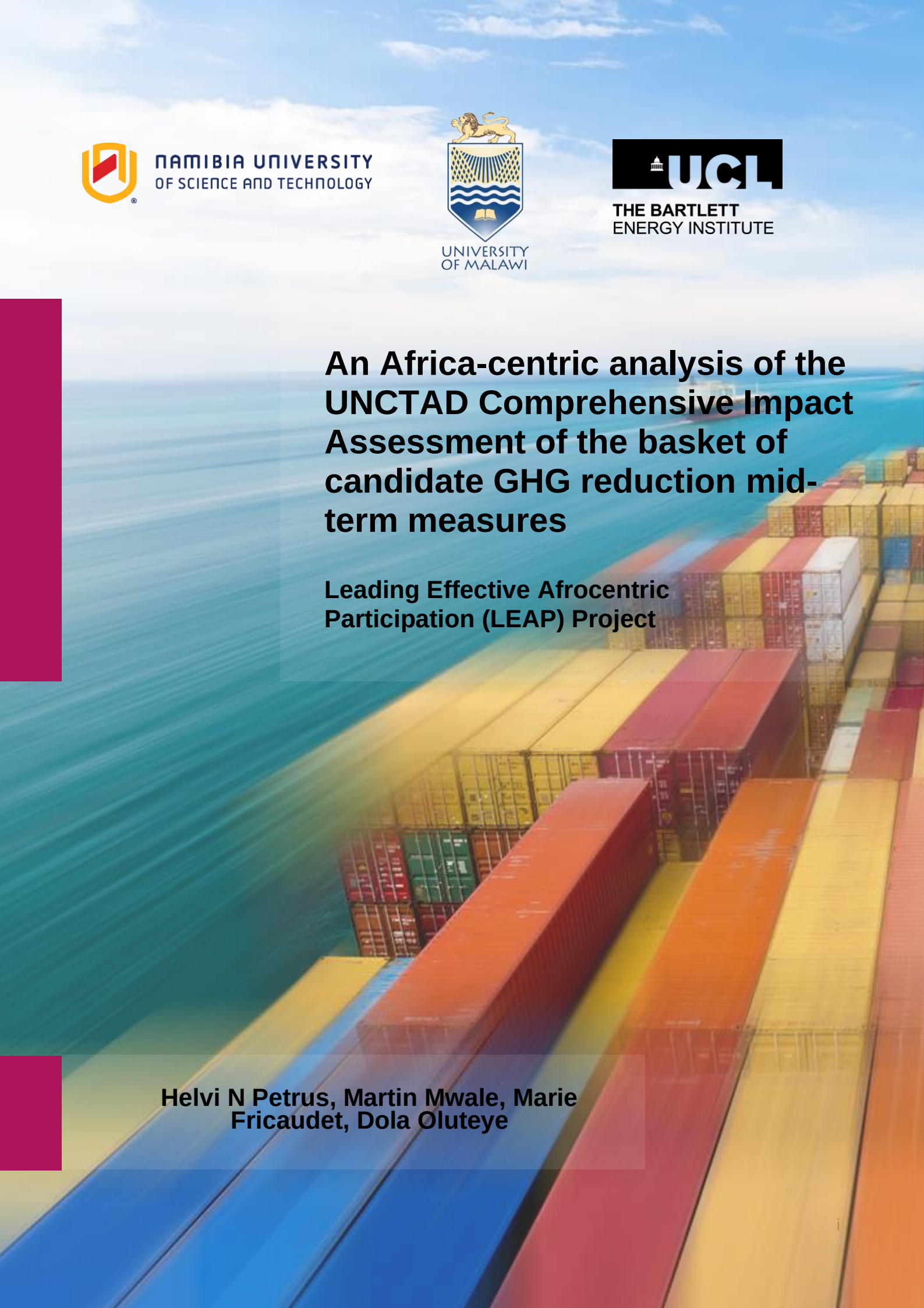

NAMIBIA UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY OF MALAWI

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# An Africa-centric analysis of the UNCTAD Comprehensive Impact Assessment of the basket of candidate GHG reduction mid-term measures

## Leading Effective Afrocentric Participation (LEAP) Project

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# Executive summary

The International Maritime Organization (IMO) has set ambitious targets to achieve net-zero greenhouse gas (GHG) emissions by 2050, with globally enforceable mid-term measures planned by 2027. These measures combine technical and economic measures to reduce emissions in international shipping while pursuing a just and equitable transition (JET), leaving no one behind. It is in the spirit of a just transition that the two measures apply a GHG intensity standard for marine fuels (referred to as global fuel standard (GFS)) and an emissions pricing mechanism (2023 IMO Strategy on Reduction of GHG Emissions from Ships, 2023) to decarbonise international shipping.

However, the transition to low-carbon shipping is anticipated to drive up transport costs, potentially impacting the global economy by increasing the average cost of goods. This burden is expected to fall disproportionately on lower-income nations, which are less equipped to absorb these additional costs compared to wealthier countries (Coleman, D.S., 2023; Querel, M., 2024). In recognition of these challenges, the IMO commissioned United Nations Conference on Trade and Development (UNCTAD) and Det Norske Veritas (DNV) to undertake a comprehensive impact assessment (CIA) of the basket of candidate GHG reduction mid-term measures on ten case studies, with two focused on Africa (Togo and South Africa).

This report, as part of the LEAP Project, provides a technical, evidence-based framing to help African states and similar economies understand the findings of the CIA to better support policymakers in interpreting, engaging with, and responding to policy proposals. The report evaluates the economic implications of the IMO's proposed measures, focusing on Gross Domestic Product (GDP), imports, exports, and consumer prices. It uses data from six African case study countries: Ghana, Kenya, Liberia, Malawi, Namibia, and Nigeria for the analysis across three-time horizons aligned with the IMO's GHG strategy checkpoints: 2030, 2040, and 2050.

**Key Policy Scenarios**

Four policy scenarios were analysed, where all incorporates a global fuel standard:

1. **Scenario 24**: No levy, no revenue distribution, and a flexibility mechanism.
2. **Scenario 26**: High levy with revenue distribution.
3. **Scenario 32**: Low levy with revenue distribution and a flexibility mechanism.
4. **Scenario 36**: No levy, no revenue distribution, and a feebate mechanism.

All four analysed policy scenarios are based on a low seaborne trade growth projection and aim to address Well-to-Wake (WtW) GHG emissions in alignment with established sustainability criteria. Among these scenarios, two incorporate a levy mechanism: scenario 26, which applies a higher levy price, and scenario 32 which employs a lower levy price alongside a GHG fuel intensity (GFI) flexibility compliance mechanism. Notably, scenario 36 introduces a feebate mechanism as part of its policy framework.

The specification parameters across these scenarios vary to enable a comprehensive analysis of output sensitivities and the implications of different compliance and revenue distribution mechanisms. These include the impacts of flexibility mechanisms, feebate systems, levy price variations (low versus high), emission trajectory adjustments, and GFI scope differences. Such differentiation provides critical insights into the effectiveness of these policy tools and their potential impacts on GHG mitigation efforts.

## Key Findings

- **GDP Impacts**: Most scenarios resulted in GDP decreases relative to the business-as-usual (BAU) scenario. However, Scenario 26 led to GDP increases in Namibia, Malawi, and Liberia, underscoring the potential of revenue distribution to mitigate adverse effects.
- **Imports**: the impact on imports varies across African countries depending on the policy scenario applied, with the exception of Scenario 32. Scenario 32 showed consistent increases in imports across all countries, driven by enhanced purchasing power following the distribution of revenues and moderate cost adjustments.
- **Exports**: Exports declined across most scenarios relative to the Business-as-usual (BAU) scenario, with exceptions in Kenya under Scenarios 24 and 36. Revenue from Scenarios 26 and 32 could support export-oriented production if reinvested strategically.
- **Consumer Prices**: Price increases were observed in all scenarios relative to the Business-as-usual (BAU) scenario, except for slight reductions in Kenya under Scenarios 24 and 36 in 2030 and 2040. Increases in consumer prices suggest that certain mid-term measures might worsen inflation. Higher levies in Scenarios 26 and 32 triggered inflations relative to increases attributed to Scenarios 24 and 36.

## Methodology

The analysis relied on scenario mapping and comparative evaluations using data on policy measures, revenue distribution, and economic variables (e.g., GDP, imports, exports, and consumer prices). This approach enabled insights into the differentiated impacts of policy tools across countries and timeframes.

This report highlights the need for adaptive strategies tailored to regional contexts, ensuring African economies can navigate the transition to zero-carbon shipping while safeguarding economic growth.

## Policy Implications

1. **Supplementary Policies**: To sustain economic growth, African countries may consider adopting supplementary fiscal and monetary policies to cushion the adverse effects of the mid-term GHG reduction measures. In this sense, Given Africa's dependence on imports of essential goods, policy scenarios that reduce imports should be approached with caution to avoid disruptions in service provision and access to critical products. Similarly, the decline in exports in most African countries could worsen Balance of Payment (BOP) challenges. To address this, countries may consider allocating revenues from Scenarios 26 and 32 toward productive sectors to boost goods production and generate export surpluses. Adding these strategies with sound fiscal and monetary policies may enhance export capacity.

2. **Inflation**: Scenarios with lower levies and revenue redistribution mechanisms (e.g., Scenario 32) are better suited to balance environmental goals with economic resilience. Increases in consumer prices observed under Scenarios 26 and 32, compared to Scenarios 24 and 36, indicate that levies may trigger inflation because there is a sudden flow of money in circulation in the country.
3. **Revenue Distribution**: The decrease in GDP under all policy scenarios, except for Scenario 26, highlights the potential of high levies with revenue distribution to mitigate negative GDP impacts and generate economic benefits. Prioritising policy frameworks that combine levies with revenue distribution to offset negative economic impacts have potential benefits for economies that are not diversified.

4. **Effect on GDP after revenue distribution**: both in the short term (2030) and in the long term (2050) and when revenue is distributed to all emerging economies, the UNCTAD analysis shows that the 6 countries of interest are better off in the high levy scenario (26). In the short term, the high levy scenario leads to a stronger increase in transport cost than the low levy (32) or non-levy scenarios (24, 36), but this negative effect is compensated by the positive effects of revenue distribution on their GDP. In the long term (2050), the increase in transport is similar across all policy options, but the high levy scenario generates significantly more revenue benefiting the 6 countries of interest.

