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Mitigating Hypothetical Bias in Stated Preference Data: Evidence from Sports Tourism[1]

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Abstract: One of the major criticisms of stated preference data is hypothetical bias. Using a unique data set of both stated and actual behavior we test for hypothetical bias of stated preference survey responses. We consider whether respondents tend to overstate their participatory sporting event behavior *ex ante* when compared to their actual behavior at different registration fees. We find that behavioral intentions accurately predicts actual behavior at a middle level of respondent certainty, over predicts actual behavior at a lower level of certainty and under predicts behavior at a higher level of certainty. This suggests that respondent uncertainty corrections can be used to mitigate hypothetical bias. Stated preference data can be used better understand actual behavior in situations where no data exist.

Key Words: Hypothetical bias, stated preference data

JEL codes: L83, Q26, Q51

Introduction

Academic fields including economics, marketing, political science and psychology use stated preference (i.e., behavioral intentions) data to provide supporting information for weighty decisions such as profit maximization (Morwitz, Steckel and Gupta 2007) and political campaigning (Hillygus 2011). Stated preference data collection methods in economics include contingent valuation and contingent behavior. Contingent valuation elicits statements of hypothetical willingness to pay, often through referendum voting scenarios, and contingent behavior elicits statements of hypothetical behavior. Although most of the contingent valuation literature has been in the fields of environmental (Owen et al. 2012) and, increasingly, health economics (Cook et al. 2007), it has also been used in sports economics to value the location of sports teams and mega-events (see Johnson and Whitehead 2006 for a review). Contingent behavior has been used for estimating the demand for NHL hockey games (Whitehead et al. 2013) and participatory recreation activities and programs (e.g., Kaplanidou and Gibson 2010, Soderberg 2012, Wicker, Hallmann and Zhang 2012, Lee et al. 2014).

In a recent symposium on contingent valuation in the *Journal of Economic Perspectives* Kling, Phaneuf and Zhou (2012) provide a balanced overview and Carson (2012) argues that the CVM is "a practical alternative when prices aren't available." In stark contrast, Hausman's (2012) opinion on CVM has gone from "dubious to hopeless" in its ability to accurately

measure value.[2] One of Hausman's (2012) three issues with contingent valuation is "hypothetical response bias that leads contingent valuation to overstatements of value." To test for hypothetical bias most studies use some form of the stylized null hypothesis that stated preference responses are equal to responses to analogous behavior when money or some other real outcome is at stake. If the hypothesis is rejected, the stated preference study suffers from hypothetical bias. Several meta-analyses compare value estimates from hypothetical and real choices. List and Gallet (2001) and Little and Berrens (2004) find that values based on hypothetical choices are about 3 times higher than those based on real choices and Murphy et al. (2005) find hypothetical values are about 1.35 times higher than those based on real choices. All of the meta-analyses studies evaluate lab and field experimental data before correction mechanisms were used extensively. Murphy et al. (2005) suggests that hypothetical bias is more likely to occur when students are used as test subjects.

Hausman (2012) cites studies from the marketing literature which he interprets as showing that behavioral intentions overstate actual behavior. A close reading of these papers, however, suggests otherwise. For example, Morwitz, Steckel and Gupta (2007) use meta-analysis to determine the conditions under which the correlation between purchase intentions and actual sales increases. They find that the correlation is higher for existing products, for durable goods and when the time between the hypothetical scenario and real outcome is shorter. Hsiao, Sun and Morwitz (2002) develop four econometric models and attempt to determine which

[2] Haab et al. (2013) thoroughly review the literature and argue that Hausman's "selective" review misses evidence supporting the ability of stated preference data to provide useful information.

model does best at linking intentions with behavior. They find that behavioral intentions are predictors of actual behavior.

In the contingent behavior literature there have been several tests of hypothetical bias. Dickie, Fisher and Gerking (1987) test the demand for stated and revealed strawberry purchases and find no statistically significant differences in demand functions. Loomis (1997) compares intended length of recreation trip collected at a lake with a hypothetical water level versus actual length of recreation trip when the hypothetical water level has been realized. There is no statistically significant difference between the average intended length of stay of 5 hours and the actual length of stay of 6 hours. Grijalva et al. (2002) find that stated preference rock climbing trips fall with a hypothetical closure of rock climbing areas. When the areas are actually closed, actual trips differ in the expected direction and by similar magnitudes.

