusions drawn from these assumptions are not universally applicable and require careful expression to avoid confusion.	The text has been revised as reflected in the final report.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
	Reviewer 4 – United Kingdom	
	Round 1 – First part of UNCTAD's draft report	
96	I reviewed the Task 3 Part 1 draft final report last week and did not have comments at this stage. To elaborate on this, regarding the modelling approach, having the read the draft report and seen the presentation at the GTAP conference on this topic, I am content that this is the best approach that can be taken, and it is an interesting one as well … just novel enough! So, I support the approach as proposed. From a modelling point of view, I consider this is a solid approach and one we would adopt if we were asked to model a similar ask, so I am comfortable with the methods being used by UNCTAD. I'm very happy to review the full draft of this report when it is ready."	Noted with thanks.
	Round 2 – Second part of UNCTAD's draft report	
97	On the impact of the levy, is it fair to assume that the reduction in real GDP decreasing from 2030 to 2050 is also driven by the reduction in GHG emissions, thus a comparison to the impact of the fleet is reasonable (DNV report)	Yes, this is true. Relevant wording was added to the final report to explain some of the absolute impact results.
98	p 25: baselines are updated dynamically and then the policy simulations are assessed statically?	This is correct.
99	CPI: section 6.1.4. the highest CPI across all the scenarios assume that the increase in costs is passed on to the consumers. The LDC CPI being more affected: is it fair to assume that it comes from their imports increasing.	Yes, this can be the cause. However, because there are variabilities depending on the specific circumstances of the LDCs, UNCTAD has refrained from making too many inferences.
100	on section 6.2.1, the results can be drawn in parallel to the DNV report p.6. Is that reasonable?	Yes, and language to make more explicit links to DNV Task 2 when interpreting results has been added as reflected in the final report.
101	The fourth paragraph in P11 needs to emphasize that the assessment of this study is a static impact and how the years 2030, 2040 and 2050 are differentiated in the BAU	The baseline is dynamic.

Comments/questions/remarks by QA/QC external reviewers		Response by UNCTAD
102	Regarding the BAULG, I would like to see a section explaining how the BAULG was implementing and addressing the distortions caused by adjusting the baseline to reflect the LOW GROWTH projections.	As DNV did not provide UNCTAD with the underlying GDP and population growth assumptions from its modelling, UNCTAD used the most recent SSP2 projections. They are in line with the SSP2_RCP2.6 assumptions that were at the base of DNV's modelling.
103	BAULG: assumption of low growth is associated with which emissions trajectory?	The baseline run uses the latest SSP2 database which accounts for actual economic growth from 2017 to 2023, thereby reflecting economic disruptions caused by the COVID-19 pandemic all the way to 2050. As in all scenarios, the BAULG scenario imposes trade costs on the GTAP model based on the maritime logistics costs calculated from DNV for each 2023–2030, 2030–2040 and 2040–2050.
104	P 58, first paragraph, would be useful to understand the growth assumptions for LDCs over time.	There is some comment on this, but they vary significantly and so they are only described at high level as reflected in the final report.
105	p.11 how is the BAULG implemented in GTAP.	It is implemented in a similar way as the scenarios themselves: based on interim baseline the trade costs were shocked in a static version of the model for each time period.
106	P 24 second paragraph, definitions of ams, axs, tms, txs would be helpful	These are "names" of variables in GTAP. Some delegates wanted these technical details. The meaning of these variables/names are explained in 3.6.1. of the final report.
107	P 24. second paragraph, would be useful to add if sensitivities have been runned altering the equal proportion angle(regarding the importer or the exporter bearing the cost).	The text has been revised as reflected in the final report.
108	p 24, third paragraph: reference to the sensitivity analyses done should be used(what are the main points of the analysis)	The text has been revised as reflected in the final report.
109	p 24, fourth paragraph, I am confused about the language on the second sentence. Are the SIDS and LDCS grouped in a composite region? And how the 160 are actually splitted?	The text has been revised as reflected in the final report.
110	Section 3.2, "UNCTAD modifies the maritime trade costs recorded in GTAP for each bilateral trade flow by commodity group.": Please elaborate on the modifications made and how these cost figures were further updated from 2017 to 2023, as the GTAP database records the data for the year 2017.	To properly account for maritime logistics costs associated with trade for each commodity and bilateral pair, the trade costs shocks were imposed onto the GTAP model as a weighted share of commodity-specific maritime transport cost to CIF imports price for each trade node.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
111	Page 25: a reference to what the maritime logistic costs are would be helpful	The definition of maritime logistics costs is provided in the final report. Section 7.4 on calculating maritime logistics costs.
112	p. 22 eq 9: define j	j is the identifier of a country within the sum. Definition has been added.
113	page 25. second paragraph, please define the interim baseline and how it was chosen in reference to the BAULG	Details have been added as reflected in the final report.
114	p 25 transferred to GTAP regional household (see below) not sure what the below refers to	Reference is made to the last paragraph on regional household income allocation
115	I am not sure I understand the *timo* and which equations it refers to	A footnote has been added to clarify in the final report.
116	an important limitation of this work is the lack of reference to the emissions level and the changes imposed by the policies. P 58 exogenous transport demand mentions the impact on international trade but it will also have an environmental impact as well., compared to keeping the emissions constant	Discussion on this point has been added to the 'Limitations' section of the final report.
117	Table 4 - could a reference to the levels from the BAULG from DNV be made before translating to percentage changes	We have incorporated a reference to the increase in cost intensity across scenarios from DNV in the final report.
	Reviewer 5 – Japan	
	Round 1 – First part of UNCTAD's draft report	
118	Page 7, Section 2.1, paragraph 1, line 5 (Error! Reference source not found) should be fixed	Clarified in final draft report.
119	Page 9, Section 3.1, paragraph 2: The subscript "i" in equation (1) should be explained.	Clarified in final draft report.
120	Page 12: In the last paragraph, it is not clear what is the treatment of time in the model for the case of revenue disbursement. For example, after the run in 2030 with revenue disbursement, are these changes in GDP reflected in revenue disbursement criteria for the next run in 2040? If not, how does this affect the results?	