# Contents



# Glossary of terms

| | |
|---|---|
| Business-as-usual (BAU) scenario | Describes the development of the concentration of greenhouse gas emissions in the atmosphere under the assumption that no further efforts to reduce shipping emissions will be made |
| Flexibility mechanisms | Trading mechanism, by which vessels overperforming the Global Fuel Standard (GFS) can trade credits with ships underperforming the GFS. They can do so by aggregating compliance across a group of ships ('pooling') or the sale of compliance and remedial units. |
| Feebate systems | A feebate mechanism first collects a fee on each tonne of GHG emissions generated by a vessel throughout the year, then calculates and redistributes a rebate to each vessel based on its uptake of eligible e-fuels. |
| Greenhouse gases (GHGs) | The atmospheric gases responsible for causing global warming and climate change. The major GHGs are carbon dioxide (CO2), methane (CH4) and nitrous oxide (N20). Less prevalent –but very powerful — greenhouse gases are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6). |
| GHG fuel intensity | The ratio of total greenhouse gas emissions (in grams of CO2e) to the total energy consumed by the ship (in MJ). This value, expressed in g CO2e/MJ, is the metric used to determine compliance with the IMO technical element (GFS) |
| Global fuel standard (GFS) | A GHG intensity standard for marine fuels |
| Global Trade Analysis Project (GTAP) | A computable general equilibrium modelled, maintained by a global network of researchers and policy makers conducting quantitative analysis of international policy issues. |
| Gross Domestic Product (GDP) | An aggregate measure of production equal to the sum of the gross value added of all resident institutional units engaged in production (plus any taxes, and minus any subsidies on products not included in the value of their outputs). |

| | |
|---|---|
| Well-to-Wake (WtW) GHG emissions | Greenhouse gas emissions from the fuel production to the end-use by a ship |
| Well-to-tank (WtT) GHG emission | Greenhouse gas emissions from primary production to carriage of the fuel in a ship's tank, also known as upstream |

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# List of abbreviations

| | |
|---|---|
| BAU | Business-as-usual |
| BOP | Balance of Payment |
| CIA | Comprehensive Impact Assessment |
| DNV | Det Norske Veritas |
| EU | European Union |
| GFS | Goal-based marine fuel standard |
| GHG | Greenhouse gas |
| GDP | Gross Domestic Product |
| GTAP | Global Trade Analysis Project |
| LDCs | Least Developed Countries |
| SIDS | Small Island Developing States |
| UNCTAD | United Nations Conference on Trade and Development |
| WtW | Well-to-Wake |
| WtT | Well-to-tank |

# 1 Introduction

The International Maritime Organization (IMO) has set ambitious targets to achieve net-zero greenhouse gas (GHG) emissions by 2050 or around that time. To do so, the IMO plans to introduce a set of globally enforceable policies, referred to as “mid-term measures,” by 2027. These measures are expected to include a GHG intensity standard for marine fuels and an economic mechanism, such as emissions pricing, to facilitate reductions and ensure a “just and equitable transition” (2023 IMO Strategy on Reduction of GHG Emissions from Ships, 2023).

However, the shift to low-carbon shipping is likely to increase transport costs, which could negatively affect the global economy by raising average goods prices. Lower-income nations are expected to bear a disproportionate burden compared to wealthier countries (Rojon et al., 2021).

In this context, this report utilises United Nations Conference on Trade and Development (UNCTAD) analysis for the Comprehensive Impact Assessment (CIA) of the basket of candidate GHG reduction mid-term measures to evaluate the impacts of various marine fuel standards and greenhouse gas (GHG) pricing mechanisms on key economic indicators such as Gross Domestic Product (GDP), imports, exports, and consumer prices in Africa across three-time horizons: short-term (2030), medium-term (2040), and long-run (2050).

To understand the impacts of different International Maritime Organization (IMO) policy options on African economies, the report uses four policy scenarios:

1. **Scenario 24**: No levy, no revenue distribution, and a flexibility mechanism.
2. **Scenario 26**: High levy with revenue distribution.
3. **Scenario 32**: Low levy with revenue distribution and a flexibility mechanism.
4. **Scenario 36**: No levy, no revenue distribution, and a feebate mechanism.

Section 2 describes the policy scenarios and provides the specific parameters and assumptions used in their subsequent analysis on selected African States caused both by the changes in maritime logistics costs and the distribution of hypothetical collected revenues. Section 3 reviews the simulation used to estimate the impacts of each policy scenario relative to business-as-usual scenario (the low growth (BAULG) scenario was used) as analysed by UNCTAD. Section 4 outlines the methodology for extracting and comparing results from the existing literature, and in particular the IMO’s UNCTAD CIA, while section 5 details the limitations and uncertainties related to this study.

Section 6 then presents the findings of the three selected policy scenarios and their impact on selected African countries on GDP, import, export and consumer prices. The overall economic effects of different policy measures are then discussed.

## 1.1 Aim and research questions

This study aims to assess the impact of the basket of candidate GHG reduction mid-term measures on Gross Domestic Product (GDP), imports, exports, and consumer prices in Africa across three-time

horizons: short-term (2030), medium-term (2040), and long-run (2050). The study answers the following research question:

- What are the impacts of the basket of candidate GHG reduction mid-term measures on Gross Domestic Product (GDP), imports, exports, and consumer prices in Africa?

## 1.2 Overview of the research methods

The report utilises the Excel Spreadsheet populated with the UNTAD 2024 report data, created by Fricaudet et al (2024)[1]. The analysis followed: 1) scenario analysis using maps and 2) scenario analysis by policy.

## 1.3 Overview of the report

The study finds that generally GDP decreases in Africa for all policy scenario applied with the exception of a policy scenario with high levy with revenue distribution to all economies where Namibia; Rest of landlocked countries (Malawi); and Rest of Western Africa (Liberia) register GDP increases. The impact on imports varies across African countries depending on the policy scenario applied except for Scenario 32 (flexibility, low levy, and revenue distributed to all economies) where all countries show increases. Exports decreases irrespective of the policy scenario applied except for Kenya where they slightly increase under scenarios 24 (no levy with no revenue distribution and a flexibility mechanism) and 36 (no levy with no revenue distribution, a flexibility mechanism and a feebate). Consumer prices increase in all scenarios applied relative to the Business-as-usual (BAU) scenario except for Kenya which experience a slight reduction under scenarios 24 (no levy with no revenue distribution and a flexibility mechanism) and 36 (no levy with no revenue distribution, a flexibility mechanism and a feebate) in 2030 and 2040.

# 2 Scope of the study

The study scope covers the evaluation of the economic impacts of various technically possible combinations of a goal-based marine fuel standard (GFS) and forms of maritime GHG pricing mechanism on countries' trade, GDP change and end-consumer prices based on UNCTAD's CIA for countries. The modelling work under Task 3 was partially informed by the Det Norske Veritas (DNV) Task 2 analysis (i.e. impact on fleet). Consequently, Task 3 models the impacts on States resulting from changes in maritime logistics costs and the distribution of hypothetical collected revenues, both derived from DNV's Task 2 outputs). The assessment includes detailed analysis for four countries: Ghana, Kenya, Namibia, Nigeria, Malawi (proxied by rest of landlocked economies) and Liberia (proxied by rest of Western Africa) across three-time horizons: 2030, 2040 and 2050. These time horizons align with IMO's 2023 revised strategy checkpoints.

It should be noted that the aggregates: rest of landlocked economies in Africa and rest of Western Africa, say something about Malawi and Liberia respectively as findings from Dequiedt et al (2024) and Black et al (2024) who study Malawi and Liberia as independent countries find that there is significant variation in the impact on GDP between the countries of the groupings "rest of Western Africa" and "rest of landlocked countries in Africa". Furthermore, while Malawi's results broadly align

[1] https://www.shippingandoceans.com/post/new-tool-for-exploring-the-impacts-of-policy-measures-aimed-at-reducing-ghg-emissions-from-shipping

with the average change in GDP of the countries grouped by UNCTAD under “rest of landlocked countries in Africa” in both Dequiedt et al (2024) and Black et al (2024), Dequiedt et al (2024) finds that Liberia is significantly less impacted than the other countries grouped by UNCTAD under “rest of Western Africa” (in particular less impacted than Benin, Cabo Verde, Gambia and Guinea-Bissau). This suggests that results for Liberia and Malawi should be taken with caution. Nevertheless, data permitting, Malawi and Liberia should be studied independently to isolate country-specific effects. Table 1 below presents the policy scenarios.

**Table 1: Policy scenarios selected for an African perspective under Task 3**

| Scenario number | Emission trajectory | Sea-borne trade growth | GFI scope | GFI flexibility | Levy | Feebate | Revenue Distribution modelling |
|---|---|---|---|---|---|---|---|
| BAULG | BAU | Low | None | None | None | None | - |
| 24 | Base | Low | WtW | Flexibility (120%:80%) | No Levy | None | - |
| 26 | Base | Low | WtW | No Flexibility | High levy ($150-300 /tonne CO2-eq) | None | Yes |
| 32 | Base | Low | WtW | Flexibility (120%:80%) | Low Levy ($30-120/tonne CO2-eq) | None | Yes |
| 36 | Base | Low | WtW | Flexibility | No levy | 105% to 2040 | - |

Source: UNCTAD, 2024

UNCTAD (July 2024) models all the scenarios in Table 1, among others, but examine their impact on groups of economies (LDCs, developing economies, developed economies, SIDS and World). This study models the four selected scenarios on individual countries in Africa (Ghana, Kenya, Namibia, Nigeria, Malawi as proxied by rest of landlocked economies in Africa and Liberia as proxied by rest of Western Africa) to understand their level of impact. This study prioritises the four scenarios as they take into account important dimensions relevant to Africa’s policy landscape such as the inclusion of levies of different magnitudes (low and high), feebate mechanisms, revenue distribution, GFI flexibility.

For comparability, the scenarios chosen have the same assumptions on the scope of emissions, the trajectory of decarbonization (i.e. the stringency of the policy) and the shipping demand. All scenarios consider Well-to-wake (WtW) emissions, which is a default Well-to-tank (WtT) GHG emission factors provided in Fuel European Union (EU) Maritime for all fossil fuels, and a base GHG emission trajectory which may not be an overambitious target compared to the strive GHG emission trajectory. The Base trajectory reflects the lower ends of the indicative checkpoints. Put differently, to reduce the

total annual GHG emissions from international shipping by ‘at least’ 20% by 2030 and by ‘at least’ 70% by 2040, both compared to 2008. The Strive trajectory reflects the upper ends of the indicative checkpoints, in other words ‘striving for’ reductions of 30% by 2030 and 80% by 2040 compared to 2008. Finally, all scenarios assessed in Task 3 assume a low seaborne trade growth, referencing the ‘business-as-usual low growth’ (BAULG) scenario developed by DNV (2024a) as the baseline. As such, impacts arising from the various policy scenarios are therefore compared against the BAULG scenario.

The GFI flexibility mechanism provides two alternative options for compliance: 1) ships that attain GFI below required GFI (positive compliance balance) can sell excess emission units to, or join a pool with, ships with attained GFI above required GFI (negative compliance balance) and 2) ships with positive compliance balance can 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 from a Revenue body at a set price. Regarding the GFI flexibility mechanism, three scenarios (scenarios 24, 32 and 36) incorporate this mechanism, whereas one scenario (scenario 26) does not.

Furthermore, Table 1 indicates that scenario 26 includes a relatively higher levy, while scenarios 24 and 36 feature only a GFS measure without a levy. As a result, scenario 26 and 32 include levies and are, therefore, expected to generate revenues to be distributed. Thus, Table 1 illustrates that out of the four scenarios, two includes the revenue distribution option while the other two options do not include revenue distribution.

Table 2 below provides details on the hypothetical revenue distribution schemes analysed.

**Table 2: Hypothetical revenue distribution schemes**

| **Level-1 criteria** | **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 |

Source: UNCTAD, 2024

Scenarios 26 and 32, among others, were selected at the Steering Committee for the Comprehensive Impact Assessment of the Basket of Candidate Mid-term Measures (SC) for assessing the impact of a hypothetical revenue disbursement on imports, exports, GDP and consumer prices (UNCTAD 2024). Thus, the SC settled on a set of three revenue distribution schemes to be applied. These three schemes differ on how they define the targeted beneficiary countries (Level-1 criterion) but apply the same 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
- Countries classified as SIDS and LDCs only

For scenarios 26 and 32, this study applies revenue distribution to all economies. To substantiate this, developing countries, LDCs and Small Islands Developing States (SIDS) will require carbon revenues to 1) enhance maritime transport infrastructure and capacity, 2) support broader climate aims such as mitigating and adapting to climate change and, 3) decarbonize shipping. On the other hand, developed countries may require carbon financing to largely, decarbonize shipping to ensure the ships built use less fossil fuels considering that they are the leaders in the ship building industry. However, distributing revenue to all economies may consequently reduce revenues allocated to LDCs especially Sub-Saharan Africa where transport costs are very high and require huge investments in port infrastructure to lower the cost of final delivered products. It is possible that this may result in smaller magnitudes of impacts on LDCs.

