

Incidence of Carbon Pricing in Tanzania: Using Revenues to Empower Low-Income Households with Renewable Energy

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Abstract

- **Objective:** to analyze the distributional effects of carbon pricing on Tanzanian households and to investigate compensation schemes that utilize revenue for renewable energy initiatives
- **Methods:** a microsimulation approach that integrates household data with Multi-Regional Input-Output (MRIO) analysis to evaluate carbon footprints and the incidence of carbon pricing and compensation schemes across various income groups
- **Key Findings:** While national carbon pricing tends to have progressive effects, it shows large horizontal differences between households within quintiles. Revenue recycling through monetary transfers or the provision of solar energy appliances can help mitigate these burdens.
- **Conclusion:** By pairing carbon pricing with renewable energy solutions, Tanzania can enhance its efforts toward poverty reduction and improved electrification.

Introduction

- Tanzania is experiencing significant **economic growth**, but this progress is also accompanied by a rise in **carbon emissions**.
- Many households rely heavily on **fossil fuels**—such as kerosene, charcoal and biomass—serving as their primary energy sources. This dependence contributes to both **environmental and health challenges**.
- This paper investigates the **distributional impacts** of various **carbon pricing and compensation** schemes on Tanzanian households.
- Carbon pricing is an effective tool to:
 1. **Discourage** the development of **high-carbon infrastructure**
 2. Generate revenues to **support sustainable energy solutions**
- **Key Objective:** What are the distributional impacts of carbon pricing in Tanzania and how can the revenue generated from carbon pricing be leveraged to foster sustainable development, particularly through renewable energy initiatives?

Methodology

- **Approach:** Microsimulation combining MRIO and household survey data
- **Data:**
 - MRIO data: Global Trade Analysis Project (GTAP) 11 database is used to calculate embedded CO_2 emissions for household consumption.
 - Household data: The Tanzania National Panel Survey (2020-2021) provides relevant household information.
- **Scenarios:**
 - a. **Four carbon pricing designs.**
 - i. International carbon price
 - ii. National carbon price
 - iii. National carbon price on fuels (petrol and diesel)
 - iv. National carbon price on electricity
 - b. **Five compensation schemes**, which include monetary transfers and the provision of solar appliances (see Table 1)
- Carbon price is set at $40\$/tCO_2$.

Table 1. Compensation schemes

| | Scheme | Explanation | Receiving households | Value per household |
|--------------|----------------------------------|--|---|---|
| Monetary | Lump sum transfer | Uniform lump-sum transfer, total revenue distributed equally per capita | All quintiles | 116\$/year |
| | Targeted transfer | Lump-sum transfer, households without children receive 60% of the lump-sum amount, those with children the full amount | Quintiles 1-3 | \$116/year without children, \$193/year with children |
| Non-monetary | Solar light provision | Provision, installation, and maintenance of solar lighting systems | All quintiles, without grid electrification | \$175/year |
| | Solar cooker provision | Provision of solar cookers, pots, training, and maintenance | Quintiles 1-3, without clean cooking | \$197/year |
| Combined | Solar cooker & targeted transfer | Combination of solar cooker provision and targeted transfer, households which already use clean cooking appliances receive the targeted transfer | Quintiles 1-3, without clean cooking | \$193/year |
| | | | Quintiles 1-3 with clean cooking | \$116/year without children, \$193/year with children |

