Model of weekly working participation for a Belgian synthetic population

Cinzia Cirillo*, Eric Cornelis** and Philippe L. Toint**

* The University of Maryland
College Park, MD 20742 USA
** The University of Namur
Transportation Research Group
5000, Namur Belgium

Introduction

The work patterns of individuals or households continue to provide a major determinant in daily mobility, even if a number of recent contributions indicate that it is not, or no longer, the only critical one. (Cirillo and Toint, 2001) It is therefore natural, along with other attempts to explicit the other important structural factors, to investigate the real content and impact of work patterns. Although this subject has been already considered by the transportation research community, and for a long time, its has often been considered rather broadly, with a strong emphasis on effects such as departure time, expected traveled distance or mode of transportation, but the analysis of the patterns themselves has not been so frequently studied. Our purpose is therefore to focus on the patterns structure, and to consider the construction of the household work pattern as a piece of the household activity scheduling. However, if one restricts the scope to daily patterns scheduling, then the number of useful distinctions shrinks considerably and often boils down to the distinction between full-time and part-time work, with possible consideration for industrial work shifts, or questions about whom is responsible for the organization of the working hours (MOBEL). However, analysis of the existing data on work pattern structure (Pas, 1988) indicates that there is considerable variation from day to day, and that variations across individuals are also correlated to variations over the days. Thus it is our opinion that the global view of work trips, tours or chains can hardly be realistically apprehended if one limits oneself to the daily and individual view.

We present in the talk an attempt to extend the analysis of the household work patterns to a weekly horizon, rather than the most common daily one. We believe that this weekly pattern is considerably more adapted to the description of the observed variability, although we are aware of even longer cycles such as those depending on seasons or annual holidays. We therefore focus on the determinants of the choice, for a household of given socio-economic characteristics and composition, of the choice of a weekly work pattern for all household members simultaneously.

The data

To cover the Belgian national territory and to capture the behavioural differences existing across the three Regions (Brussels, Walloon Region, Flemish Region) we used three sources of data. The three surveys, called MOBEL, ERMM and OVG, were all conceived as travel diary and held between 1999 and 2003. MOBEL is a national travel survey, with a special focus on the capital Brussels; although the data collected are representative of the Belgian population, the observations were insufficient to calibrate a weekly model of working

participation. The two Regional surveys, collected with similar protocol, provided the supplementary information needed to capture the behavioral differences from day-to-day. MOBEL and ERMM databases store information on a daily basis, while the OVG survey contains trips data over two days of the same weeks. However, the second day recorded has never been used because it was judged biased by the group in charge of the project. To respect these findings and for homogeneity our final database contains one day trip chain for each individual. We acknowledge that this way to proceed cannot account for differences among working participation programs across the week. A project to collect travel diary over a week is currently under evaluation in Belgium.

The Model

The proposed model is based on a utility maximizing principle and assumes a weekly cycle for a household working participation program. The week is divided into seven days time periods. The household can be composed by one adult or by two adults. We apply two decision-making processes. For each time period the one adult household can either decides to go to work or to don't go to work; in the first case he/she can work part time or full time. The process is more complex for two adults households; the alternatives are constructed as follow: both components not working; one of them working, the other not working, both working. When working participation is observed then we allow also the choice between full time and part time involvement. A nested logit structure, is adopted to model this decision process. The variables included are: age divided by categories 18-39/40-59/+60, sex, education (no diploma, elementary, secondary, higher degrees), driving license, and household type (single with or without children, couple with or without children).

The synthetic population

We also discuss the parallel construction of a synthetic population for Belgium. This population consists in a set of households, themselves containing individuals. Each individual is identified by his/her age, gender, level of education, activity status and driving license ownership and household identification. There are 8 age classes, three activity status (active, inactive, student) and four education levels. Each household has a type (ten types are considered) and a home location, in one of the 589 Belgian municipalities, themselves distributed between four different land-use categories. The population contains approximately 10 millions synthetic individuals, belonging to more than four millions synthetic households. This population is constructed by successive constrained random selection in known parameter distributions. These distributions are themselves extracted from a variety of data sources: the national census (for number of individuals and households), demographic studies (for household types, age classes, activity patterns and education levels), the existing travel surveys (MOBEL in particular) and, finally, the federal transport administration (for driving license ownership). If time allows, some details will be given on the algorithms used in the definition of the synthetic population.

The Application

The model calibrated is then applied to the Belgian synthetic population and the activity participation shares will be compared to those reported in the surveys. A geographic performances is also envisaged; in fact accuracy of the model will be calculated both on regional and national scale.

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