# 3 Modelling Simulations

The assessment of impacts on States involved the translation of the impacts on fleet to impacts on States focusing on outcome variables such as GDP, imports, exports and consumer prices. The modelling incorporates both a computational general equilibrium model, and transport/logistics modelling. The impact of the candidate mid-term GHG reduction measures are 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. Calculations were made to examine the percentage difference in the variables of interest, namely maritime transport costs, shipping time costs, maritime logistics costs, imports, exports, GDP, consumer prices, and between the policy scenario and BAU in 2030, 2040 and 2050. 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 Global Trade Analysis Project (GTAP) for each bilateral trade flow by commodity group under the baseline scenario. It should be noted that GTAP is a global data base describing bilateral trade patterns, production, consumption and intermediate use of commodities and services.

The modification entails inflating the maritime trade costs with the percentage difference reflecting the impact of the policy scenario on maritime logistics costs that were calculated. 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 distribution on imports, exports, GDP and consumer prices, UNCTAD calculates the distributions to be allocated to the individual GTAP economies in accordance with the hypothetical revenue distributions schemes described in Table 2 above.

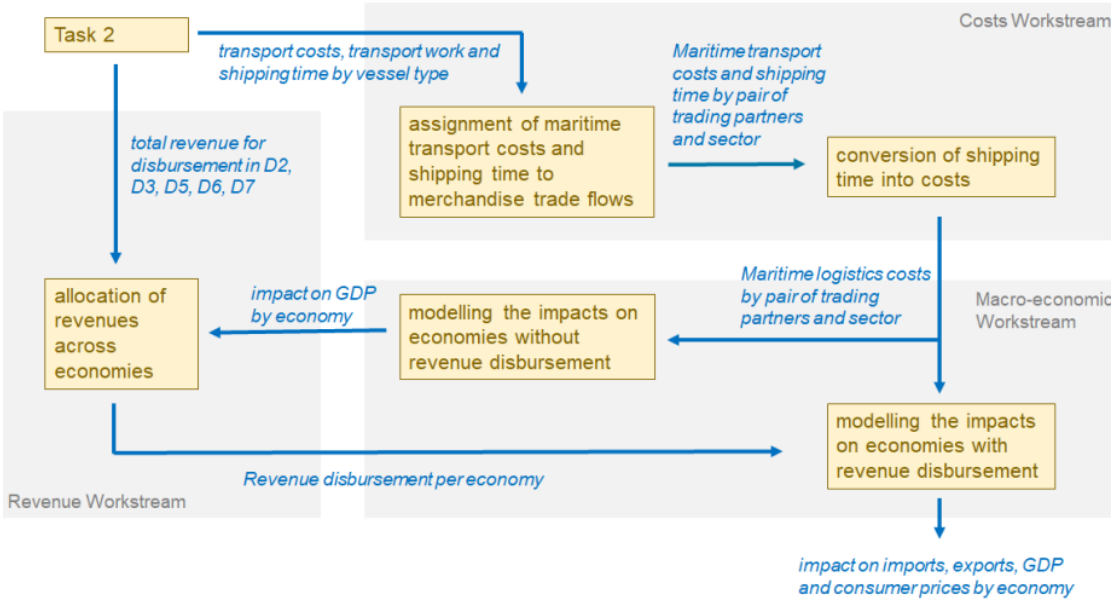



**Figure 1: Main modelling steps and data flows**

Source: UNCTAD, 2024

Figure 1 above, provides details of the modelling steps that were followed to compute the impacts.

# 4 Methodology

The report utilises the Excel Spreadsheet populated with the UNTAD 2024 report data, created by Fricaudet et al (2024)[2]. The raw data comprises of the following data:

- Country
- Policy scenarios
- Revenue distribution scenario
- Variable (imports, exports, GDP, consumer prices)
- Date (2030, 2040, and 2050)
- Value
- GFI scope (TtW, WtW)
- Emission trajectory
- Policy (flexibility, no flexibility, high levy etc)
- Revenue distribution

The analysis followed the following approach:

## 4.1 Scenario analysis using maps

This involved analysing the impact on states by only selecting: one year, one emission trajectory, one GFI scope, one variable and one scenario.

[2] https://www.shippingandoceans.com/post/new-tool-for-exploring-the-impacts-of-policy-measures-aimed-at-reducing-ghg-emissions-from-shipping

All countries within an aggregate are allocated the aggregate value from UNCTAD (e.g. Liberia is given the estimate of "Rest of LDCs in Africa").

### 4.2 Scenarios analysis by policy

This involved impact on policy measure (for instance consumer price in a given year, with emission trajectory and a greenhouse gas fuel intensity). Scenarios numbers are indicated in parenthesis and analysis were conducted by selecting only one year, one emission trajectory, one GFI scope and one variable. This step allows the selection of many countries and many scenarios as possible.

# 5 Limitations and uncertainties of the available data for selected African States

This section details the challenges faced by the UNCTAD in using the available data and policy scenarios to simulate the impact on different states. Similar data constraints are experienced by Least Developed Countries (LDCs) and the Small Island Developing States (SIDS). It is therefore imperative to identify the main policy issues and review how these impact on different States.

### 5.1 Data Constraints

Due to data and modelling limitations, the UNCTAD analysis did not explicitly include two countries, Malawi and Liberia. Instead, these countries are accounted for as aggregates, and as such, did not feature as standalone country results. For example, Malawi was incorporated under the aggregate “rest of landlocked economies in Africa”) and Liberia’s was incorporated under the aggregate “rest of Western Africa”. Table 3 below summarises the country aggregates.

**Table 3: Country aggregates**

| **Country aggregates** | **Name of country** |
|---|---|
| Rest of landlocked economies in Africa | Burkina Faso |
| | Central African Republic |
| | Chad |
| | Ethiopia |
| | Malawi |

| Country aggregates | Name of country |
|---|---|
| | Mali |
| | Niger |
| | Rwanda |
| | Uganda |
| | Zambia |
| Rest of Western Africa | Benin |
| | Cabo Verde |
| | Gambia |
| | Guinea |
| | Guinea-Bissau |
| | Liberia |
| | Mauritania |
| | Senegal |
| | Sierra Leone |
| | St Helena |
| | Togo |

### 5.2 Uncertainties

There are uncertainties about how changes in route specifics, as well as changes in global transport demand and supply, will affect maritime logistics costs and revenues. 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. The Global Trade Analysis Project (GTAP) used in modelling assumes revenues are instantaneously distributed and that there is instantaneous accrual of benefits from revenue distribution to economies. In practice, it is conceivable that revenue distribution could lag the process of collection, given the various models or administrative steps associated with distribution. The modelling done does not consider the implications of any other future national or international GHG reduction or air pollution measures.

# 6 Findings

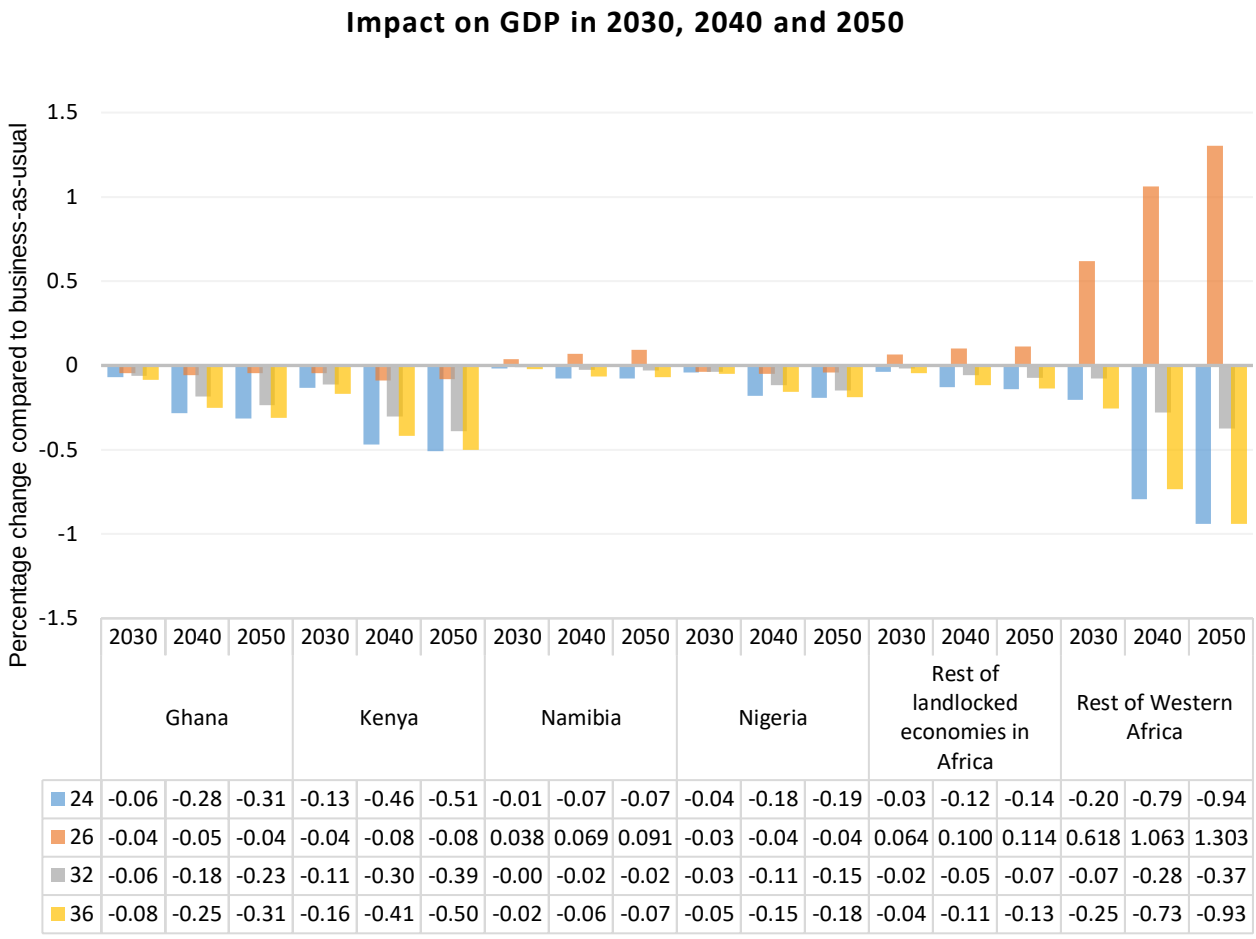
### 6.1 Impact on states

This section presents the impacts of economic measures including gross domestic product, import, export and consumer prices on selected African States namely:

- Namibia
- Kenya
- Ghana
- Nigeria
- Rest of Western Africa (Liberia)
- Rest of landlocked economies in Africa (Malawi)

#### 6.1.1 Impacts on Gross Domestic Product in selected African States

Figures 2 below provides a summary of key GDP impacts by country for the time horizon 2030, 2040 and 2050 and four policy scenarios applied to reflect the percentage changes in GDP.




| | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ghana | | | Kenya | | | Namibia | | | Nigeria | | | Rest of landlocked economies in Africa | | | Rest of Western Africa | | |
| 24 | -0.06 | -0.28 | -0.31 | -0.13 | -0.46 | -0.51 | -0.01 | -0.07 | -0.07 | -0.04 | -0.18 | -0.19 | -0.03 | -0.12 | -0.14 | -0.20 | -0.79 | -0.94 |
| 26 | -0.04 | -0.05 | -0.04 | -0.04 | -0.08 | -0.08 | 0.038 | 0.069 | 0.091 | -0.03 | -0.04 | -0.04 | 0.064 | 0.100 | 0.114 | 0.618 | 1.063 | 1.303 |
| 32 | -0.06 | -0.18 | -0.23 | -0.11 | -0.30 | -0.39 | -0.00 | -0.02 | -0.02 | -0.03 | -0.11 | -0.15 | -0.02 | -0.05 | -0.07 | -0.07 | -0.28 | -0.37 |
| 36 | -0.08 | -0.25 | -0.31 | -0.16 | -0.41 | -0.50 | -0.02 | -0.06 | -0.07 | -0.05 | -0.15 | -0.18 | -0.04 | -0.11 | -0.13 | -0.25 | -0.73 | -0.93 |

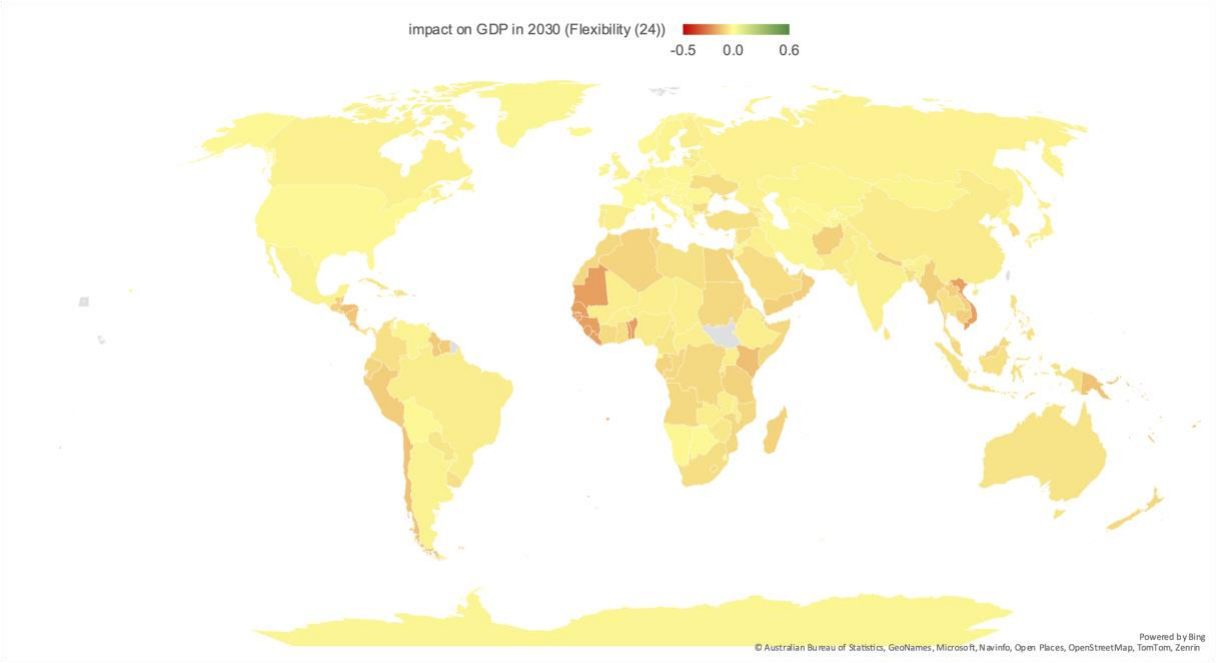
**Figure 2: Impact on GDP in 2030, 2040 and 2050**

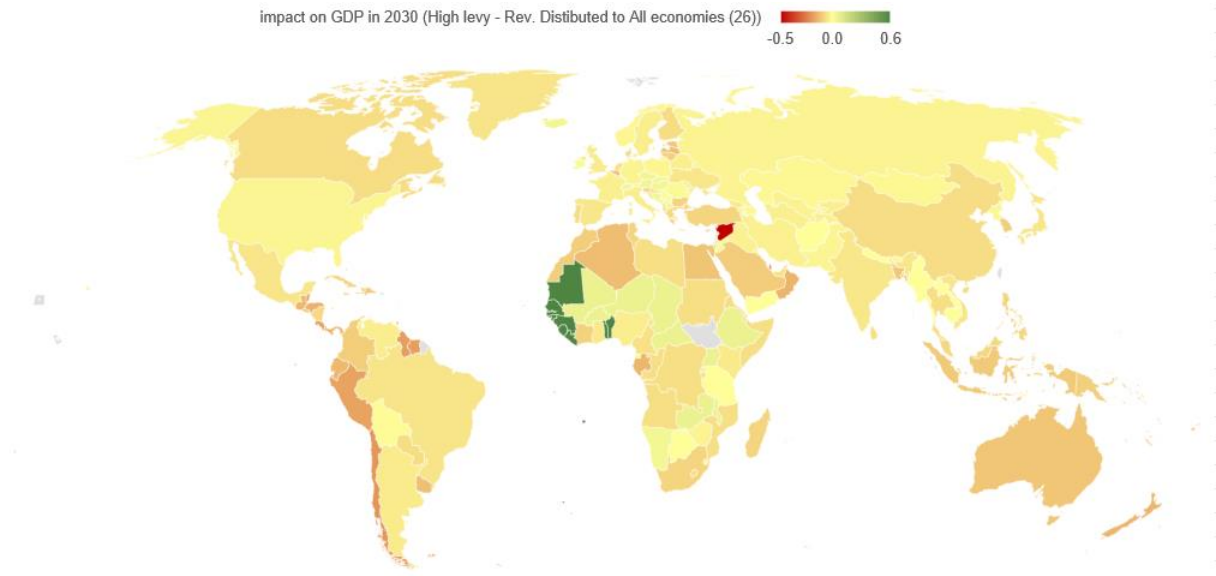
Source: UNCTAD (2024). Scenarios 26 and 32 present results with distribution to all economies (criteria level 1)

- Figure 2 shows that there is a general decrease in GDP relative to the Business-as-usual (BAU) scenario in Africa across the three-time horizons (2030, 2040 and 2050) when all scenarios are applied with an exception of scenario 26 (High levy - Rev. Distributed to All economies) where results are mixed.
- In scenarios without levy and revenue distribution (24 and 36), all countries see a reduction in their GDP, ranging in 2050 from -0.07% (Namibia) to -0.94% (Rest of Western Africa, which includes Liberia). This finding is similar to Pereda et al (2023), who model the implementation of a $50/tonne CO2-eq without revenue distribution and find decreases in GDP in Ghana (-0.05% to -1%), Kenya (0 to -0.025%), Namibia (0 to -0.025%), Nigeria (0 to -0.025%), Malawi (0 to -0.025%) and Liberia (-0.05% to -1%).
- On the contrary, in the short run (2030), GDP decreases by -0.045, -0.046 and -0.037 percent in Ghana, Kenya and Nigeria respectively under scenario 26 with revenue distribution to all economies and increases by 0.038, 0.064 and 0.618 percent in Namibia, Rest of landlocked countries and Rest of Western Africa respectively.
- The positive effect on GDP seen in Namibia, Rest of landlocked countries (Malawi) and Rest of Western Africa (Liberia) under scenario 26 may partially be attributed to the positive effects of revenue distribution, in particular in Malawi and Liberia.

- It is important for African countries to consider supplementary fiscal and monetary policies to cushion the negative effects on GDP of the basket of candidate greenhouse gas (GHG) reduction mid-term measures adopted.
- Figure 2 shows that overall, there are decreases in GDP across Africa irrespective of the policy scenario applied except for scenario 26 (High levy - Rev. Distributed to All economies) where increases are seen in Namibia (0.09 percent), Rest of landlocked economies in Africa (0.11 percent) and Rest of Western Africa (1.3 percent).

Figure 3 below shows maps highlighting impacts on GDP in the short term (2030) for the selected countries under each of the four policy scenarios.



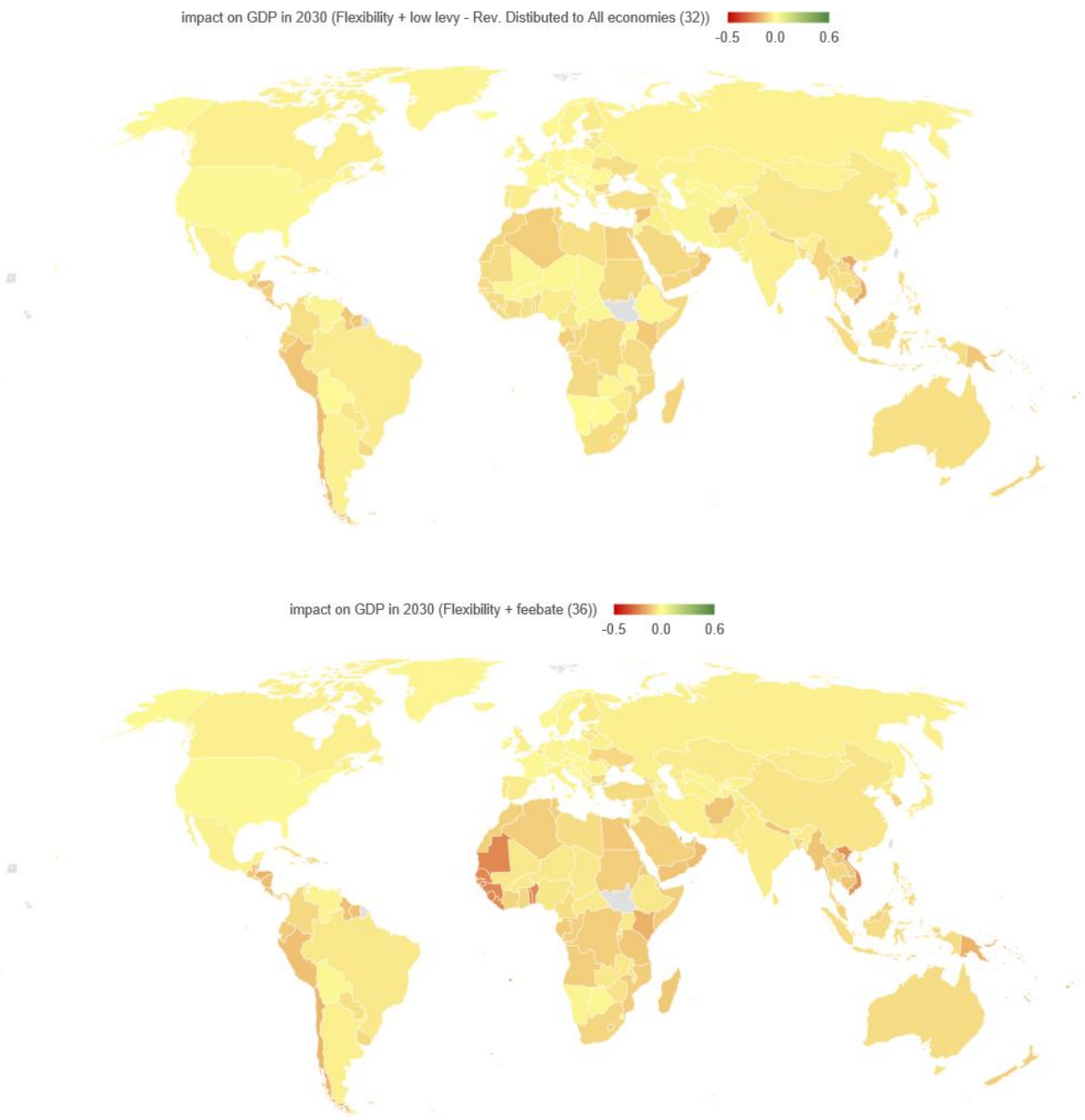
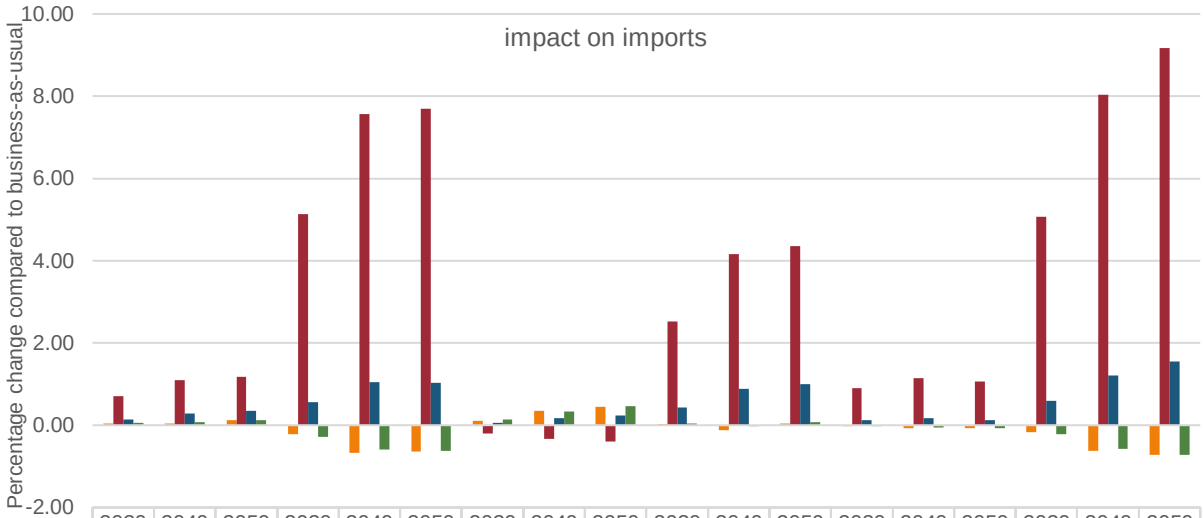



