Essays on the measurement sensitivity of risk aversion and causal effects in education

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6 Conclusion

This thesis has presented four studies that investigate the measurement sensitivity of different micro economic quantities. The first and major part of the thesis consists of three papers that concern the sensitivity of measurements of risk attitudes with respect to departures from the classical expected utility model. In this model risk aversion is solely determined by curvature of the utility function and it is assumed that every decision problem is fully integrated into wealth. Measures of utility are important for equitable taxation, the composition of efficient public insurance, prescriptive decisions in health care and welfare analysis in structural economic models. In the second part we consider an empirical application in education economics where we investigate the measurement sensitivity of the causal effect of student's knowledge about loan conditions on their borrowing behavior with respect to the classical (empirical) assumption of exogeneity. This measure is informative for policies that aim to increase student's borrowing through increased information provision.

The first part starts with chapter 2, where we consider what happens to the obtained measure of utility curvature if it is assumed that individuals can not borrow from future income, which is implicitly assumed in the classical expected utility model. In that model it is assumed that individuals can borrow freely, such that they will smooth their consumption over time, borrowing money when income is relatively low, and saving money when income is relatively high. In this case the individuals' consumption profile will be smooth and the consumption of a windfall gain will be spread over the entire lifetime, i.e. it will be fully integrated into lifetime wealth. When borrowing is constrained and this is binding, however, a windfall gain will be consumed quickly. In this case the consumption of the additional income is spread over a finite period that is endogenously determined and depends on time preferences. Hence, in this setting, the windfall gain is not fully integrated

into lifetime wealth and its relative impact depends on the length of the affected consumption period. A given amount of additional income has a larger relative impact when it is consumed in a day compared to when it is spread over the entire lifetime.

The effect of intertemporal constraints on the measure of utility curvature is illustrated using an empirical application where risk aversion is measured using the hypothetical valuation of a series of lotteries by a representative sample of individuals. It is shown how, in this context, the standard model can be extended to accommodate for the additional time dimension by formulating a simple discounted expected utility model. Here we allow for the opportunity that individuals have to spread consumption optimally over time, while making the plausible assumption that individuals are borrowing constrained. This model forms an intermediate case between the expected utility model defined over wealth (the standard model) and defined over income (the immediate model). The average coefficient of relative risk aversion was estimated to be 82. If consumption is assumed to be immediate, the inferred relative risk aversion is 2, while we find an estimate of 338 if full asset integration is assumed. This shows that the degree of utility curvature is estimated overly concave by the classical model if individuals are borrowing constrained and also that we can get lower estimates while retaining the plausible assumption that consumption is not immediate.

In chapter 3 we take a different departure from the classical expected utility model. There we assume people's behavior is better described by prospect theory, which states that people evaluate outcomes with respect to a flexible reference point, and that they weight probabilities non-linearly. Using a non-parametric measurement method that is robust to these departures from the classical model, we find utility curvature to be close to linearity for a representative sample of the Dutch population. This result externally validates results from the laboratory that suggest that classical utility measurements overestimate concavity, which can be explained by the ignoring of probability weighting and loss aversion in these measurements. Further, the results suggest that utility is concave for gains and convex for losses, implying diminishing sensitivity towards outcomes, as predicted by prospect theory but contrary to the classical prediction of universal concavity. In the study we also obtain parameter-free measurements of loss aversion. The results show that on average people are

significantly loss averse and weight a loss about 1.87 times as much as a commensurable gain. Interestingly, we find evidence that males and higher educated persons are significantly less loss averse. The former result suggests that gender differences in risk attitudes are primarily driven by loss aversion and not by utility curvature as suggested by previous studies that assume the classical expected utility model. The latter result suggests that measurements of loss aversion based on relatively highly educated student samples lead to an underestimation of the loss aversion coefficient.

In chapter 4 we stay in the realm of prospect theory and, again, consider loss aversion and the non-linear weighting as departures from the classical theory. The approach in this chapter, however, is more parametric which allows for the econometric modeling of decision errors. Furthermore, we use a larger part of the dataset that allows for the estimation of subjective probability weighting as well. The results qualitatively confirm the non-parametric results of chapter 3 and suggest that utility is mildly concave for gains and mildly convex for losses, implying diminishing sensitivity and suggesting that classical utility measurements that neglect probability weighting are overly concave.

A direct comparison with the non-parametric measures suggests that assuming homogeneity leads to a small downward bias. Interestingly, the estimates are closer to linearity compared to parametric studies that impose more stringent parametric assumptions (e.g. Donkers et al. 2001; Harrison and Rutström 2007), suggesting the utilities obtained in these studies may suffer from a contamination bias: a misspecification of the probability weighting function will bias the estimated concavity of the utility function.

In addition to these results, we find evidence that probabilities are weighted non-linearly, with an inverse-S shape, and that both functions display pessimism (low elevation for gains, high elevation for losses). These results externally validate probability weighting that was found in a laboratory context. The obtained degree of loss aversion of 1.58, as operationalized by Tversky and Kahneman (1992), is somewhat lower than the non-parametric estimate of 1.87 in chapter 3, again suggesting that assuming homogeneity may lead to a small bias. The estimate is still consistent with contemporaneous studies (Schmidt and Traub 2002; Johnson et al. 2006, Abdellaoui 2008), however, that find loss aversion below 2. Finally the parametric analysis refines the result of chapter 3 that shows that

gender differences in risk aversion can not be ascribed to utility curvature, as is done in classical studies, but to loss aversion. This chapter adds differences in probability weighting for gains to this explanation.

In the second part of this thesis (chapter 5) we consider an empirical application in education economics where we investigate the measurement sensitivity of the causal effect of student's knowledge about loan conditions on their borrowing, with respect to the classical empirical assumption of exogeneity. Several studies document that students are poorly informed about the conditions of the government student loan scheme in the Netherlands. Students who are better informed have higher take-up rates. This suggests that governments can stimulate borrowing and thereby increase efficiency by providing more information about the - supposedly favorable - conditions of their loan schemes. This interpretation, however, implicitly assumes that the knowledge students have about the loan conditions is independent of other (unobserved) factors that determine borrowing, i.e. it assumes that knowledge is exogenous. To investigate whether there really exists a causal impact of better knowledge about loan conditions on borrowing behavior, we conducted a randomized experiment where half of the participants were exposed to an information treatment. Using the information treatment as instrumental variable for knowledge we find that there is no causal impact of better knowledge on borrowing, thereby indicating that the exogeneity assumption invalid. The policy implication is that information provision is an ineffective method to increase the loan take-up rate.

This thesis has presented four studies that investigate departures from classical measurement assumptions in microeconomics. In the first part it was investigated how measures of utility are affected by departures from the classical assumption of expected utility. While applying prospect theory's deviations from expected utility to the measurement of utility is not novel, introducing a time dimension to the model is a new approach that deserves consideration, especially for large stakes. A combination of the two models, by including a time dimension in prospect theory, could also be a fruitful approach to separate utility curvature from probability weighting, loss aversion and impatience. Including a time dimension by modeling optimal smoothing behavior is necessary

parametric, however, and depends heavily on the intertemporal constraints facing the agent. This may make the results from such an approach less convincing.

Careful thinking about identification assumption(s) is at the heart of good empirical research. The second part of this thesis makes clear that students' loan take-up will not increase by information provision, even though there is a clear positive association between knowledge about loan conditions and borrowing. This means uninformedness about the favorable loan conditions cannot explain why borrowing rates are lower in the Netherlands than elsewhere, which remains an important puzzle that deserves further research. As higher education financing is under continuous pressure due to increased participation, future policy decisions may benefit from such an investigation.