When hypothetical bias remains there are several approaches to hypothetical bias mitigation in contingent valuation (Loomis 2011). Champ and Bishop (2001) employ a quantitative certainty scale and find that respondents who are, at least, a 7 out of 10 level of certainty on a voluntary contribution question behave similarly when faced with the actual choices. Blumenschein et al. (2008) employ a qualitative certainty scale and find that respondents who are "very certain" about their hypothetical choice behave similarly in the actual setting. Carson and Groves (2007) argue that consequential contingent valuation surveys will not suffer from hypothetical bias. Landry and List (2007) find no hypothetical bias when responses are consequential in a field experiment. Vossler and Watson (2013) find no hypothetical bias when comparing hypothetical and actual referendum votes.

Whitehead et al. (2008) argue that combining revealed and stated preference data can be

used to mitigate hypothetical bias in contingent behavior data. For example, Whitehead (2005) and Whitehead, Noonan and Marquardt (2012) find that survey respondents overstate their future behavior. Using jointly estimated ex-ante revealed and stated preference data models, a common hypothetical bias correction yields statistically equivalent predictions to the ex-post actual behavior in both studies. Overall the results of the recent studies suggest that although hypothetical bias occurs there are methods to mitigate the effect.

We use the contingent behavior method to estimate the demand for a sports tourism event to test if hypothetical bias can be mitigated by using an intensity of preference correction. We conduct surveys of participants of a bike ride in 2011 and 2012. In 2011 we ask riders if they would participate at the current registration fee and higher registration fees. In 2012 the registration fee rose by $10. Using these data we conduct nonparametric and parametric tests for hypothetical bias at different levels of respondent certainty. We combine revealed and stated preference data and find that hypothetical bias can be mitigated. Our results provide evidence that hypothetical questions are "a practical alternative when prices aren't available" and are neither "hopeless" nor "dubious".

Data

Our data is from a participatory sporting event, "Blood Sweat and Gears" (BSG).[3] The BSG includes 50 and 100 mile bike rides (the organizers insist on calling it a ride, but many participants are racing) in and around mountain communities in Watauga County, North Carolina, including the Blue Ridge Parkway. Up to 1250 riders participate annually.

[3] See the website for details: http://www.bloodsweatandgears.org/.

Participation in the BSG is constrained due to limits placed by the National Park Service. Ninety three riders were on the 2011 waiting list and 456 were on the 2012 waiting list. The 2011 waiting list does not include potential participants past the 100th waiting listed rider as the event organizers did not keep track.[4]

Event registration fee demand data was gathered by surveys that were emailed to registered riders after the 2011 BSG. In 2011, out of the 1156 registered riders with useable email addresses, 561 completed the survey after three mailings. The response rate is 48%. In 2012 611 riders completed the survey from 1135 useable email addresses for a 54% response rate. Deleting duplicate email addresses from each year (i.e., multi-year and multi-family participants) the sample size used for analysis is 1923 participants. Of these, 60% participated in 2011 and 61% participated in 2012.

In the 2011 survey respondents were told: "Proceeds from the 2012 ride will benefit two charities established by the Watauga County Chapter of the American Red Cross. The Jeremy Dale Fisher Fund and The Russell Fund provide assistance to local families that are displaced by fire, flood or similar disasters." Respondents who stated that they intended to participate in the 50 mile ride received the 50 mile ride question: "The 50 mile route has a limit of 500 riders and sold out in a week in 2011." Respondents who stated that they intended to participate in the 100 mile ride received a similar version: "The 100 mile route has a limit of 750 riders and sold out in one day in 2011." The stated preference scenario is a higher entrance fee: "One proposal being

[4] The 2014 BSG sold out in 16 minutes with 4000 potential riders attempting to register for 1250 spots.

considered is to charge a higher entrance fee in order to provide even more assistance to local families. Would you be willing to pay the following entrance fees for the 2012 ride if you knew all of the additional funds went to charity?" Respondents were presented with a response table. In the left hand side column were five entrance fees, $60, $70, $80, $90 and $100. The top row contained five responses, "definitely no," "probably no," "not sure," "probably yes," and "definitely yes." Respondents checked a box in each entrance fee row to indicate their preference (see Appendix).

We discard all redundant stated preference responses. A redundant response is one in which the respondent states that they would definitely pay a higher amount or would definitely not pay a lower amount. For example, if the respondent would definitely pay $60 and $70 we discard the $60 response. If the respondent would definitely not pay $90 and $100 we discard the $100 response. We include all respondents who answered at least one non-redundant stated preference question. Sixteen percent of the sample of 561 includes one stated preference question response, 8% has two, 17% has three, 30% has four and 29% of the sample has five stated preference responses included.

