

# Referee Report - Chancel and Rehm (2024)

## The Carbon Footprint of Capital: Evidence from France, Germany and the US based on Distributional Environmental Accounts

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### 1 Summary

In "The Carbon Footprint of Capital", Chancel and Rehm present a new accounting method to measure the carbon footprints of individuals, which consists in capturing the emissions linked to polluting assets and including them into the carbon footprints of their owners, and observe their distribution within the population. By doing so, they observe that emissions linked to asset ownership are unequally distributed and concentrated at the top of the wealth distribution. Thus, they claim that the emissions of the wealthiest have been underestimated in most of the recent literature, as they call for a broader theory of optimal taxation that would take into account the role of individuals not only as consumers, but also as owners of polluting assets.

So far, the existing literature on the individual carbon footprint has mostly focused on the role of individuals as final consumers. To Chancel and Rehm, individuals are indeed responsible for their consumption, but these "consumer-based" approaches have neglected the fact that they are also responsible for the assets they own. That is why the authors propose a novel framework for individual carbon footprints, which would include not only emissions related to consumption, but also those linked with asset ownership. Using data from France, Germany and the US, they develop a strategy to incorporate the production footprint of firms into the individual carbon footprint of their owners and consumers.

There already were attempts at departing from the "consumer-based" approaches by contrasting the carbon footprints with those of firms (production-based approaches and methods of shared attribution). However, these alternatives are hard to implement at the individual level, while attempts at linking carbon emissions to individual emissions portfolios have yet failed to reach consensus. The key novelty of Chancel and Rehm (2024) is to combine data from environmental accounts and national accounts (on income, wealth, and production) at the individual level, and compare emission estimates to the distribution of asset ownership within the population. This method allows them to develop their three approaches to measure the individual carbon footprint. First, in the ownership-based approach, they attribute all direct emissions from production to the firm owners. Secondly, they build their own consumption-based approach where they allocate all direct and indirect emissions to final consumers using their data. Finally, they present a more nuanced measure with the mixed-based approach, where all emissions are attributed to consumers, except those due to capital formation (investment).

Thus, Chancel and Rehm find that by dismissing emissions tied to asset ownership, most of the existing accounting systems have underestimated the carbon footprint of the wealthier groups, with even stronger carbon inequalities than implied in the literature. Indeed, emissions from asset ownership would be concentrated at the top of the wealth distribution, where they even represent the majority of emissions, even more than wealth itself. That is why the authors argue that climate policies should shift from the "consumer-pays" principle to a fairer tax-system on the carbon content of assets and call for a broader theory of optimal taxation related to carbon emissions and asset distribution.

## 2 Comments

To begin with, the Chancel and Rehm acknowledge three main limitations to their paper. First, they recognize their data on individuals at the very top of the wealth distribution are incomplete, because of the self-reporting nature of the wealth surveys they rely on. As a result, they can only infer the breakdown of assets owned by the wealthier individuals in the population from the portfolio of the richest individuals who answered, not to mention these surveys are also prone to under-reporting of asset values. Nevertheless, the authors believe these biases operate in the direction of reducing the concentration of emissions at the top, which would only strengthen their findings. Secondly, they assess a lack of granularity in asset data since they observe a limited number of asset classes. This implies they cannot differentiate carbon-intensive from low-carbon investments within individual portfolios. This could be an issue given that the composition of portfolios change with the wealth distribution. However, we hardly believe that very wealthiest individuals mostly own equities in environmental-friendly firms, which could be a concern for the findings as we infer their portfolios. To address this, one could ideally use data on wealth and asset holdings at the individual level, linked to precise firms owned by each individual. Most importantly, we must keep in mind that data on the distribution of assets is unavailable in some countries, which makes the framework proposed in this paper impossible to apply. Thirdly, the authors point out the challenges associated with cross-border investments, where they rely on an average carbon intensity by country, ignoring sector-specific variations in foreign economies. This issue could be fixed with granular international investment data and information on sector-specific emissions intensities for cross-border assets.

Furthermore, Chancel and Rehm recognize that their paper only partially and imperfectly address the government's role in decarbonization. Even though they test various allocation rules to attribute government's emissions to individuals, their framework dismisses all responsibility of the government that is not associated with its direct services. For example, the lack of public transportation limits individuals' and firms' ability to reduce their emissions, but they can hardly be held directly accountable for it. This is an aspect of the framework that can be improved on.

The last limitation the authors address is related to the interpretation of their results regarding individual responsibility. Indeed, they argue that no broadly defined carbon footprint measure can fully capture the actual responsibility of individuals for their emissions. It is likely that individuals do not have full autonomy over their consumption nor the assets they own. Thus, the authors claim we cannot conclude which of the consumption and ownership approaches best represents individual responsibilities, reinforcing the idea that they rather complement each other, with the mixed-based approach bringing some nuance in-between.

We now make three suggestions to the paper, starting with the "Sensitivity of the results to assumption" (6.1). Chancel and Rehm claim they conducted a series of robustness checks to see how their results react if they departed from their benchmark assumptions about the allocation of emissions to individuals, (detailed in Appendix I, Section C.7). If the general trends they observed hold under extreme combinations of assumptions, we do not think these tests qualify as "robustness checks" in a strictly econometric sense. Indeed, they adjust parameters and allocation methods based on other assumptions without relying on statistical tools. Instead of using "robustness checks", we suggest to stick with "sensitivity of the results to assumptions". On another more technical note, we notice Figure 6 excludes the bottom wealth groups "because intensity emissions/wealth ratios show erratic trends". We believe further explanations would contribute to improve the quality of the paper, especially given the importance of this graph. The last suggestion concerns the mixed-based approach. For the reasons previously mentioned, we think the paper would benefit from stating more clearly that this approach is a first attempts to nuance the responsibility of individuals as consumers and owners in this novel framework with asset emissions. As a result, this approach is still imperfect and cannot perfectly capture the true control individuals have over their choices. That is why we also recommend to develop more in part 6.2 on the further investigations that could lead to these "more refined versions of the mixed-based approach".

Last but not least, despite these limitations, we believe that this paper should be published and that it would be a significant contribution to the existing literature. On the one hand, the carbon footprint measure proposed manages to achieve macroconsistency, which is a reason to believe that this framework should be applied to other countries, and eventually used for designing policies. On the other hand, their findings challenge previous stylized facts in the carbon emission literature, which would surely benefit from further investigations of their novel framework.

### **3 Recommendation**

Even though the paper clearly suffers from limitations due to the data it uses, I would still recommend accepting it because of the importance of its contribution to the existing literature. The novel framework it proposes opens the door to a brand new way of understanding the carbon footprint of individuals and its distribution, as well as it calls for a broader theory of optimal taxation based on carbon emissions.