MOBILITY ANALYSIS AND MODELS OF MOBILITY

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Abstract

This paper presents the main determinants of mobility demand from a literature overview and surveys amongst research institutions. From these studies, econometric models have been built up on a macroscale level. The main parameters and the structure of these econometric models are explained through a few examples and attention is drawn to their weaknesses.

Keywords: Mobility demand, main parameters, econometric models.

1. Introduction

From a literary review and several contacts with scientists, it appears that mobility studies can be divided into two main areas of investigation:
- on a national level;
- on a local or urban level.

Most of the studies on a local or urban level are based on geographical networks in which traffic is simulated in function of local concerns (physical, economical or social). These models are called micro simulation models and have been extensively described by U. Hammarström (1995) in another chapter of this report.

2. Mobility analysis on a national level

From analyses performed on transport demand (see for instance Tanja, P.T. and de Ligt, T.J., 1991), a distinction has to be made between passenger transport and freight transport. These two types of transport are not quite related with the same factors.

Passenger transport demand.
The factors which induce the passenger transport demand are numerous and relatively well known:
- demography, age distribution and households composition (single person family,...);
- economic factors : yearly growth rate of GNP, income or consumption; fuel and vehicle prices; public transport prices; fiscal measures and structure of taxation,....;
- infrastructure facilities: road density, geographical distribution of activities : schools, stores, public transport network,....;
- socio cultural factors : car ownership, employment, part time jobs, education level, recreation, foreign trips, ...

...
Freight transport demand.
Responsible factors for freight transport can be summarised as follows:
- Demography, age, ...;
- Economic factors: yearly GNP or income or consumption growth rate, fiscal measures and structure of taxation, resources availability’s, internalisation of trade, ...;
- Industrial infrastructure and management: location of industries, division of production units, just in time deliveries, ...;
- Socio cultural factors: labour mobility and availability ....;
- Infrastructure facilities: road density and location,...;
- Other: technical and environmental concerns, ...

As it can be seen above, a lot of factors are involved in the mobility demand. The importance of all these factors is changing with time and areas. Data is often lacking: unusable or not accurate or even non-existent. The result of this is that the assessment of these factors can need extensive studies, asking important means (surveys). This aspect is stressed by the complex relationship existing between all these factors. To overcome these problems, macro simulation statistical models have been developed using few numbers of determinant factors.

3. Macroscale models of mobility (econometric)

Despite the diversity of factors involved, or complex relationships, modelling tools have been constructed to simulate and forecast mobility. In general, these models run on a national scale for the reason that macroeconomic data is available on that scale.

The models are based on statistical correlation’s (time series) between mobility or fuel demand (dependant variables) and the most significant economic and social exogenous factors (independent variables). The mobility is expressed in terms of mileage (kilometrage) per vehicle, per year and per capita, passenger mileage per year, tonnes miles per year, ... In general, a few determinant exogenous factors have been taken into account (see below). The coefficients chosen are elasticities: short-run and/or long-run elasticities.

3.1 Determinant Exogenous Factors

They are mainly chosen amongst the following:

Passenger Transport Demand
- Social Factors: Population and/or Drivers; Employment; ...
- Economic Factors: Gross National Product (GNP) and/or Net National Income (Y); Personal Income; Fuel Price and/or Cost per km; Number of vehicles; ...
- Other: Public Transport Supply; Comfort; Infrastructure Facilities (long term); Recreation; Household Constitution; ...

Freight Transport Demand
- Social Factors: Population; Geographical Delocalisation; ...
- Economic Factors: Gross National Product; International Trade; Industrial Structure; ...
- Other: Infrastructure Facilities (road, rail, ...); ...
3.2 Examples

The mathematical concept of three types of models is given below in a summarised form.
Other models can be found. For instance see De Borger L. and De Borger B. (1988). An extensive analysis of applications of such models need to be analysed but ask further investigation and consequently means. Indeed, the precision of the results given by such models must be analysed subsequently to measure their reliability. In short term the accuracy of such models may be considered as adequate but must be carefully assessed to avoid particularly the problems of errors and auto-correlations in the time series analysis.

4. Conclusions

Results of statistical correlations can be a useful indication to forecast mobility at a medium term. However, these models are based on past behaviour and are not able to take into account changes escaping from continuous trends. In addition, factors like the closing of heavy industries or specific conjunctural factors are lacking and jeopardise the credibility of the long term quantification. Further investigations are needed to give a precise analysis of these weaknesses.

5. References


