Choice with multiple alternatives

Specification of the deterministic part

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Introduction to choice models

ÉCOLE POLYTECHNIQUE
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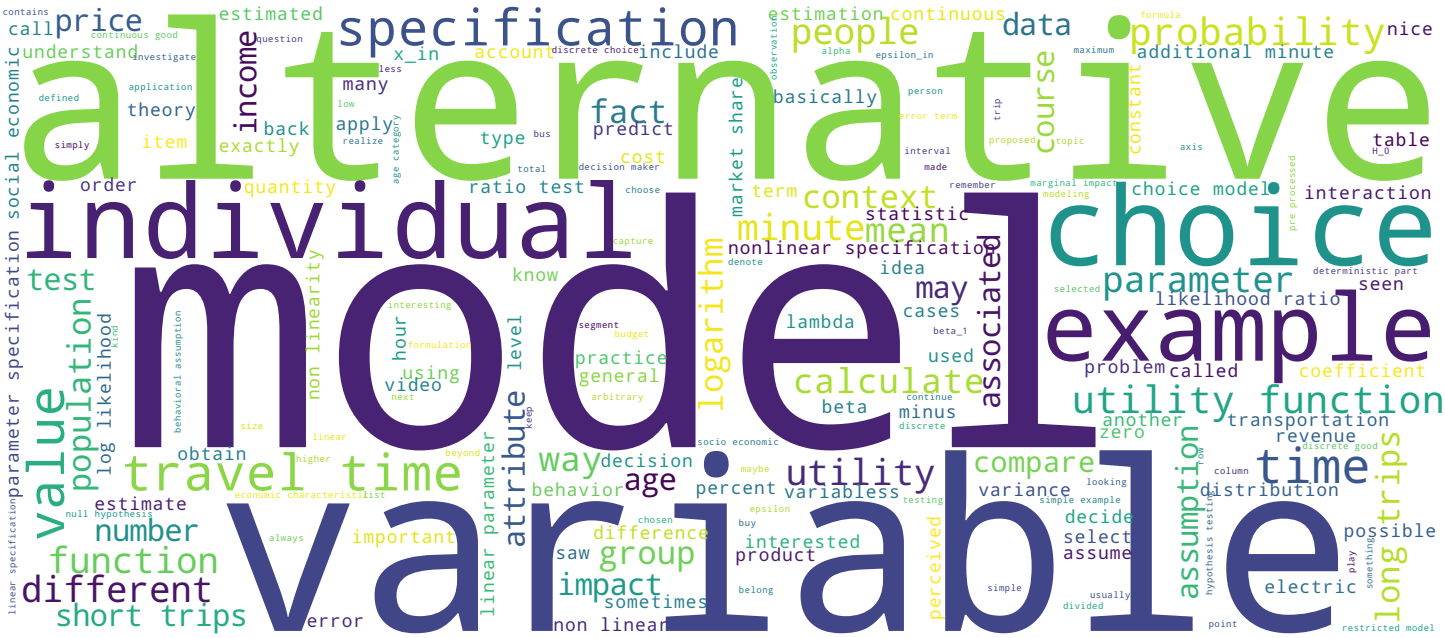

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Video

EPFL

Nonlinear specifications: data preprocessing

Hello. So we continue our investigation of the specification of the deterministic part of the utility function. And so far we have seen a lot of specification based on the linear and Parameter specification. We have seen that it can allow us to model quite behavior assumptions or logic but sometimes it's not sufficient. Sometimes we are willing to go beyond that and to use nonlinear specifications. This is the topic of this video is to understand what kind of nonlinear specification we can use, and what are the behavioral implications of the specification.

Notes

Summary

0m 04s

Behavioral motivation

Example with travel time

- Compare a trip of 5 min with a trip of 10 min
- Compare a trip of 120 min with a trip of 125 min
- Utility difference: $\beta_T \times$ 5 min, in both cases.

Behavioral assumption

One more minute of travel is not perceived the same way for short trips as for long trips

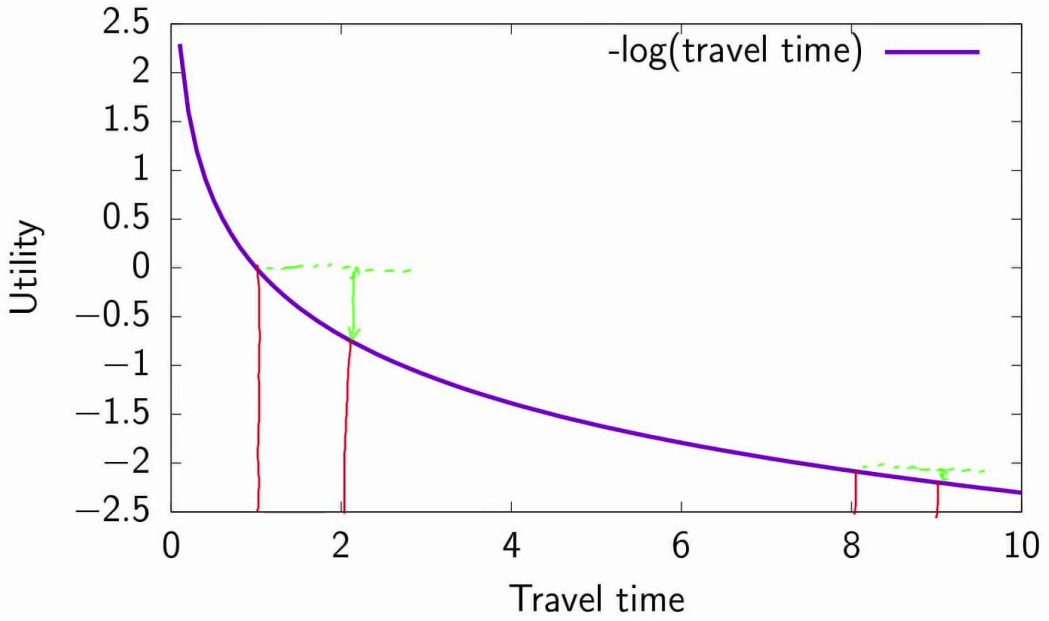
OK let's take an example to understand why we are interested in your specification. Take again the example of a transportation more chores and the impact of travel time to the choice of the mode of transportation and then compare a case where you have the choice between a trip of five minutes with a trip of 10 minutes and another context where you compare that to people of two hours and the trip of two hours and five minutes. In most cases the difference is five minutes meaning that in most cases when you calculate the probability the five minutes will play the same odd but you that's five more minutes for sleep or five minutes will be actually perceived as more penalizing than five more minutes in the context of a two hour trip. This is what we would like to model the fact that one more minute of travel time will not be perceived the same way by the traveler for short trips and for long trips. How do we do that.