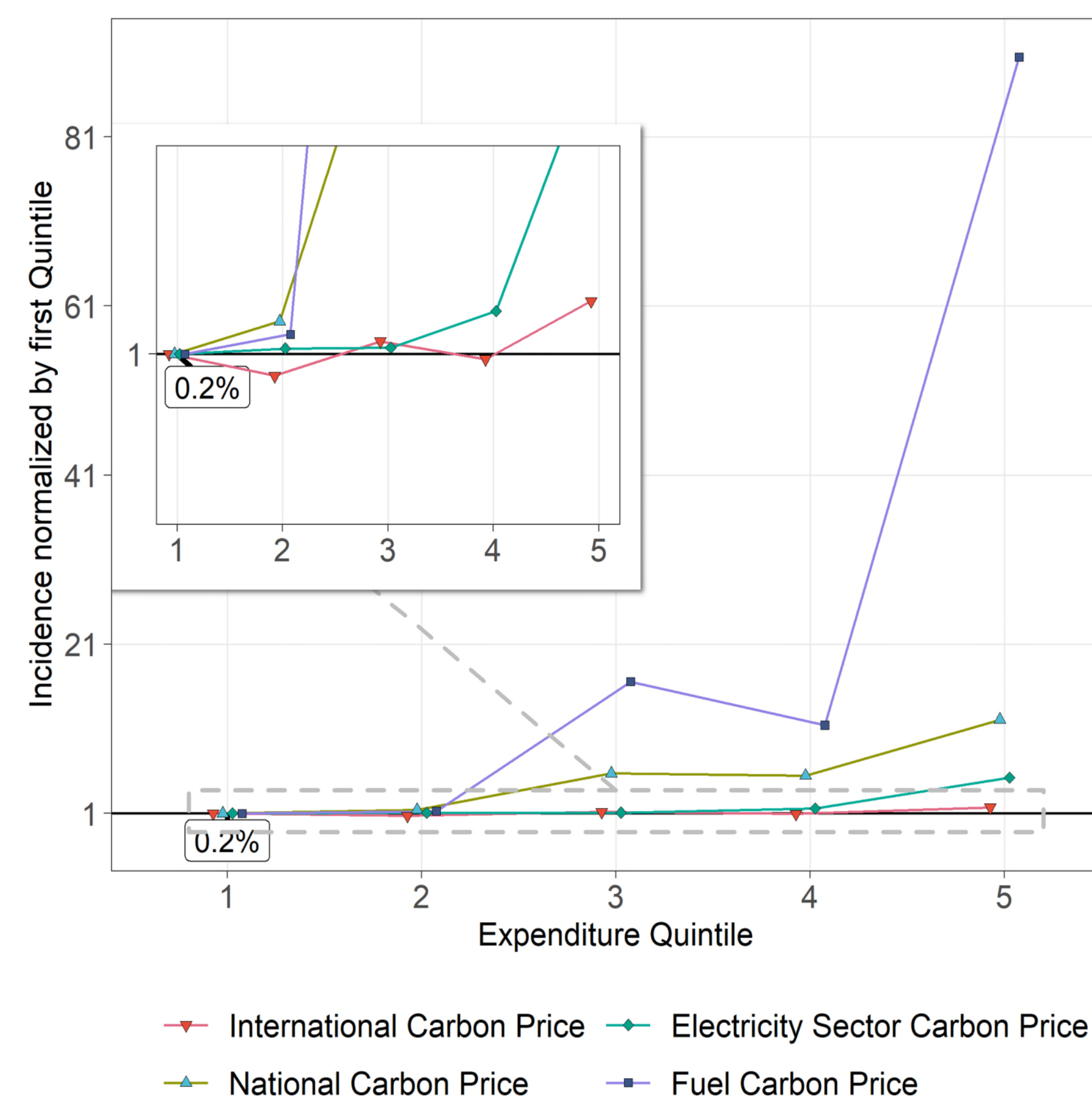


Figure 1. Relative median incidence by household quintile

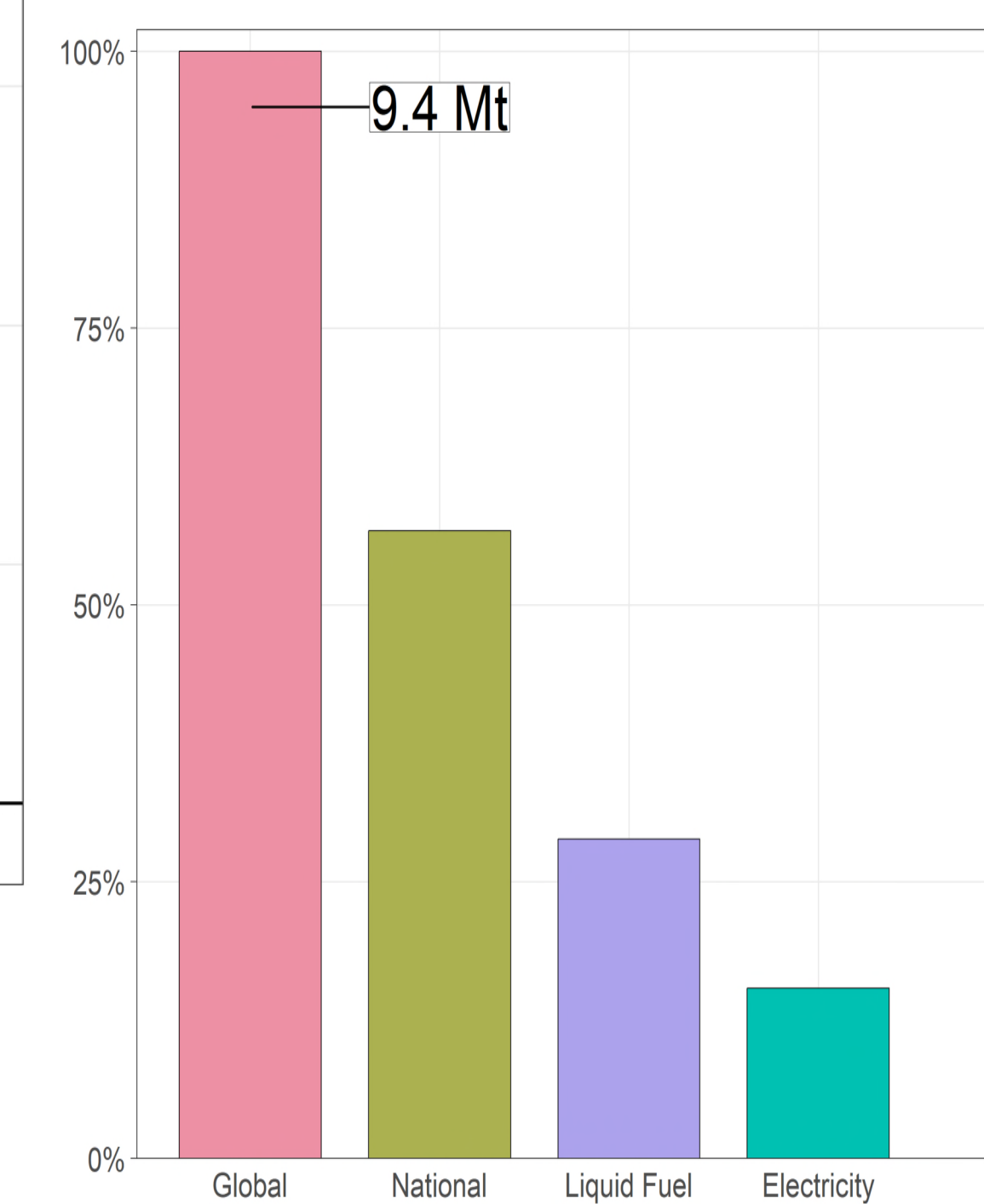


Figure 2. CO2 Emissions

Results

- Carbon Pricing Impact: Figure 1**
 - In the **national carbon pricing** scenarios, **progressive effects** have been identified, yet **notable disparities** exist among different income groups.
 - The **international carbon price** shows a rather **mixed incidence** where low-income households tend to bear a higher relative burden.
 - In all scenarios, **the richest households** face a **greater absolute cost burden** due to their higher levels of carbon-intensive consumption.
- Revenue Use for Compensation: Figure 3**
 - The **annual revenue** generated from national carbon pricing is projected to be **\$125 million**.
 - These funds can be allocated to **provide renewable energy solutions**, such as **solar lights and solar cookers**, to households without grid access or clean cooking appliances.
 - Revenue-financed **cash and renewable energy transfers** can effectively **mitigate the adverse effects** experienced by low-income households.
 - Investment in **renewable energy systems** can reduce the dependency on firewood, charcoal and kerosene and would benefit especially low-income households with **substantial long-term cost and time savings and health benefits**.