Comments/questions/remarks by QA/QC external reviewers		Response by UNCTAD
121	Page 14: It would be better to avoid using the same subscript "i" in both equation (1) for states (?) and equation (3) for fleet segment	Clarified in final draft report.
122	Page 16, Paragraph 3: What is the treatment for countries that belong to two regions in WCD, such as the US and Canada in North America West Coast and East Coast, in allocating the maritime transport costs to the state level to use in the CGE simulation step.	
123	Page 22, Paragraph 3: Further discussion could include other approaches using atmfsd (Lee, Chang, Lee, 2013) or both atmfsd and ams (Bekkers, Francois, Rojas-Romagosa, 2018). References E. Bekkers, J. F. Francois, and H. Rojas-Romagosa, "Melting Ice Caps and the Economic Impact of Opening the Northern Sea Route," The Economic Journal, vol. 128, no. 610, pp. 1095–1127, 2018, doi: 10.1111/ecoj.12460. T.-C. Lee, Y.-T. Chang, and P. T. W. Lee, "Economy-wide impact analysis of a carbon tax on international container shipping," Transportation Research Part A: Policy and Practice, vol. 58, pp. 87–102, Dec. 2013, doi: 10.1016/j.tra.2013.10.002.	
124	Page 23, Section 3.6.2, paragraph 1: It may be informative to report and compare the changes in levies/tariffs due to the changes in maritime logistic costs and those due to the revenue disbursement.	
125	Page 24, 25, 26: Table 4, 6, and 7, why are the differences between 26/46 and 31/31 in the impacts on maritime logistics costs reduced over time?	Clarified in final draft report.
126	Page 27: Table 8 and 9, is the subtitle "(Percentage difference to BAULG)" a typo?	Clarified in final draft report.
Round 2 – Second part of UNCTAD's draft report		

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
127	Page 14, Paragraph 1: It is not clear what is the treatment of time in the model for the case of revenue disbursement. For example, after the run in 2030 with revenue disbursement, are these changes in GDP reflected in revenue disbursement criteria for the next run in 2040? If not, how does this affect the results?	The text has been revised as reflected in the final report.
128	Page 17, Paragraph 3: What is the treatment for countries that belong to two regions in WCD, such as the US and Canada in North America West Coast and East Coast, in allocating the maritime transport costs to the state level to use in the CGE simulation step?	We have asked MDST to provide additional information. We will share when these become available to us.
129	Page 24, Paragraph 2: Further discussion could include other approaches using atmfsd (Lee, Chang, Lee, 2013) or both atmfsd and ams (Bekkers, Francois, Rojas-Romagosa, 2018). References E. Bekkers, J. F. Francois, and H. Rojas-Romagosa, "Melting Ice Caps and the Economic Impact of Opening the Northern Sea Route," The Economic Journal, vol. 128, no. 610, pp. 1095–1127, 2018, doi: 10.1111/ecoj.12460. T.-C. Lee, Y.-T. Chang, and P. T. W. Lee, "Economy-wide impact analysis of a carbon tax on international container shipping," Transportation Research Part A: Policy and Practice, vol. 58, pp. 87–102, Dec. 2013, doi: 10.1016/j.tra.2013.10.002.	Noted, with thanks.
130	Page 25, Paragraph 2: It would be informative to briefly discuss the closure of the trade balance, where a fixed trade balance could result in weaker economic growth and income effects and favour the changes in exporting industries (Jin and Burfisher, 2021). References	Task 3 involves obtaining a fixed amount of revenue to be disbursed as determined by DNV Task 2. Therefore, Task 3 imposes levies/tariffs that match the exact amount specified in Task 2. After assessing the shock required to collect the levy, this amount is subtracted from the total shock caused by changes in maritime logistic costs, ensuring that the overall impact remains neutral.

