Stated Choice and the Brain

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Statement of the research question

This study explores how response times vary between unlabeled binary choices in a stated choice (SC) experiment, with alternatives differing with respect to in-vehicle travel time and travel cost. Specifically we explore how the response times depend on the choice situation, i.e. the attribute level in each alternative. The pattern of response times is interpreted as an indicator of the brain processes that respondents employ to make their choice. We interpret our findings in the light of prospect theory and related theories about how the brain makes decisions.

Methodology

The experiment includes different type choices. The willingness to pay (*WTP*) choice is a choice between the (observed) reference trip and an alternative that is faster and more expensive. The willingness-to-accept (*WTA*) choice is the exact opposite, comparing the reference trip to an alternative that is slower but less expensive. The equivalent gain (*EG*) choice is a choice between an alternative with the reference time but cheaper and an alternative with the reference cost but faster. The equivalent loss (*EL*) choice is the exact opposite, including an alternative with reference cost but slower and an alternative with reference time but more expensive.

We apply a linear regression model with fixed effects to estimate the relationship between the dependent variable, response time, observed for each individual and choice task, and a number of explanatory variables. The fixed effect model allows for arbitrary dependence between (time independent) unobserved individual specific effects and the controls (which would violate the assumption of the OLS model and bias the results). We include a number of design variables among the controls: dummy variables for three of the four choice types (WTP, EL, EG or WTA) and the difference of the time and cost within different type choices (implying gains or losses). We also control for the reference time and reference cost for different type choices, and the sequence number of the choice (in the sequence of eight choices for each respondent).The effect of the choice outcome on the response time is also explored. The choice outcome can be “accept” (the most expensive alternative is chosen), “reject” (the least expensive alternative is chosen), or that both alternatives are equally good.

In addition, the non-parametric technique local constant regression is used to explore the properties of the data while imposing only minimal assumptions.

A summary of the results obtained

The response time decreases significantly with reference time and increases with reference cost. Response times increases with the differences in travel time between the two alternatives, primarily for the type choices involving time losses relative to the reference (WTA and EL). The response times, on the other hand, decrease with larger differences in

travel cost between the two alternatives. The effect is largest for type choices implying money losses (EL and WTP). These findings indicate that time and cost attributes are processed differently by the brain and also that gains and losses are processed differently by the brain.

The faster responses to larger money losses is consistent with the findings by Tom et al. (2007), showing that different parts of the brain are activated when losses are evaluated than when gains are evaluated, and that the processes involving losses and loss aversion in general are faster.

The short-term context of the experiment suggests that the increase in response time with size of time loss is due to an increasingly larger re-scheduling effort. But if the time loss in the experiment is interpreted as short-term, requiring short-term re-scheduling, the experiment does not reveal the long-term stable preferences that it was designed to reveal.

In consistency with our findings, this pattern would, however, be different for money gains and losses, because people are more accustomed to trade various goods for money in both long- and short -term contexts and money can be accumulated and saved. The behavioral response to money gains and losses would thus not be as dependent on the short-term context which is consistent with our findings.

We find a systematic learning effect over eight choice occasions: choices become faster and faster.

The choice outcome correlates with the response time: the choices where the alternative "both choices are equally good" is chosen are slowest. This suggests that the "equally good"-alternative is not primarily used as an option for respondents not wanting to play the game, and that response times tend to increase when the implicit trade-off price of time is close to the respondents value of time. Response times for "reject" responses are not significantly different from response times for "accept" responses and the response time is not significantly correlated with the estimated value of time.

Contribution to the existing literature

We find clear signs of reference-dependence in response times in the form of a strong gain-loss asymmetry, in consistency with findings in the previous literature. This gives further support for application of models allowing for reference-dependence against models that don't. It also supports the previous evidence that stated choice experiments does not reveal reference-free long-term stable preferences, which are required standard welfare economic analysis.

This study is not the first to explore response times in stated preference surveys. But previous studies were all based on the hypothesis that response times correlate with quality of responses and response error. They do not recognize that the response time may be connected to the cognitive processes and the attributes involved, which is a main contribution of the present study.

References

Tom, Sabrina M., Craig R. Fox, Christopher Trepel, and Russell A. Poldrack. 2007. “The Neural Basis of Loss Aversion in Decision-Making Under Risk.” *Science* 315 (5811) (January 26): 515–518. doi:10.1126/science.1134239.