**Figure 3: Impact on GDP in 2030 (WtW,Base)**

Source: UNCTAD (2024)

### 6.1.2 IMPACTS ON IMPORTS FOR THE TIME HORIZONS 2030, 2040 & 2050

Figure 4 below show key impacts on imports by countries in 2030, 2040 and 2050 and four policy scenarios applied to reflect the percentage changes in import relative to BAULG.




| | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ghana | | | Kenya | | | Namibia | | | Nigeria | | | Rest of landlocked economies in Africa | | | Rest of Western Africa | | |
| 24 | 0.04 | 0.04 | 0.12 | -0.23 | -0.66 | -0.64 | 0.11 | 0.35 | 0.45 | 0.03 | -0.12 | 0.04 | -0.02 | -0.07 | -0.07 | -0.17 | -0.62 | -0.72 |
| 26 | 0.70 | 1.09 | 1.17 | 5.13 | 7.56 | 7.69 | -0.19 | -0.32 | -0.39 | 2.52 | 4.16 | 4.35 | 0.90 | 1.14 | 1.07 | 5.06 | 8.04 | 9.17 |
| 32 | 0.14 | 0.28 | 0.36 | 0.57 | 1.05 | 1.04 | 0.06 | 0.17 | 0.24 | 0.42 | 0.88 | 1.00 | 0.12 | 0.17 | 0.12 | 0.60 | 1.20 | 1.54 |
| 36 | 0.05 | 0.07 | 0.13 | -0.28 | -0.59 | -0.62 | 0.13 | 0.33 | 0.46 | 0.04 | -0.03 | 0.08 | -0.03 | -0.05 | -0.07 | -0.22 | -0.58 | -0.71 |

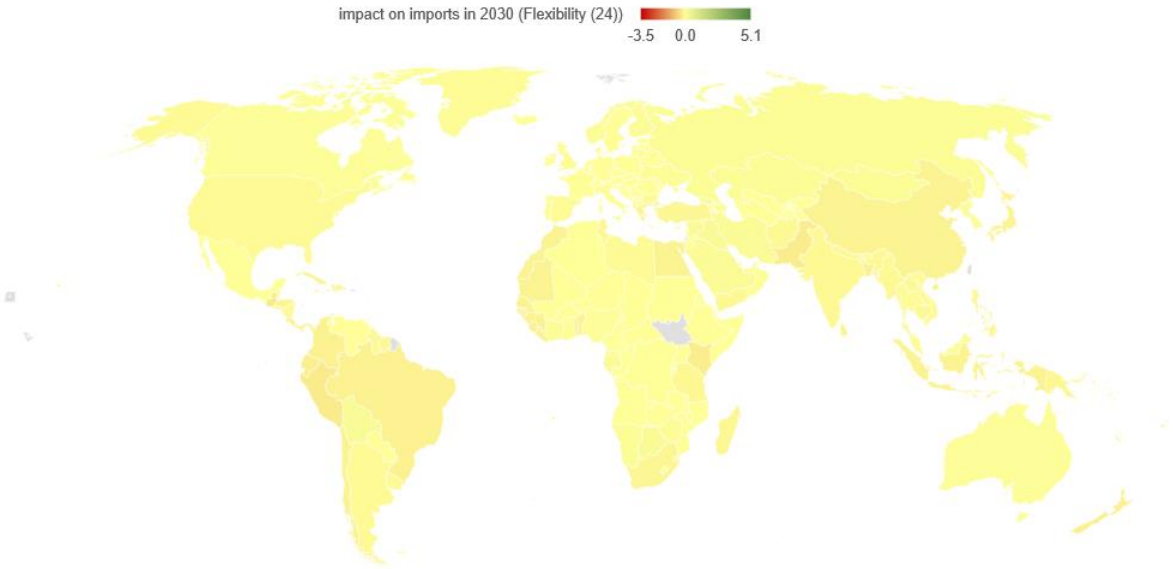
**Figure 4: Impact on imports for the time horizon 2030, 2040, & 2050**

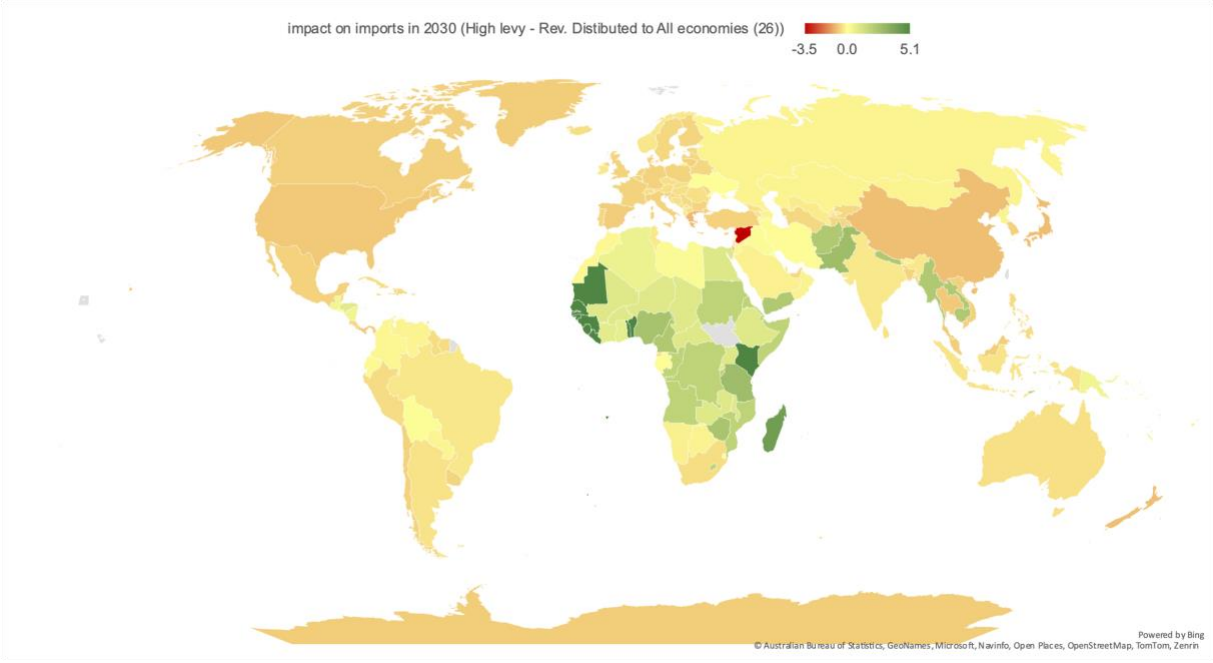
Source: UNCTAD (2024)

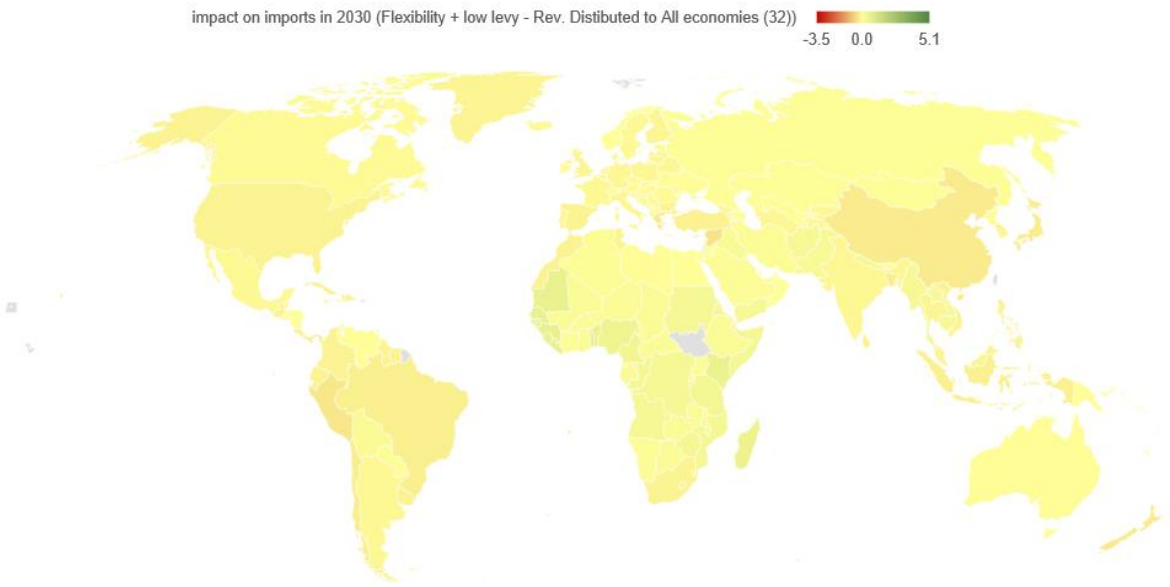
- Figure 4 shows that Ghana experiences increase in imports under all scenarios relative to the Business-as-usual (BAU) scenario. Under scenario 24 with GHG fuel intensity (GFI) compliance mechanism and no levy, imports increase between 0.036 and 0.117 percent between 2030 and 2050. The increase in scenario 26 without GHG fuel intensity (GFI) compliance mechanism and with high levy and revenue distributed is between 0.702 and 1.170 percent. Scenario 32 with GHG fuel intensity (GFI) flexibility compliance mechanism with low levy and 36 (with GFI compliance mechanism with no levy and with feebate mechanism) show an increase of between 0.142 and 0.356 and 0.050 and 0.130 percent respectively.
- The effect on imports in Kenya, Nigeria, Rest of Landlocked countries and Western Africa is mixed, on one hand, the non-levy scenarios (24 and 36) show negative effects and on the other hand, the levy scenarios with revenue distribution (26 and 32) show positive effects. In Kenya, imports decrease between -0.225 and -0.639 percent between 2030 and 2050 compared to business as usual when policy scenario 24 is applied. In scenario 36, the decrease is -0.283 and -0.621 percent in 2030 and 2050 respectively. On the other hand, there is an increase in imports of between 5.133 and 7.689 percent in 2030 and 2050 respectively when scenario 26 is applied. In the Rest of Western Africa, imports increase by 5.06 and 0.6 percent in 2030 when the levy scenarios 26, and 32 are applied respectively. On the other hand, imports decrease by -0.07 and -0.22 percent in 2030 under the non-levy scenarios (24 and 36 respectively). It is possible that the exceptional increase in imports is due to higher purchasing power associated with revenue distribution.

