

Sustainable transportation: Understanding the complex rebound effects of transportation choices

Abstract

Densification is held as one key mean to reduce greenhouse gas emissions from private driving. However, the overall mitigation results are actually likely to fall short from expectations due to the rebound-effects related to changes in transportation patterns. Possessing, operating and maintaining a private vehicle requires a significant investment of money. For the majority, this investment reduces other consumption possibilities and thus the emissions caused elsewhere. This phenomenon can be called the rebound-effect of private driving. While early evidence seems to highlight the importance of this perspective, the problem is far but fully understood. We aim to provide a small step to the state-of-the-art within this issue by studying the transportation patterns in relation to other consumption choices, and by producing the greenhouse gas elasticity of private driving in different types of urban settings. This kind of understanding could significantly help in the future in designing more sustainable human settlements.

Extended abstract

Development of more sustainable transportation systems and urban forms leading to lower transportation demand, and especially to less private driving, have been studied extensively during the last decades (e.g. Ewing and Cervero 2010). These studies have led to the current prevailing paradigm of densification in urban planning and urban development targets, higher density having been demonstrated to correlate with reduced private driving. However, the mitigation results are actually likely to fall severely short from the targets due to the significant but badly understood rebound-effects related to changes in transportation demand. This perspective goes predominantly unnoticed since the majority of studies concentrate solely on transportation and are thus not able to detect the rebound-effects.

Possessing, operating and maintaining a private vehicle requires a significant investment of money. Even in the most affluent societies, for the vast majority of consumers this investment inevitably affects a wide variety of other consumption choices as well. Thus, as the result of reduction or increase in private driving, other consumption patterns are likely to change as well. And, since all consumption activities are prospective to cause environmental burdens, the achieved reduction in the environmental impacts due to reduced private driving can be expected to fall short from the direct reductions. This phenomenon can be called the rebound-effect of private driving.

The issue is of high importance based on some initial evidence. In the studies having incorporated flying into the studied transportation system, the finding has often been that flying increases as private driving decreases, resulting at least reduced gains, but even in increased overall emissions from transport (Ottelin et al. 2014; Ornetzeder et al. 2008; Brand and Preston 2010). Furthermore, Heinonen et al. (2013) have shown how in the middle income class in Finland the carbon footprints of those not possessing private cars are only slightly lower than of those driving due to the investment to a car leading to reduced consumption power in other consumption categories. Similar findings in the sense of reduced driving not showing as reduced overall carbon footprints have been presented from Australia (Wiedenhofer et al., 2013) and UK (Minx et al., 2013) as well.

However, while the early evidence seems to highlight the importance of this perspective on the quest for more sustainable transportation systems and human settlements in general, the problem is not

even fully understood yet. Further evidence from different types of settlements are needed, and the consequential future projections taking into account the developing technological environment are predominantly yet to be even tried. We aim to provide a small step to the state-of-the-art within this issue with the study we propose. By studying the transportation patterns in relation to other consumption choices, in the form of consumer carbon footprints, we aim to produce the greenhouse gas elasticity of private driving in different types of urban settings when all consumption activity and the resulting greenhouse gas impacts are taken into account. As the main data we employ the 2012 Finnish Consumption Survey data from Statistics Finland, and form the carbon footprints with a hybrid LCA model.

This kind of understanding could significantly help in the future in designing more sustainable human settlements. The implications of studying the elasticity include seeing even private driving as a potential way to decrease the overall emissions; a possible consequence for a household investing in a highly energy efficient vehicle, which leads to a reduction in other consumption as well as reductions in the environmental impacts from driving itself. The gain is thus twofold, unlike predominantly seen. While the more energy efficient vehicle itself can reduce the emissions per unit driven, the investment into the vehicle multiplies the gain by reducing the consumption power elsewhere. In general, recognizing the elasticity related to possessing and using private vehicles, or the rebound-effect, enables one trying to affect the driving patterns to estimate better the overall gain if driving is reduced as a consequence of a certain action.

References

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