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# Analysis and prediction of private car ownership and use in Denmark: Part of the ELISA project

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## Abstrakt

This abstract presents the results of the estimation and forecast of the national car ownership and use for Denmark. The work was performed as part of the ELISA project on improved projection tools for the green transition of the transport sector, funded by the Danish Energy Agency the Ministry of Finance and the Ministry of Transport and Housing. The results are presented and documented in the report Analysis and prediction of private car ownership and use in Denmark: Part of the ELISA Project — DTU Research Database

## Introduction

Forecasts of aggregate car ownership and use levels are used in predicting transport demand, energy consumption, emission levels and tax revenues, as well as in analysing the impact on these of different regulatory policies.

The report documents the work carried out in relation to the estimation and forecast of private car ownership and use in Denmark. The work is carried out with a view to update the 2004 model known as ART (Aggregate Road Transport) (Fosgerau et. al 2004) taking into account the recent changes in travel behavior and overall economic conditions.

## Data and Model

The estimation of car ownership and use is performed in two separate models using annual macro data for the period 1976-2018 of car ownership and use, population, GDP and official indices for car purchase price and vehicle operating costs, from Statistics Denmark, Statistikbanken.

The models are estimated using dynamic time series methods in order to obtain estimates of long run cointegration relations and coefficients reflecting short-run dynamics. In particular, the car ownership model is estimated using and Error Correction Model, a model that assumes the existence of an equilibrium relationship that determines both short and long run relationships. The model restricts the ratio between long run and short run elasticities to be equal for all explanatory variables. The validity of this restriction was tested statistically, and the restriction was accepted as an appropriate description of the data.

For the car use model, we considered two different measures – mileage per car and mileage per capita. While the 2004 ART model used mileage per car as a measure of car use, this choice had to be reconsidered due to the complex trend this series followed during the sample period. In particular, mileage per car has shown an increasing trend until the early 1990s, after which it declined. This change could be explained by the general increase in the car fleet and especially the increase in the share of households with two or more cars. With other explanatory variables showing an overall upward or downward trend, it proved difficult to identify the effect of individual factors on this measure of car use. We therefore chose a model formulation with mileage per capita, which has a positive trend. The model is estimated using Error Correction Model with no constraints on the ratio between long run and short run elasticities.

## Results

The resulting models provides a good fit to the data and coefficient estimates that have the expected signs and are statistically significant. Our estimates show that a change in income or purchase price has a significant long run effect on the level of per capita fleet size and mileage. A change in operating costs is found to have a significant effect on the level of per capita mileage while its effect on fleet size is not significant at conventional levels.

We find that a percentage increase in GDP per capita is associated with a significant increase in the per capita fleet size by 0.83% and per capita mileage by 0.80% in the long run. Similarly, a percentage increase in purchase price leads to a fall in the per capita fleet size by 0.57% and the per capita mileage by 0.64%. The corresponding effects due to a percentage increase in operating costs are decreases of 0.34% and 0.61%, respectively, but the former effect is not statistically significant at conventional levels.

Our findings for the elasticities of purchase price, income and vehicle operating costs are quite comparable to the results from the 2004 study (Fosgerau, Holmblad & Pilegaard, 2004). The long run effect of income on mileage per capita is the same, while its effect on fleet size per capita is now higher. The long run effect of purchase price now higher on both mileage per capita and fleet size, although the difference is not large. For operating costs the long run effect on mileage per capita is now lower. These findings are not surprising considering the recent trend in data. The observed change in effects could be explained by the increase in the number of multicar households. When households buy an additional car, they are likely to increase their overall mileage but however not to double it. Therefore, purchase price becomes relatively more important while the importance of operating costs will be lower. Our results also indicate that reactions to income and purchase price changes in the long run will primarily be in the form of adjustments to the fleet size, while the adjustment in mileage per car will be smaller and less significant. We find our results to be comparable to findings in the international literature.

## References

Fosgerau, M., Holmblad, M. & Pilegaard, N. (2004). ART – En aggregeret prognosemodel for dansk vejtrafik, Danmarks TransportForskning, Notat 5, 2004