- **Error! Reference source not found.**4 shows that the impact on imports is different across Africa depending on the scenario applied except for scenario 32 (Flexibility + low levy - Rev. Distributed to All economies) where all countries show increases.
- The positive impacts seen under scenario 32 may partially be attributed to: 1) increased purchasing power due to revenue distribution associated with this scenario which increases appetite for imported goods and 2) the low levy associated with scenario 32 leads to similar to smaller increase in maritime cost in all years. This means that it may not necessarily disincentivise importation of goods due to resultant price adjustments as most African countries are import-dependent as much as the other scenarios.
- When only a flexibility mechanism (scenario 24) is applied, imports increase in Ghana (0.12 percent in 2050), Namibia (0.45 percent) and Nigeria (0.04 percent). On the other hand, Kenya; Rest of landlocked economies in Africa and Rest of Western Africa show decreases of -0.64, -0.07 and -0.72 percent respectively.

**Error! Reference source not found.**5 below shows maps highlighting impacts on imports in the short term (2030) for the selected countries under each of the four policy scenarios.




impact on imports in 2030 (High levy - Rev. Distibuted to All economies (26))
-3.5 0.0 5.1
Powered by Bing
© Australian Bureau of Statistics, GeoNames, Microsoft, Navinfo, Open Places, OpenStreetMap, TomTom, Zenrin


impact on imports in 2030 (Flexibility + low levy - Rev. Distibuted to All economies (32))
-3.5 0.0 5.1

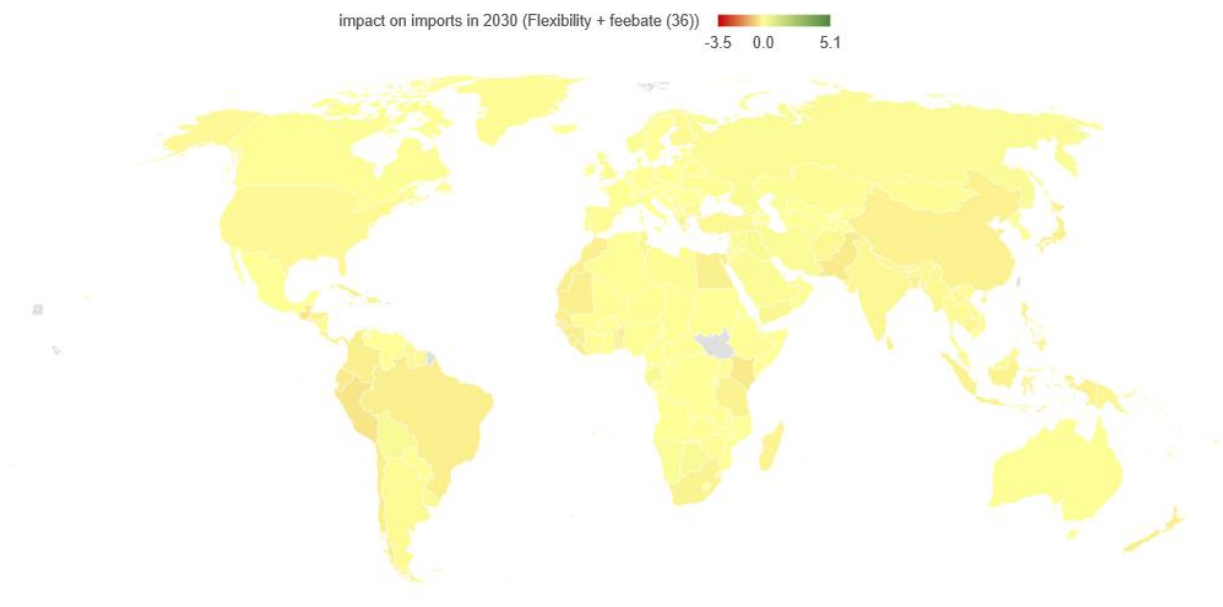
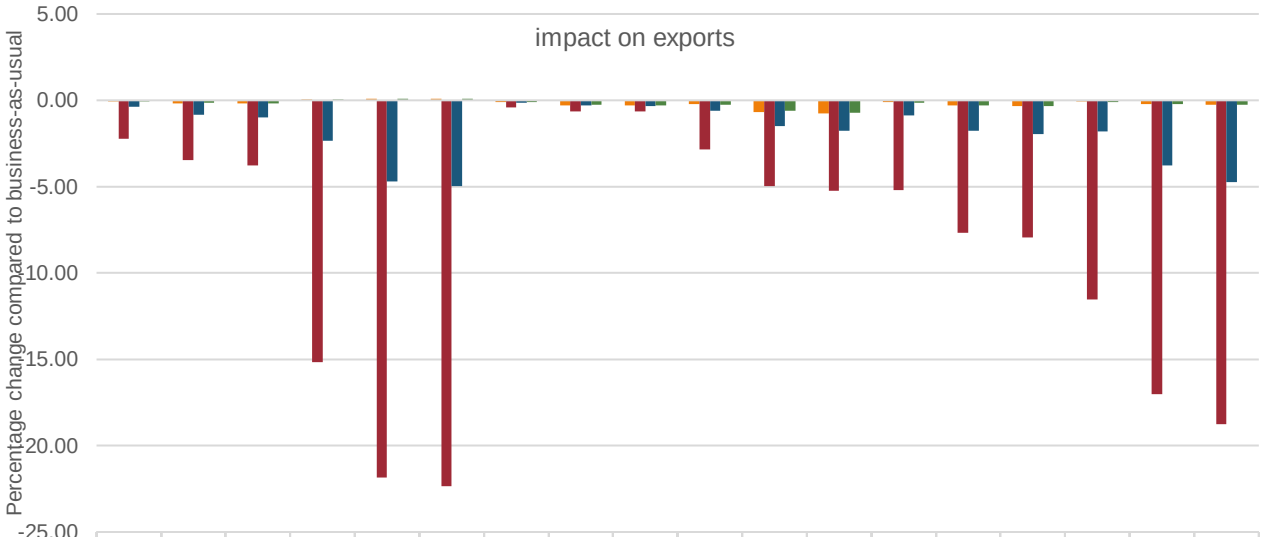



**Figure 5: Impact on imports in 2030 (WtW, Base)**

Source: UNCTAD (2024)

### 6.1.3 IMPACTS ON EXPORTS FOR THE TIME HORIZONS 2030, 2040 & 2050

**Error! Reference source not found.** below summarises key impacts on exports by country in 2030, 2040 and 2050 as well as four policy scenarios applied to reflect the percentage changes in export relative to BAULG.




| | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ghana | | | Kenya | | | Namibia | | | Nigeria | | | Rest of landlocked economies in Africa | | | Rest of Western Africa | | |
| 24 | -0.05 | -0.16 | -0.20 | 0.03 | 0.09 | 0.09 | -0.09 | -0.28 | -0.30 | -0.20 | -0.68 | -0.74 | -0.11 | -0.30 | -0.34 | -0.07 | -0.21 | -0.26 |
| 26 | -2.25 | -3.48 | -3.77 | -15.1 | -21.8 | -22.3 | -0.42 | -0.64 | -0.63 | -2.86 | -4.97 | -5.24 | -5.20 | -7.69 | -7.93 | -11.5 | -17.0 | -18.7 |
| 32 | -0.38 | -0.82 | -1.00 | -2.35 | -4.70 | -4.96 | -0.13 | -0.30 | -0.34 | -0.59 | -1.51 | -1.75 | -0.87 | -1.78 | -1.95 | -1.82 | -3.78 | -4.74 |
| 36 | -0.06 | -0.15 | -0.19 | 0.04 | 0.09 | 0.10 | -0.11 | -0.26 | -0.30 | -0.25 | -0.62 | -0.73 | -0.13 | -0.29 | -0.34 | -0.09 | -0.21 | -0.26 |

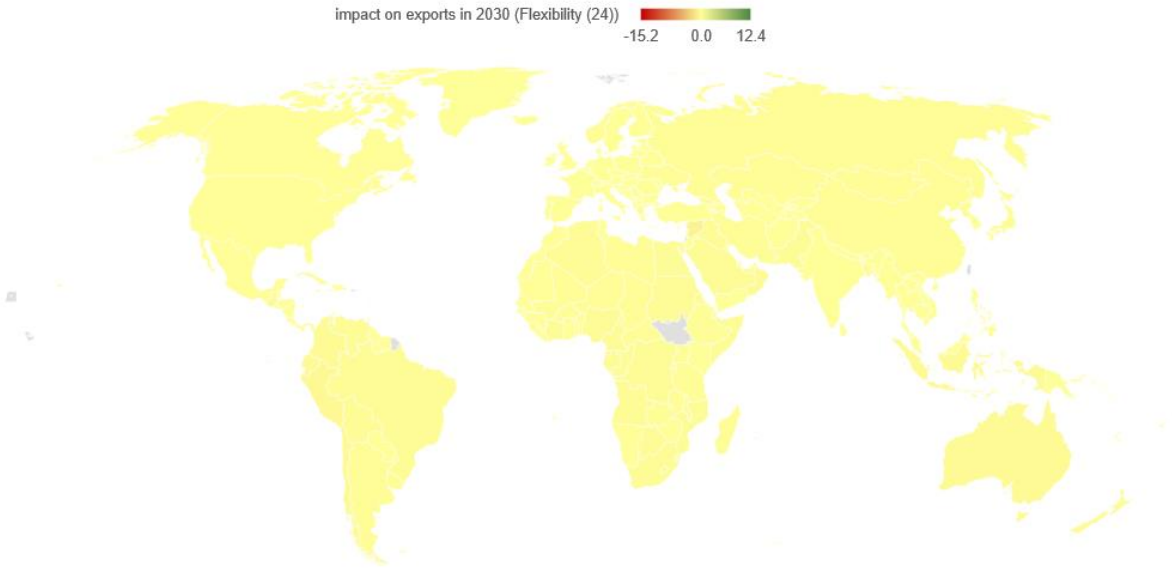
**Figure 6: Impact on exports for the time horizon 2030, 2040, & 2050**

