

Impacts of MRIO Deviations from Official Statistics on Carbon Footprint Estimates

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Multi-regional input-output (MRIO) databases developed by academics during the 2010s led to a substantial increase in the number of environmental footprints assessment. These databases overcame the "domestic technology assumption" inherent in single-region models and provided high industry or country resolution. However, despite their widespread academic use and potential for policy application, their impact on actual policymaking has remained limited. A primary barrier is that statistical indicators used in policy processes must meet strict methodological criteria, including consistency with official statistics  standards many academic MRIOs struggle to demonstrate.

This paper addresses a significant research gap identified as "official statistics bias". While biases like   sectoral aggregation bias  TM,   spatial aggregation bias  TM, and the homogenous price assumption have been extensively studied, the effect of deviations from official monetary benchmarks has received little attention because such benchmarks have historically been unavailable. This is critical because discrepancies in core monetary data can lead to the overinterpretation of results or misleading insights on carbon footprints, ultimately undermining the reliability of these indicators for policy use.

The study evaluates the extent to which major academic MRIO databases deviate from official data by using Eurostat  s FIGARO database as the official benchmark. FIGARO is considered the authoritative source for this comparison as it adheres to the quality standards of official statistics and will likely be the primary source for reporting carbon footprint indicators in Europe. The methodology involves a three-block comparison focusing on the year 2015: a cell-level comparison of monetary MRIO structures using Weighted Average Percentage Error (WAPE), a comparison of consistency across monetary macro-aggregates, and a quantification of the resulting differences in carbon footprint estimates. The databases selected for comparison against FIGARO include EXIOBASE, GLORIA, and FIGARO-E3, all of which offer high industry and product resolution.

The results reveal significant discrepancies between academic databases and the official benchmark. Both EXIOBASE and GLORIA show substantial deviations from FIGARO, with total WAPE values of approximately 30% and 32%, respectively. The most pronounced differences occur in intermediate consumption, where WAPE values reach approximately 40%. At the national level, the variance is even more stark; the median WAPE for GLORIA is 37% (ranging from 23% to 72%) and for EXIOBASE is 35% (ranging from 19% to 86%). In contrast, FIGARO-E3, which was designed for consistency with official statistics, reports total differences of only 1%.

These monetary deviations translate directly into uncertainties for environmental indicators. The study finds that the "official statistics bias" introduced by mismatches in EXIOBASE and GLORIA results in a median carbon footprint bias of about -4%. However, the range of this effect is broad and potentially misleading for specific countries, spanning from -25% to +44% for EXIOBASE and -25% to +19% for GLORIA. FIGARO-E3 showed no such effect, maintaining a median bias of 0%.

Ultimately, these findings suggest that while academic MRIO databases offer superior environmental extensions and sectoral resolution, the uncertainty of their core monetary data poses a challenge for policy integration. For carbon footprint indicators to be effectively used in European

policy consistency with official statistics is paramount. The study highlights the need for users to carefully evaluate whether the advantages of academic databases are outweighed by the risks of official statistics bias.