

The Environmental Footprint of Mexican Exports: An Interregional Input-Output Analysis of Greenhouse Gases and Criteria Pollutants

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The primary objective of this research is to estimate the regional inequality in the distribution of the environmental costs associated with the production of Mexican exports. To achieve this, the study measures these costs through the generation of greenhouse gases and criteria pollutants. Specifically, the research addresses three main aspects: a) the territorial allocation and spatial concentration of these emissions at the state level, b) the comparative environmental footprint of the export-oriented production versus the production destined for domestic final demand, and c) the structural emission intensity of the export basket compared to the domestic market across different economic sectors.

To address these aspects, the study employs an interregional input-output model extended with environmental vectors. The methodology uses the standard Leontief decomposition (Miller and Blair, 2022), extended to calculate both direct and indirect emissions from export production and domestic demand. To overcome data limitations at the subnational level, the study implements a top-down distribution strategy that allocates national emission vectors to the federal entities using specific proxy variables.

The empirical analysis relies on the multi-state input-output matrices published by the National Institute of Statistics and Geography (INEGI) for the year 2018. Given the availability of information, the number of economic sectors was reduced from 32 to 26, allowing the study to use an 832-state-sector structure. Specific satellite vectors were constructed for greenhouse gases (carbon dioxide CO₂, methane CH₄, and nitrous oxide N₂O) and criteria pollutants (carbon monoxide CO, nitrogen oxides NO_x, sulfur oxides SO_x, PM₁₀ and PM_{2.5} particles, volatile organic compounds VOCs, and ammonia NH₃). The data sources included EXIOBASE v3.0 (Stadler, et al., 2018), the National Emissions Registry (RENE), and the National Inventory of Criteria Pollutant Emissions (INEM), complemented by official agricultural and energy statistics for state-level distribution. To facilitate comparability and spatial analysis, these multiple vectors were subsequently aggregated into their respective equivalents: PM_{2.5} Eq. and CO₂ Eq. emissions.

The novelty of this research lies in being the first study to quantify and map the environmental inequality footprint of Mexican exports at a regional level. While previous literature has analyzed the unequal distribution of income in production chains, the subnational distribution of the environmental burden has not been deeply explored. The results reveal a profound spatial duality: criteria pollutants, which are harmful to local health, are highly concentrated along the northern border, linked to manufacturing and the export logistics. In contrast, greenhouse gas emissions linked to the external sector shift towards the south-southeast of the country, driven by hydrocarbon extraction. Ultimately, the study demonstrates that production for exports is structurally more polluting per unit of value and generates a significantly higher regional inequality than production for domestic consumption, highlighting the need for spatially differentiated environmental policies.