Results

In Table 1, we present the stated preference responses at each entrance fee. The total number of stated preference responses is 1748 with between 54% and 73% of the sample of 561 answering questions at each entrance fee. In general, the responses exhibit rationality with the percentage "definitely yes" falling from 56% to 15% as the fee rises from $60 to $100.

Generally, CV data doesn't allow for a test of hypothetical bias but our data provides a

natural experiment to test for hypothetical bias because the entrance fee for the BSG was raised from $60 to $70 in 2012. In the data, each respondent's answer to the $70 entrance fee question and intention to ride the 50 or 100 mile route can be compared to their actual behavior in the 2012 ride. For this analysis we include redundant responses. For example, if the survey respondent answered "definitely yes" to a registration fee of $80 we include them as a "definitely yes" at the $60 and $70 fees.

In our sample, 33% answered "definitely yes" and 69% answered "probably yes" to the 2012 BSG participation question with a $70 entrance fee. Two hundred and twelve 2011 survey respondents actually registered for the 2012 BSG. These responses provide upper and lower bounds to the actual return participation of 42% for the 2011 sample. In contrast, 68% of respondents state that they will definitely participate at the $60 entrance fee while 93% would probably participate. At the $80 entrance fee, only 14% state that they will definitely participate and 35% state that they would probably participate. The aggregate stated preference data provides evidence of predictive validity. The $70 entrance fee stated preferences are more accurate than the stated preferences at the $60 and $80 entrance fees when predicting actual behavior at the $70 fee.

When we consider individual predictions at the $70 fee with the "definitely yes" response for 503 participants with complete data, 14% of respondents successfully predicted their own participation and 39% successfully predicted their non-participation. In addition, twenty-nine percent stated that they definitely would not participate but did, while 19% stated that they definitely would participate and did not. When we consider individual predictions with the "probably yes" response, 30% of respondents successfully predicted their own participation and

19% successfully predicted their non-participation at the $70 fee. Lastly, twelve percent stated that they probably would not participate but did while 39% stated that they probably would participate and did not.

Empirical Model

In this section, we describe the empirical model to estimate the ability of stated preference behavioral intentions data to predict actual behavior. Conceptually, the categorical response, y_i, to the registration fee participation question depends on whether willingness-to-pay, *WTP*, is greater than the registration fee. Since we have no individual specific information from non-respondents and pseudo-panel data, from two to seven revealed and stated preference responses for each respondent, we estimate a "censored" fixed effects panel probit, $\pi[y_{it}^z = 1] = \Phi(\alpha_i + \beta' x_{it})$, where y_{it}^z is the participation response, z is the participation threshold, α_i is the individual specific fixed effect, x_{it} is a vector of independent variables (registration fee and a stated preference dummy variable), $i = 1, \ldots, 1923$ participants and $t = 1, \ldots, T_i$ time periods. Three participation thresholds are estimated: "definitely yes", "probably yes", and "not sure".

We report regression results in Table 2. We find that the coefficient on the registration fee amount is negative and statistically significant in each model in accordance with economic theory. In the model where we code only "definitely yes" stated preference responses as participating in BSG the stated preference dummy variable is negative and statistically significant indicating that the stated preference data understates actual behavior. In the model where we code "definitely yes" and "probably yes" responses as participating the stated preference variable is not statistically different from zero indicating that the stated preference data is consistent with actual behavior. In the final model, where we code "definitely yes",

"probably yes" and "not sure" responses as participating in BSG the stated preference variable is positive and statistically significant. In this final model our results indicate that the stated preference data overstates actual behavior and hypothetical bias exists. We find that using an intensity of preference correction can mitigate for hypothetical bias but using only individuals who are "definitely sure" will overcorrect the problem.

Application

Soderberg (2012) uses stated preference data to estimate the value of goods that are complementary to a participatory running race with a binding participant constraint. He argues that revenue-enhancing pricing strategies are difficult because information about the elasticity of demand is difficult to obtain. Revenue can be enhanced by optimally pricing complementary goods. With the BSG data and results, we conduct a simulation exercise to determine the revenue maximizing registration fee.