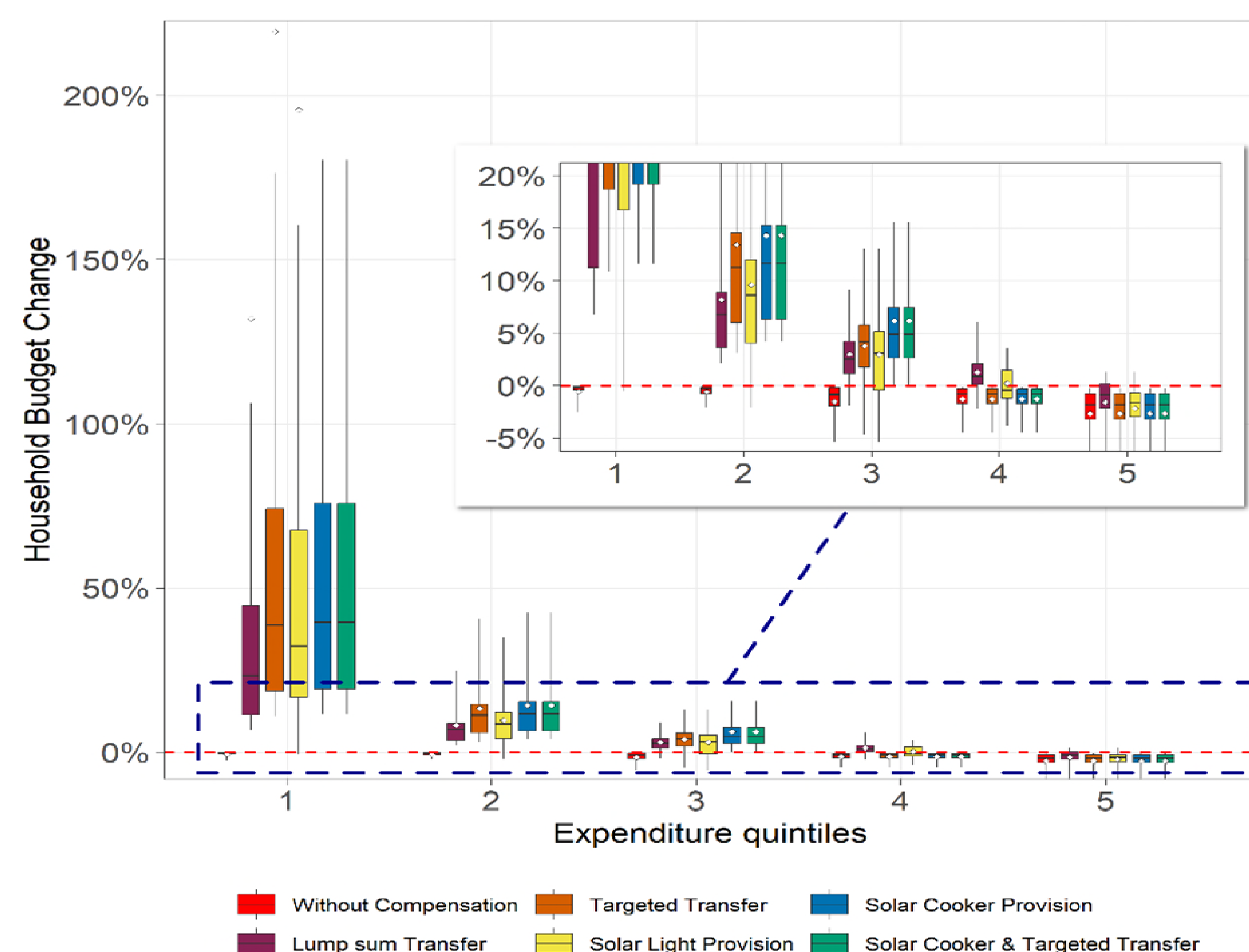


Figure 3. National Carbon Price: Change in Household Budget for Different Compensation Schemes

Conclusions

- ❖ Carbon pricing serves as an effective strategy for sustainable development by **discouraging** the creation of **high carbon lock-ins** while **generating revenue** for the advancement of **renewable energy initiatives**.
- ❖ Additionally, it aligns with the **sustainable development goals** set forth by Tanzania, namely electrification and clean cooking objectives.
- ❖ It is advisable to **integrate carbon pricing** with revenue recycling directed toward **renewable energy solutions** to promote social inclusivity, ensure political feasibility and foster sustainable.

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