Source: UNCTAD (2024)

- **Error! Reference source not found.** shows that overall, exports decrease in the six African countries relative to the Business-as-usual (BAU) scenario irrespective of the policy scenario applied except for Kenya where increases are seen in 2030, 2040 and 2050 under the non-levy scenarios (24 and 36). For example, exports slightly increase between 0.028 and 0.092 percent between 2030 and 2050 under scenario 24 (flexibility only) and between 0.039 and 0.101 percent when scenario 36 (flexibility and feebate) is applied.
- Further, it can be observed that Kenya experiences larger decreases in exports under scenario 26 (High levy - Rev. Distributed to All economies) compared to the other African countries of -15.179 percent in 2030, -21.858 percent in 2040 and -22.358 percent in 2050.
- This could imply that when revenue is distributed, Kenyan consumers have high purchasing power that allow them to increase domestic consumption at the expense of exporting the consumed goods.
- **Error! Reference source not found.** shows that when scenario 24 (flexibility only) is applied, the decrease in exports in 2050 is -0.2, -0.3, -0.74, -0.34, -0.26 percent in Ghana, Namibia, Nigeria, Rest of landlocked economies in Africa, and Rest of Western Africa. This finding is similar to Pereda et al (2023), who study the impact of implementing a $50/tonne CO2-eq without redistributing the revenue, and show that exports decrease by -0.40 percent in Western Africa.
- Under scenario 26, the effect is negative in all the countries with the largest decrease seen in Kenya (-22 percent) followed by Rest of Western Africa (-19 percent) and Rest of landlocked economies in Africa (-8 percent).
- Namibia shows the lowest decrease of -0.6 percent.

- It is possible that the decrease in exports is as a result of an increase in domestic demand for the goods in question due to high purchasing power associated with revenue distribution under scenario 26.
- Similarly, applying scenario 32 decreases exports by -1, -4.96, -0.3, -1.75, -1.95 and -4.74 percent in Ghana, Kenya, Namibia, Nigeria, Rest of landlocked economies in Africa and Rest of Western Africa respectively.
- The effect of scenario 36 on exports across Africa is not significantly different from the results seen under scenario 24.
- Considering that African countries are struggling with Balance of Payment (BOP) problems, increasing exports remain one of the priority areas. As such, it is important for these countries to allocate part of the revenues realized under scenarios 26 and 32 towards productive sectors to produce more goods and services to generate surplus for export.
- Further, these countries should design and implement supplementary fiscal and monetary policies that seek to boost production of goods for export.

**Error! Reference source not found.**7**Error! Reference source not found.** below shows maps highlighting impacts on exports in the short term (2030) for the selected countries under each of the four policy scenarios.



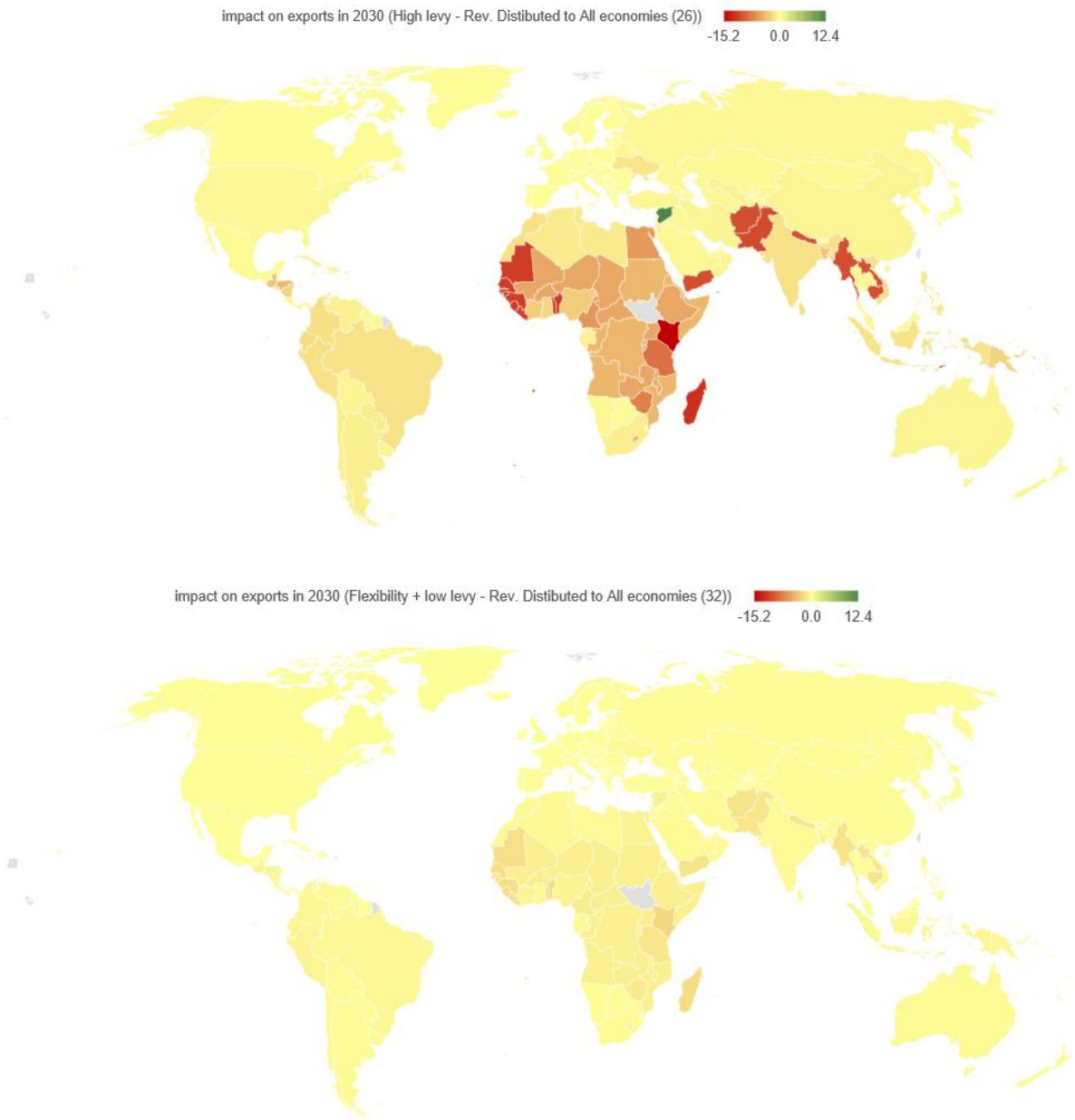



**Figure 7: Impact on exports in 2030 (WtW, Base)**

Source: UNCTAD (2024)

### 6.1.4 Impacts on Consumer Prices for the Time Horizons 2030, 2040 & 2050

**Error! Reference source not found.**8 below provide a summary of key impacts on consumer prices by country in 2030, 2040 and 2050 as well as four policy scenarios applied to reflect the percentage changes in consumer price relative to BAULG.


| | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ghana | | | Kenya | | | Namibia | | | Nigeria | | | Rest of landlocked economies in Africa | | | Rest of Western Africa | | |
| 24 | 0.20 | 0.47 | 0.16 | -0.04 | -0.07 | 0.12 | 0.13 | 0.28 | 0.16 | 0.21 | 0.34 | 0.24 | 0.10 | 0.23 | 0.12 | 0.10 | 0.26 | 0.04 |
| 26 | 1.40 | 2.19 | 2.40 | 8.20 | 12.62 | 13.07 | 0.62 | 0.99 | 1.09 | 3.41 | 5.56 | 5.91 | 2.56 | 3.84 | 4.02 | 4.33 | 6.57 | 7.25 |
| 32 | 0.38 | 0.91 | 1.17 | 1.15 | 2.40 | 2.62 | 0.21 | 0.52 | 0.70 | 0.71 | 1.60 | 1.93 | 0.47 | 1.01 | 1.19 | 0.71 | 1.51 | 1.87 |
| 36 | 0.25 | 0.39 | 0.20 | -0.07 | -0.01 | 0.10 | 0.17 | 0.25 | 0.18 | 0.27 | 0.31 | 0.25 | 0.12 | 0.21 | 0.13 | 0.12 | 0.21 | 0.07 |

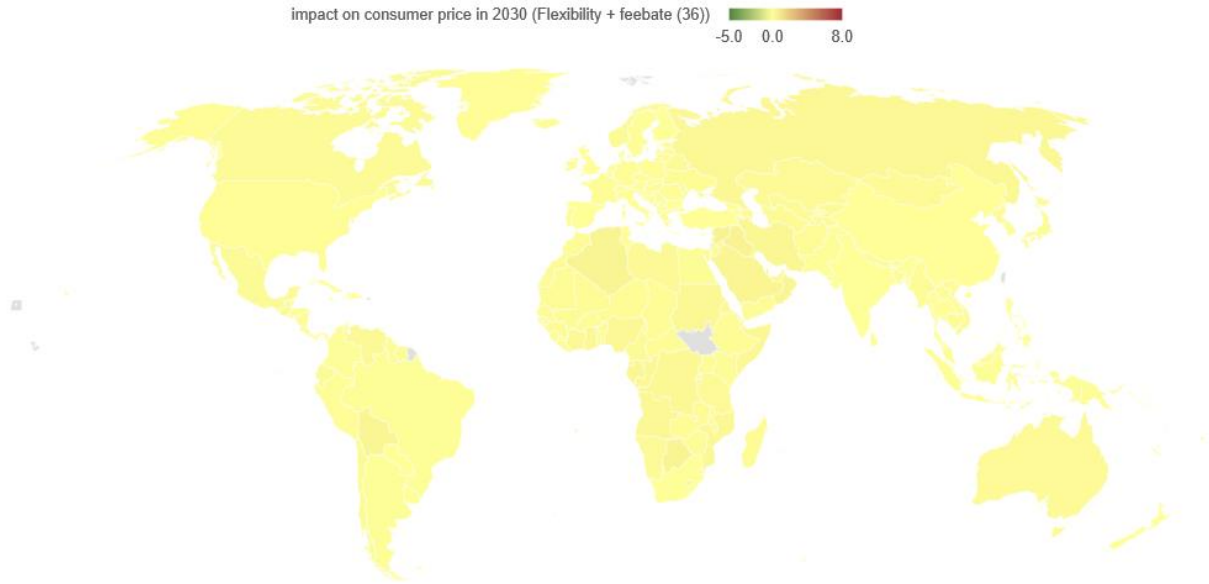
**Figure 8: Impact on consumer prices for the time horizon 2030, 2040 & 2050**