Considering the model where "definitely yes" and "probably yes" responses are coded as participating in the event, the marginal effect of the registration fee coefficient is $\frac{\partial \pi}{\partial f} = \Phi(\cdot)\beta_f = -0.023$, where *f* is the registration fee. This suggests that a \$10 increase in the registration fee reduces the probability of participation by 2.3% at the mean probability. The registration fee elasticity is $\varepsilon_f = \beta_f \frac{f}{\pi} = -3.47$. The elastic demand indicates that an increase in the registration fee would decrease revenue (and vice versa)

In 2012 there are 1551 unique email addresses for riders who participated or were on the waiting list. The probit model estimates that the participation probability is 39.24% at the registration fee of \$70. We estimate the population of riders in the BSG market is 3953 =

1551/.3924. A simulation of the probit probability function is used to estimate the number of riders at registration fees between $0 (n=3953) and $100 (n=90). Without the quantity constraint of 1250 riders, fee revenue is maximized at $160,217 with a fee of $50 and 3204 riders. These results could be used by BSG organizers to encourage the National Park Service to relax the quantity constraint. With the quantity constraint, fee revenue is maximized at $91,250 and a fee of $72. Preliminary results similar to this were used by BSG organizers to raise the registration fee from $60 to $70. Revenue increased by over $10,000 as a result.

Conclusions

Hypothetical bias is considered a major flaw in stated preference methods. We provide evidence, however, of the ability of stated preference data to predict actual behavior when using intensity of preference corrections. Our results are consistent with much of the literature in marketing and environmental economics where researchers are cautiously optimistic about the ability of behavioral intentions data to predict actual behavior (Sun and Morwitz 2010). For example, Champ and Bishop (2001) and Blumenschein et al. (2007) find that the divergence between hypothetical and actual willingness to pay is mitigated or eliminated by taking into account respondent certainty in their hypothetical decision. Similarly, we find that respondents who answer “probably yes” and “definitely yes” about participation in a sports tourism event behave similarly in the actual situation.

We show that even if contingent behavior analysis suffers from hypothetical bias, respondent certainty corrections can align stated preferences with revealed preferences. While some may interpret these results as informative, they are not necessarily unbiased estimates of BSG demand. Carson and Groves (2007) argue that the incentive structure of stated preference

questions can be used to predict the direction of hypothetical bias. In our case the incentives of the stated preference questions could lead to strategic behavior. Since the BSG fee was $60 in 2011 and the rationale for a higher fee was an increase in charitable donations and not a take it or leave it offer, respondents have an incentive to state that they will not participate in an effort to keep the registration fee low. Some evidence of strategic behavior can be found in the asymmetric individual prediction errors. Twenty-nine percent stated that they definitely would not participate but did, while 19% stated that they definitely would participate and did not. Decision makers should use these results with the caution that the BSG demand is likely to be less registration fee elastic than the elasticity estimate provided here. The practical implication is that the model might over-predict the effects of higher and lower registration fees. But, at least an educated guess about the direction of the bias can be made. Future research should strive to design incentive compatible stated preference questions.

Lastly, we conduct a simulation exercise to provide evidence about whether the stated preference data provides "a practical alternative when prices aren't available" as Carson (2012) claims or is "hopeless" as Hausman (2012) claims. Our interpretation of the data and "real world" experience supports Carson's claim. As a result of the 2011 BSG survey and preliminary analyses of the stated preference data, BSG organizers raised the registration fee to $70 and generated over $10,000 more for charity. Some may argue that this is prima facie evidence that stated preference data is not "hopeless."

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Table 1. Revealed and Stated Preference Participation Data						
				Participation		
Year	Cases	SP	Fee	Definitely Yes	Probably Yes	Not Sure
2011	1923	0	60	59.85%		
2012	316	1	60	55.70%	89.87%	98.42%
2012	412	1	70	22.33%	66.26%	84.47%
2012	383	1	80	5.74%	31.85%	63.97%
2012	332	1	90	0.60%	15.06%	43.67%
2012	305	1	100	15.41%	26.23%	49.51%
2012	1923	0	70	60.89%		

Table 2. Fixed Effects Probit Participation Models						
	Definitely		Definitely and Probably		Definitely, Probably and Not Sure	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
FEE	-.0415*	0.0028	-.0576*	0.0026	-.0503*	0.0026
SP	-1.119*	0.068	0.0122	0.067	.663*	0.073
LL Function	-2859.55		-3007.88		-2940.81	
AIC	9149.1		9407.8		9207.6	

*Indicates statistically significant at the p = .01 level.

Appendix. Willingness to pay question