To what extent can household classifications be used as a proxy to calculate household level consumption-based carbon accounts?

Topic: Consumption-Based Accounts of Household Types
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Environmentally Extended Multi Regional Input Output (EE-MRIO) models are widely used to analyse the impacts of consumption and are a useful tool for the development of environmental policies. Applications have recently emerged in the commercial domain, as consumption-based carbon accounting has gained wider interest. Some financial service providers and consumer apps have begun to apply EE-MRIO multipliers to financial transaction data with the aim to measure the carbon footprints of their retail and business customers. Given purchases are reflective of daily user consumption, the methodology can derive personalised carbon profiles as a function of oneâ€™s spend. Customers are provided with feedback about their total carbon impact and key sources of emissions, enabling them to understand and take steps to reduce their carbon footprints. While the validity of the approach has been positively recognised, activities and purchases are not always captured through card transactions. Moreover, purchase-based carbon footprint estimates tend to lack granularity at the product level, as bank statements do not record the receipt-level breakdown. Some consumer apps have attempted to address these shortfalls by combining â€˜bottom-upâ€™ survey data volunteered by users to improve their carbon estimates. Although this approach promises personalised footprint estimations that closely align with usersâ€™ lifestyles, it lacks scalability as it relies on supplementary information that is not always accessible nor guaranteed.

This research paper explores the potential for using household classifications to better estimate the detailed spending patterns and hence the carbon footprint of clients from a major U.K. bank. The Output Area Classification (OAC) is one such classification system. The OAC is a geodemographic classification which clusters households in census collection areas of the U.K. by socio-demographic similarities. The OAC associated with each bank account can be recorded, as address level data is captured within the dataset. National household expenditure surveys such as the U.K.â€™s annual Living Cost and Food Survey (LCFS) provide detailed and representative accounts of householdsâ€™ basket-level spend. Given each survey entryâ€™s OAC type is recorded, we can estimate spending patterns by OAC.

Applying UK-MRIO conversion factors to the LCFS dataset, a predictive model will be built to estimate the carbon footprint profile for each OAC category. The model will be trained based on longitudinal spending patterns of OAC households for years 2009 â€“ 2018 (n = 53,479), and later tested on the two most recently available LCFS datasets (years 2019 and 2020). The modelâ€™s predictive power will be assessed through a series of goodness-of-fit statistical techniques, to enable a comparison of predicted and observed results. The analysis will help identify which spend categories, OAC groups and test-years generate the most accurate CO2 emissions predictions. To improve the modelâ€™s predictive power, this research paper will look to explore alternative classification techniques to derive household groupings that best describe carbon footprints of different household types.

Using the proposed archetype method as a shortcut approach for predicting carbon footprints presents exciting and novel avenues of research to both commercial and policy spheres. In the context of policy, the findings of this study will deliver important insights regarding emission patterns across different consumer groups. This will enable policymakers to derive targeted measures and move beyond a â€˜one-size-fits-allâ€™ approach to carbon mitigation strategies.