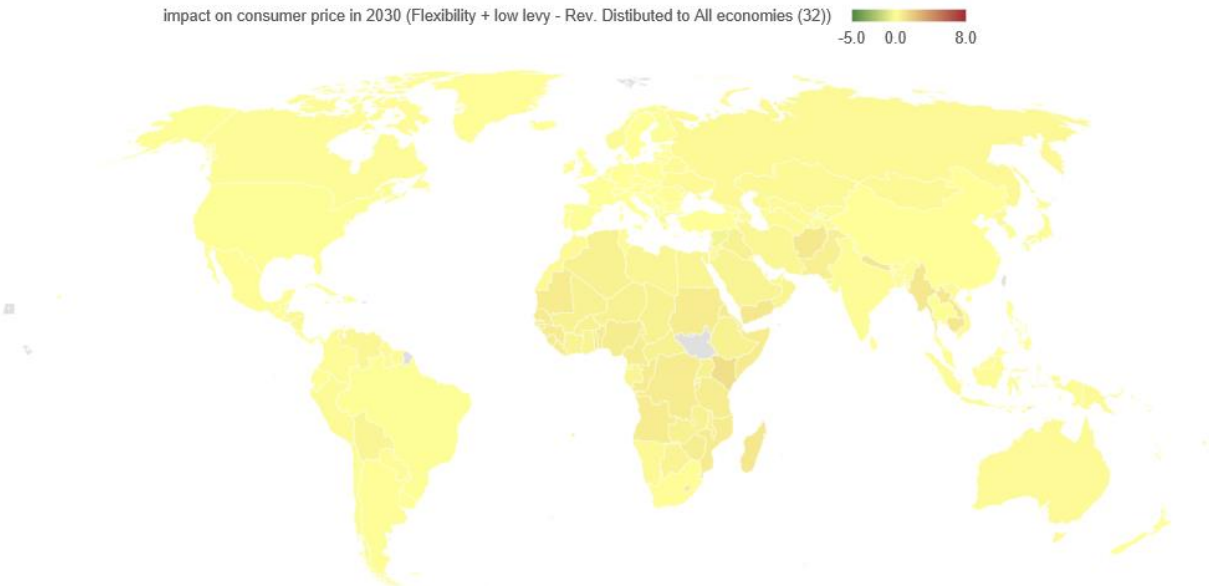
Source: UNCTAD (2024)

- **Error! Reference source not found.**8 shows increase in consumer price in Ghana, Namibia, Nigeria, Rest of landlocked economies in Africa and Rest of Western Africa under all scenarios of interest relative to the Business-as-usual (BAU) scenario.
- When scenario 26 is applied in the short-run (2030), consumer price increases by 1.396, 8.202, 0.616, 3.410, 2.564 and 3.445 percent in Ghana, Kenya, Namibia, Nigeria, rest of landlocked economies in Africa and rest of Western Africa respectively. This finding is similar to Dequiedt et al (2024), who model the impact of implementing a $40/tonne CO2 without redistributing the revenue and show increases in consumer price of 2.28 percent in Kenya, 0.55 percent in Namibia, 0.12 percent in Nigeria and 0.21 percent in Malawi (proxied by rest of landlocked economies in Africa).
- However, there are decreases in consumer prices in Kenya in 2030 and 2040 under both a base GHG fuel intensity (GFI) flexibility compliance mechanism with no levy (scenario 24), and a base with flexibility with no levy plus feebate (scenario 36). The decrease is between -0.045 and -0.065 percent in 2030 under scenario 24 and between -0.070 and -0.007 percent in 2040 under scenario 36.
- In the short term, the lower increase in consumer price may partially be attributed to non-introduction of levies under the respective policy scenarios which reduces inflation as the levies are not passed on to final consumers through price adjustments, and partially to the increase in purchasing power following the redistribution of revenue. However, in the long term, most of different can be attributed to the redistribution of revenue, as the increase in maritime costs and therefore increase in imports costs are lower in the long term in the levy scenarios compared to the non-levy scenarios (UNCTAD, 2024).

- **Error! Reference source not found.**8 shows that consumer price under scenario 36 is not significantly different from the impact seen under scenario 24.
- The increases in consumer prices are larger under scenario 26 (High levy - Rev. Distributed to All economies) followed by scenario 32 (Flexibility + low levy - Rev. Distributed to All economies) compared to increases seen under scenarios without levy (24 and 36). For example, when scenario 26 is applied, consumer price increases by 2.4, 13.07, 1.09, 5.91, 4.02 and 7.25 percent in Ghana, Kenya, Namibia, Nigeria, Rest of landlocked economies in Africa and Rest of Western Africa respectively. This finding implies that introduction of levies results in inflation in Africa.
- To minimize significant increases in inflation, African governments may consider adopting policy scenarios with low levies.

**Error! Reference source not found.**9 below shows maps highlighting impacts on consumer price in the short term (2030) for the selected countries under each of the four policy scenarios.



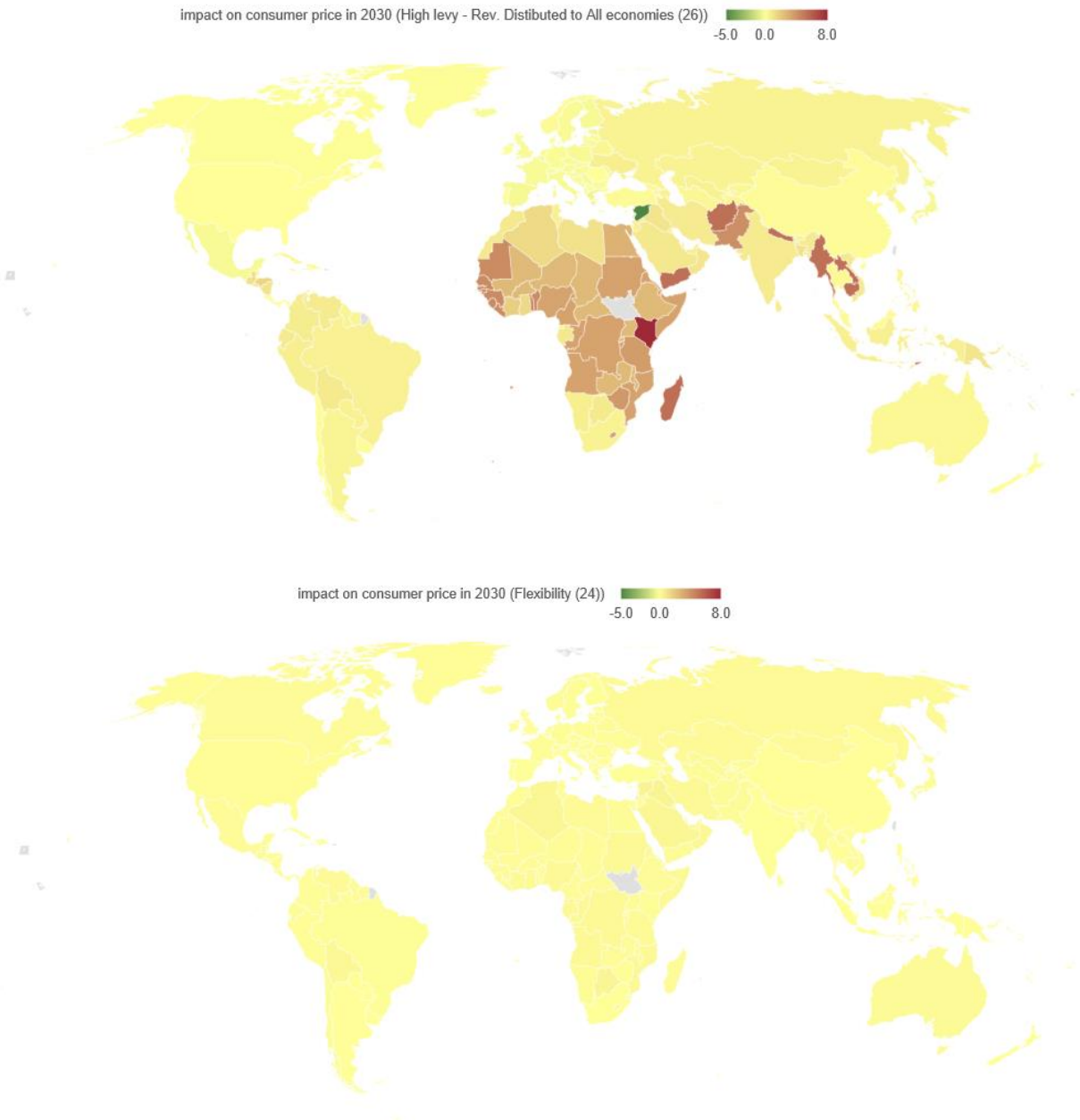



**Figure 9: Impact on consumer prices in 2030 (WtW, Base)**

Source: UNCTAD (2024)

# 7 Conclusion

This study examines the economic impacts of various combinations of a greenhouse gas (GHG) Fuel Standard (GFS) and greenhouse gas (GHG) pricing mechanisms on Gross Domestic Product (GDP), imports, exports, and consumer prices across Africa for the years 2030, 2040, and 2050. The analysis focuses on four policy scenarios: the first scenario involves no levy with no revenue distribution and a flexibility mechanism (scenario 24), the second scenario involves a high levy with revenue distribution (scenario 26), the third scenario implemented low levy with revenue distribution and a

flexibility mechanism (scenario 32), and the fourth scenario involves no levy with no revenue distribution, a flexibility mechanism and a feebate (scenario 36).

The results show significant GDP decreases in Africa relative to the Business-as-usual (BAU) scenario irrespective of policy scenario applied except for a scenario with high levy with revenue distribution to all economies (scenario 26), where Namibia; Rest of landlocked countries (Malawi); and Rest of Western Africa (Liberia) register GDP increases. This suggests that implementing scenarios with high levies and revenue distribution could mitigate negative GDP impacts by providing economic benefits that offset some adverse effects. It is important for African countries to consider supplementary fiscal and monetary policies to cushion the negative effects on GDP of the basket of candidate greenhouse gas (GHG) reduction mid-term measures adopted.

The impact on imports is mixed across Africa irrespective of the policy scenario applied except for scenario 32 (flexibility, low levy, and revenue distributed to all economies) where all countries show increases. The positive effects registered under scenario 32 may partially be attributed to: 1) increased purchasing power due to revenue distribution associated with this scenario which increases appetite for imported goods and 2) the low levy associated with scenario 32 leads to similar to smaller increase in maritime cost in all years. This means that it may not necessarily disincentivize importation of goods due to resultant price adjustments as most African countries are import-dependent as much as the other scenarios.

There are general decreases in exports relative to the Business-as-usual (BAU) scenario irrespective of the policy scenario applied with an exception of Kenya where increases are registered under scenarios 24 (no levy with no revenue distribution and with flexibility mechanism) and 36 (no levy with no revenue distribution and with a flexibility mechanism via feebate). Considering serious BOP challenges facing African economies, it is important for these countries to allocate part of the revenues realized under scenarios 26 (a high levy with revenue distribution) and 32 (low levy with revenue distribution and a flexibility mechanism) towards boosting goods production to generate surplus for export. Such investments should be complemented with supplementary fiscal and monetary policies that seek to boost production.

Consumer prices increase in all scenarios applied relative to the Business-as-usual (BAU) scenario except for Kenya which experiences a reduction under scenarios 24 (no levy with no revenue distribution and with a flexibility mechanism) and 36 (no levy with no revenue distribution and with a flexibility mechanism via feebate) in 2030 and 2040. The increases in consumer prices suggest that certain mid-term measures might worsen inflation. The results show that consumer price increases are larger under scenario 26 (high levy and revenue distributed to all economies) followed by scenario 32 (flexibility, low levy, and revenue distributed to all economies) compared to increases seen under scenarios without levy (24 and 36). This suggests that introduction of levies could trigger inflation in Africa potentially reducing consumer welfare in the absence of increase in purchasing power following the redistribution of revenue. To minimize significant increases in inflation, African governments may need to adopt policy scenarios with low levies. These findings underscore the complex economic responses to environmental policies in Africa and highlight the need for adaptive strategies in the implementation of marine fuel standards and GHG pricing.

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