

# Modeling Automobile Demand and Driver Population in Palestinian Territories

## Simultaneous-Equation Estimation Method

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Automobile demand has been extensively investigated because of its direct effects on many related fields, including travel behavior, public policy and management, and transportation impact analysis. A modeling framework is developed to estimate aggregate automobile demand using simultaneous-equation regression analysis. This modeling approach is used to estimate automobile demand and driver population in the Palestinian Territories, where major changes in the political, socioeconomic, and infrastructure systems are currently under way. The developed model captures a number of relevant socioeconomic and political variables believed to affect automobile ownership in the Palestinian Territories. The findings suggest that there is a strong interrelationship and simultaneity between automobile ownership and the population of drivers. Relevant tests are applied to examine the econometric specifications of the presented models, which indicate that income, price, demographic, and employment variables are considered significant in the simultaneous-equation model. The model can be used as a basis for forecasting automobile demand.

Automobile demand is considered one of the key variables in the analysis of transportation systems and in transportation planning. Automobile ownership affects travel characteristics and interacts with land use variables. Level of automobile ownership is frequently considered one of the variables that influence traffic congestion, environmental impact models, and transportation infrastructure development and management policies and decisions. In many cases, automobile demand issues motivate the emergence of legislative measures regarding automobile imports and affect state revenues.

The impacts of increasing automobile ownership in developing countries are expected to be much greater than those in developed countries because of a greater increase in the rate of motorization in developing countries despite current limited ownership rates. In comparison, automobile ownership rates in developed countries are approaching saturation levels. However, because of the continuous improvement in economic conditions in developing countries, along with the achievement of better living standards and higher quality of life, the rate of increase in automobile ownership in these countries is anticipated to continue at a much higher rate than that in developed countries.

Despite the unique adverse political atmosphere and the continuous conflict, which best describes the general situation since the Israeli occupation of the West Bank and Gaza Strip, the Palestinian Territories is not an exception in terms of automobile ownership. The number of automobiles increased in the Palestinian Territories from about 4,000 in 1971 to more than 142,000 in 1998. In contrast, the

driving population increased nearly 1900 percent, and population increased from 1.00 million to an estimated 2.16 million during the same period. The driving population's share of the total population increased from about 1 percent in 1971 to about 13 percent in 1998. Despite the very different level of motorization in the Palestinian Territories compared with that in developed countries, it is worth noting that, for example, in the United States during the same period, automobiles increased by 40 percent, drivers by 60 percent, and population by 29 percent.

Great changes in political and socioeconomic conditions have been observed recently in the Palestinian Territories. The Israelis are gradually handing power to Palestinians according to the Oslo peace agreement signed in 1993, after more than 25 years of Israeli occupation of the West Bank and Gaza Strip. The consequences of the occupation extended to various infrastructure sectors of the Palestinian economy. However, with the anticipated economic growth and overall stability in the region, along with the improvement in the transportation infrastructure (as part of the overall infrastructure upgrading and rehabilitation efforts), automobile ownership is expected to increase sharply. The expected increase is the motivation for the current research. A foundation is provided here for further research toward developing appropriate forecasting tools for automobile demand.

Modeling of automobile demand is not a new task. However, most of the research done in this field was performed in developed countries. The findings of such research cannot be applied or transferred to developing countries because of different socioeconomic conditions and infrastructure. Moreover, past research on automobile ownership utilized either single-equation regression models on the aggregate level or discrete choice models on the disaggregate level. Such models did not consider the interaction and simultaneity between automobile ownership and driver population (as in the case of the single-equation regression aggregate model) or were based on a limited set of households. Therefore, an aggregate approach that better models national automobile ownership is provided here, and, at the same time, an attempt to capture the interaction and simultaneity between automobile ownership and the driving population is presented. Though this issue may appear to be trivial, no previous efforts have been made to model the interaction and simultaneity between these two variables.

A brief presentation of previous work in the field of automobile demand modeling is presented first. Next, there is an overview of the empirical setting that forms the basis of subsequent model estimation followed by a presentation of the simultaneous automobile ownership-driver population model. Estimation results along with relevant econometric and specification issues are discussed. Elasticity calculations are then presented and briefly discussed. Finally, a summary of findings is made and appropriate conclusions are drawn.