Notes

Summary

0m 38s

Behavioral motivation



Well one possibility would be to model the utility function as a function of travel time in a nonlinear way. For instance in this example the utility function is the legalism of the travel time. So we should take this look at the formulation and look at the impact of the utility function of an additional minute for short trips and of one additional minutes for long trips you'll realize that's the impact on the utility function will be higher for short trips and for long trips known for long trips. So this is due to the non-linearity of the logarithm. And this is exactly what we would like to model. We would like to model the fact that an additional minute impact more utility for short trips than for long trips.

Notes

Summary

1m 36s

Nonlinear transformations of the variables

Assumption 1: the marginal impact of travel time is constant

$$V_{in} = \beta_T \text{time}_{in} + \cdots$$

Assumption 2: the marginal impact of travel time decreases with travel time

$$V_{in} = \beta_T \ln(\text{time}_{in}) + \cdots$$

Remarks

- It is still a linear-in-parameters form
- The unit, the value, and the interpretation of β_T are different

So this looks very appropriate so we can now compare the two specifications in the first one. The assumption is that the marginal impact of travel time is constant. So this is what we did before When, where the utility is a linear function of time. And now we would like to model the single assumption that the marginal impact of travel time decreases with travel time and this is where we proposed a logarithm of time as a variables. Well, what is interesting to see here is that, we are back to the linear parameter Specification. Actually this logarithm can be pre-computed. You can take your data file, create a new column that you call log of time and you calculate the logarithm of the variables time before you started your estimation. OK so this is nice. Its possible to account for a nonlinear specification of the variables but still having a linear parameter specification of the utility function of course, in this case the variabless will have different unit. So the value and in the condition of beta will be completely different but its not a big issue. So the discussion we had with the interaction of the variabless applies as well for non-linear transformation of the variabless.

Notes

Summary

2m 25s

Nonlinear transformations of the variables

Data can be preprocessed to account for nonlinearities

$$V_{in} = V(h(z_{in}, S_n)) = \sum_k \beta_k (h(z_{in}, S_n))_k$$

It is linear-in-parameter, even with h nonlinear.

Note

Interactions between attributes and socio-economic characteristics are a special case of h

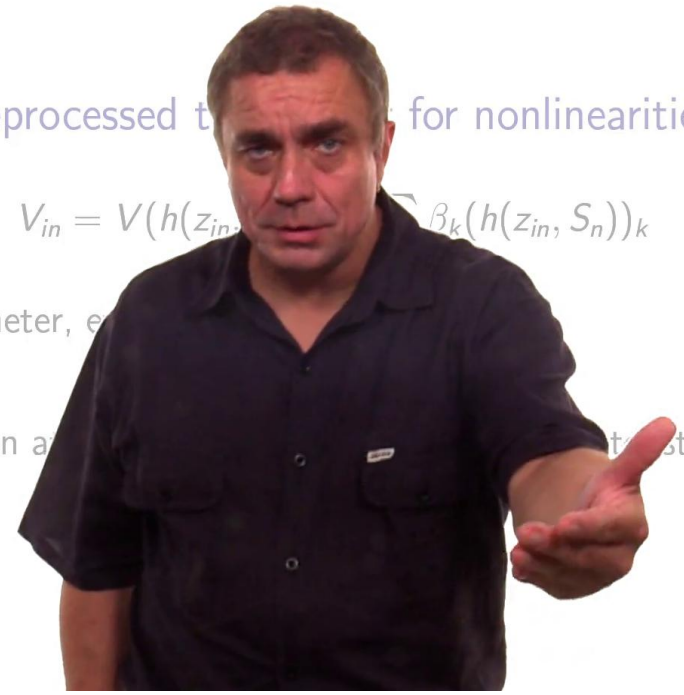
These can be pre-processed to account for these non linearity. So in general all the variabless that you can include in the model can be complex functions of all attributes and al social economics characteristics so in disguise Id know this transforms using age so age can be a function of the existing variables. But again they are Pre-processed. They can be pre-calculated and and what we saw in the previous video about interactions between attributes and social economics are just a special case of the age function.

Notes

Summary

3m 41s

Nonlinear transformations of the variables



Data can be preprocessed t for nonlinearities

$$V_{in} = V(h(z_{in}, \sum \beta_k(h(z_{in}, S_n))_k$$

It is linear-in-parameter, e

Note

Interactions between a tics are a special case of h

Ok, so this is nice but logarithm may also look arbitrary. Why logarithm. We are over nonlinear specifications. so let's investigate other ways to capture the same thing. The same behavioral assumptions that 1 minutes of travel time will not affect the utility the same way for short trips and long trips.

Notes

Summary

4m 13s