	Comments/questions/remarks by QA/QC external reviewers	Response by UNCTAD
	W. Jin and M. E. Burfisher, "Comparing Trade Balance Closures in the GTAP-Recursive Dynamic (GTAP-RD) Model Framework," U.S. INTERNATIONAL TRADE COMMISSION, Washington, 2021–01–A, 2021.	
131	Page 25, Section 3.6.2, Paragraph 1: It may be informative to report and compare the changes in levies/tariffs due to the changes in maritime logistic costs and those due to the revenue disbursement.	The current modelling employs an endogenous trade balance closure to facilitate analysis of economic adjustments associated with increased shipping cost. A fixed ratio of trade balance to world income closure for each country is not specified as this not only constrains economic adjustments but also limits cross-border investment flows.
132	Page 27, Table 5: The differences between high levy (26/46) and low levy (31/32) in the impacts on maritime logistics costs reduced over time. Is it because the speed adjustment is less pronounced over time?	Table 5 explains the relative impact on maritime logistics costs, by commodity, in 2050. The small difference in the impacts on maritime logistics costs between scenario 26-46 in 2050 is primarily caused by the requirement to reach net zero emissions by 2050. Our analysis shows shipping time and maritime logistics costs rise with different pace across the scenarios between 2030 and 2050 but level off at a similar level in 2050.
133	Page 44, Paragraph 2: "the impact of the policy measure after the revenue disbursement on LDCs increases imports by almost 19 percent under scenario 26 when revenues are disbursed to SIDS and LDCs only." It is not clear how this "19 percent" is calculated.	In the scenario when revenues are distributed to SIDS and LDCs only, LDCs receive a very high share of their GDP as revenue (up to a quarter of their GDP in 2030). This influx of capital is appreciating the currency of the LDCs. Resulting in comparatively cheaper imports and more expensive exports.
134	Page 46, Paragraph 2: The text explained that LDCs' exports decrease while their imports increase due to the appreciation of their currency (the real exchange rate) under the scheme in which revenues are disbursed to the SIDS and LDCs only. An additional explanation could be that domestic production does not keep up with the increase in consumer demand from the revenue disbursement.	Yes, this is correct. Productive capacities are also used at close to full capacity, impacting the export capacity.

Comments/questions/remarks by QA/QC external reviewers		Response by UNCTAD
135	Page 53, Paragraph 1, bullet point 2: Is "a minimum of -0.09 per cent" correct? Scenario 26 where revenues are disbursed to SIDS and LDCs shows -0.08 per cent change in 2050 in Table 23.	Text has been revised as reflected in the final report.
136	Page 53, Paragraph 1, bullet point 3: Is it correct that only scenario 22 shows the highest impact? All scenarios in Table 13 indicate real GDP change of -0.16 per cent in 2050.	This is correct when looking at higher fidelity (more significant figures). At the 2 sig fig displayed here, this detail is lost. Clarification has been added to the bullet point.
137	Page 53, Paragraph 1, bullet point 4: "The scenarios with a higher levy price have the lowest global impact (both relative to lower GHG price scenarios, and relative to all other scenarios)". Is it true that "the lowest global impact" refers to the highest absolute value of negative impact? Maybe a difference choice of words could be less misleading?	Yes, that is the meaning.
138	Page 57, Bullet Points 1 and 2: Are the comparisons between S22 and S36 in impacts on real GDP (less than 2 percent in the long run and less than 3 percent in the short run) calculated based on the values of column "World" in Table 7 (impacts on real GDP)?	Yes - clarification added as reflected in the final report.
139	Page 57, Bullet Point 3: "...the levy scenarios which are consistently lower impact in the long run, but also more variable in impact...This indicates that the long-run global impact on real GDP can be significantly reduced through the use of a levy, with the reduction in impact positively related to the GHG price (a higher GHG price creates a larger reduction in long run impact)". Do "lower impact in the long run" and "significantly reduced through the use of a levy" refer to higher absolute value of a negative impact? Different wording may be less confusing.	Yes - The wording has now been aligned to express impacts as either smaller or larger here and throughout the final report.

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