Equitable Allocation of MobilityCoins Aimed at Maximizing the Reduction of CO_2 Emissions

Master‘s Thesis of Sydney Foierl

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This study explores the impacts of equitable allocation schemes within a MobilityCoin tradable credit scheme system designed to reduce transportation-related carbon emissions. It relies on an equal distribution of non-monetary credits linked to a predefined carbon emission goal rather than direct monetary transactions that tend to over-burden lower socio-economic classes. However, recent studies have found in both public and professional opinions that a need-based allocation would promote equitability and system acceptance more so than an equal allocation.

A comprehensive literature review has deemed equity within the MobilityCoin system as the just distribution of benefits (surplus) and burdens (deficit) within and across different demographic groups, aiming to ensure fair access to mobility and opportunity. Following, all the possible demographic groups and characteristics that could be deemed applicable to different mobility needs were explored. Then vertical and horizontal equity was ensured by narrowing the focus to five demographic dimensions: gender, ability, race, employment status, and income class. These groups are broken down into subgroups as seen in Figure 2.

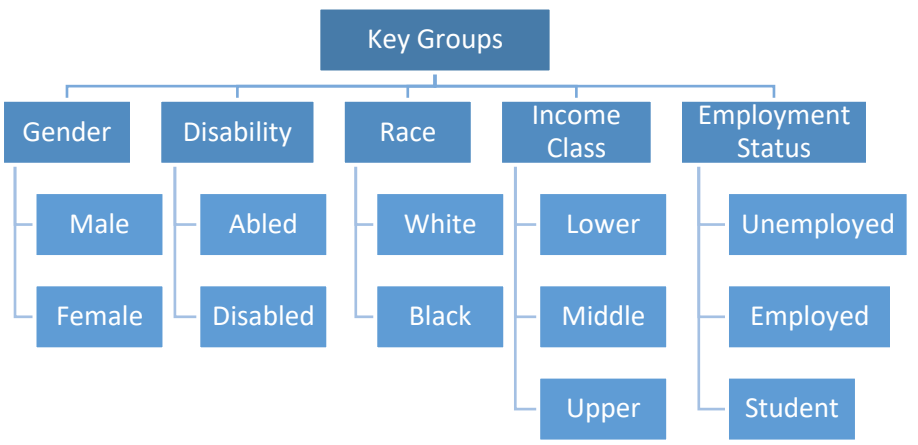

Figure 2: Key groups for equitable credit allocation.

The analysis rests on the synthetic population of the metropolitan region of Munich, Germany and corresponding daily trip data. The current daily emission amount across each demographic, as well as an overall amount, was compared to the groups share of the population to serve as the basis of the analysis, Figure 1. Four allocation models were used for analysis: equal distribution, deficit-focused, surplus-focused, and an equally weighted model. Each model used normalized weighted multipliers apply to the corresponding members of each group. Each allocation was then assessed using both overall system and group-level comparisons of statistical measures Palma Ratio, Gini Index, and Surplus-Deficit Ratio.

This revealed little variation between Gini Index values across equal and equitable allocation schemes, however, considerable variation for Palma Ratio values. Indicating the possibility that there is little change in equity across the overall system, but great changes to those who are heavily over or under burdened.

Further findings suggest that an equity-focused allocation can improve the balance of benefits and burdens, increase user acceptance, and enhance the legitimacy and functionality of the Mobility Coin trading system. Specifically for the system, it could lead to a more balanced trading environment, maintain stable market prices, and increase market participation. Implementing such schemes, however, introduces administrative complexities, including the need for continuous monitoring and recalibration of the distribution system.

Ultimately, the study demonstrates that incorporating equity into the MobilityCoin credit allocation design can yield both social and operational benefits, supporting fairer access while fostering market stability and engagement.

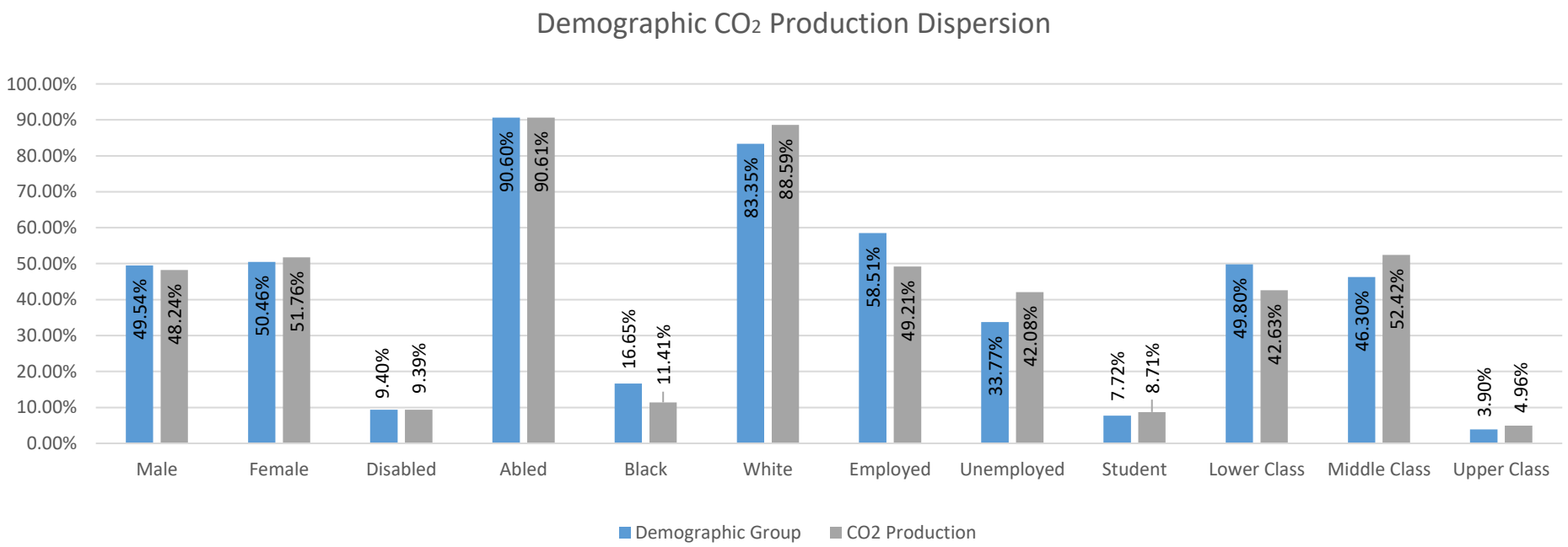

Figure 1: Carbon emission trends over various demographics.