MODELING URBAN TRANSPORT DEMAND FORECASTING TO SUPPORT STRATEGIC CITY PLANNING

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ABSTRACT

Strategic planning of logistics structures ï reviewing transport networks and service supply for access to work, education, leisure, purchasing and supply to trade organizations ï is one important component of the urban planning essential to redirecting flows and ways of life. Here aggregate models are useful to guide urban and public transport strategic planning action plans. An application in a medium-sized city planning changes in land use addressed low-income user travel to work, one of the bases for public planning. Developments for other purposes, and for medium/high-income users, are not reported here. A single approach was considered: urban authorities, on models simple to formulate and use, assess the consequences of land use changes on travel flows, to warrant changes in the transport system, based on the model calibrated with SPSS ver. 8. Data simulation assumed partial rezoning of a typical city with consequent estimation of model parameters considering changes in land use and travel. Explanatory variables were: population by zone of origin (P_i), parameter b_1; number of jobs per destination zone (E_j), parameter b_2; survival level by origin-destination, parameter φ, in the form exp (φ x (NS_{ij})); and the variable T_{ij} for travel volume between i and j. Dummy variables introduced into the original formulation included the exponent, α_i, estimating the log-linear formulation, with values 0 or 1, associated with respective α_i parameters of the zones of origin. Zone 1 is the reference zone, so α_1 does not enter into the regression analysis: the resulting functional specification has a null intercept and, according to the two-stage least squares (2SLS) method, the log-linear formulation associated with the original is applied with the parameter LN α_i by origin. The original formula for the volume of travel to work is: $T_{ij} = \alpha_i \,.\, P_1^{b_1} \,.\, E_j^{b_2}$. exp ($\varphi$ (NS_{ij})), if $NS_{ij} > 0$; $T_{ij} = 0$, if $NS_{ij} \leq 0$, with NS_{ij} = survival level$_{ij}$ = $R_i - C_{ij} - A_i$, where A_i = mean rent or installments in zone i; R_i = mean monthly family income after tax in zone i; C_{ij} = monthly monetary cost of travel between i and j. The estimated parameters were: b_1 = -0.526 (-1.656), b_2 = 0.963 (13.310), φ = 3, 193E-03 (1.503), α_i = parameter (variable) (in separate table), whose Student t-statistic values are in brackets. R^2 = 99.6 % and corrected R^2 = 99.1%, F test showing the calculated value F = 699.396 to be higher than Ftabelado at 1% and 5% levels of significance $\equiv$ a good degree of explanation by the model and a good predictive model, barring evidence to the contrary. The level of significance of the parameters of the explanatory variables was 10%. Not all α_i achieved individual statistical significance.

Keywords: urban logistics, demand forecasting, land use.