ON THE ROLE OF UNCERTAINTY ON TRAVEL COST AND DEPARTURE TIME CHOICE

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ABSTRACT
We consider a dynamic network model (1) in which each commuter has a cost function which depends on travel time and scheduled delays. In a particular case with an exogenously given travel time which vary over the day, the commuter has to choose his departure time in order to minimize his generalized cost function.

In that basic case, we can show that the optimal departure time may not be unique: for some sets of parameters, we can exhibit three optimal departure time. Since this result is valid for an exogeneous travel time function, we may think of a rather more realistic system.

It is well known in transportation science (2,3) that many events can modify the characteristics of a trip: weather, accident ... So, the same commuter, on the same road during the same time period, will have different travel times over the week.

So we set up a model in which the travel time is stochastic and we consider three situations:
In the first one, risk averse drivers know only the distribution of events. In this case, we study the impact of unexpected variability on the user cost and we show that commuters choose an earlier departure time such as in the deterministic situation with early arrival.

In the second case, we assume that a control device is able to reduce the variability of travel time (holding the mean travel time constant). Then, for risk averse commuters, it is shown that the expected utility for travel time decreases with the variability of travel time. This can be expressed as follows: the generalized cost function increases with a mean preserving spread for the travel time.

For the last situation, we consider that an information system (ATIS) provides to each commuter the exact value of the travel time, before the choice of departure time. Then, we can present the advantage from the provision of the information over a control strategy.

Until that point, we have been using a cost function which is piecewise linear. This implies that if the fluctuations in travel time does not change the regime (i.e. a user who arrives early without variability, still arrives early with variability) then users are « locally » risk neutral. However, since the function is piecewise linear, the user are globally risk averse. We now propose to extend the model to the case where users are not locally risk neutral. This intend to use the framework of VNM expected utility model.

Starting from the usual specification of the expected utility function and the distribution of the travel time cost, we try to exhibit and characterize the expected value for the travel time

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cost. From that point, we derive the optimal departure time and we analyse the impact of information on risk averse commuters' behavior and on cost levels.

Last part of the paper presents numerical examples in which we use reasonable values of the parameters (obtained from synthetic data (4)) to simulate the distribution of departure time choice.

REFERENCES


