Southern Economic Journal 2009, 76(1), 198–223

Estimating Local Welfare Generated by an NFL Team under Credible Threat of Relocation

Aju J. Fenn* and John R. Crooker†

This study offers the opportunity to examine the welfare contribution of the Minnesota Vikings to Minnesota households in the context of a credible threat of team relocation. We find the credibility of the threat of relocation is essential to providing unbiased estimates of welfare. This study utilizes contingent valuation methodology (CVM) and a random utility model (RUM) to analyze Minnesotans' decision-making mechanisms for supporting a new stadium initiative. While previous studies have attempted to measure the welfare associated with a sports franchise, we develop and discuss bias that may be imparted to estimates when the researcher fails to calculate a "choke price." Further, we develop an unbiased approach to identify welfare when respondents perceive a risk of losing the franchise. The range of welfare contribution by the Vikings to households in Minnesota is $445.3 million to $1,571.3 million according to a 95% confidence interval based on our study.

JEL Classification: H41, L83

1. Introduction

"The Minnesota Vikings face a very serious challenge with the Metrodome that threatens our ability to survive. The Metrodome seriously limits the Vikings' revenue opportunities and will soon cause the team to be uncompetitive or lose millions of Dollars—or both."[1]

The Minnesota Vikings are seeking a new stadium. Minnesotans know that the threat of relocation is a credible one, given their experience with the relocation of the Minnesota North Stars (a National Hockey League team that relocated to Dallas) and their awareness of the circumstances surrounding the relocations of the Cleveland Browns (now the Baltimore Ravens) and the Houston Oilers (now the Tennessee Titans). The Minnesota Vikings were sold by Red McCombs to Zygmund Wilf for $600 million. This paper is based on a survey conducted during the period that McCombs had the team up for sale. "In a written statement, Vikings owner Red McCombs expresses his frustration that the Legislature this year (2002) did not do more to help the football team realize its stadium dreams. In his statement, McCombs says he's engaged JP Morgan Securities to explore sale or relocation options for the team."

* Department of Economics & Business, 14 E. Cache La Poudre St., Colorado College, Colorado Springs, CO 80903, USA; E-mail aju.fenn@coloradocollege.edu; corresponding author.

† Department of Economics & Finance, Dockery 300-G, University of Central Missouri, Warrensburg, MO 64093, USA; E-mail crooker@ucmo.edu.

The authors wish to acknowledge suggestions from Ann Simpson, Professor Allen Sanderson, Professor John Whitehead, and two anonymous referees.

Received August 2005; accepted April 2008.

[1] Quoted from the Minnesota Vikings Official Team Website (http://www.vikings.com/Stadium/; accessed June 1, 2002).

(SOURCE: Minnesota Public Radio, May 21, 2002, Minnesota Public Radio) This circumstance provided us with a unique opportunity to examine the willingness to pay (*WTP*) for a new stadium when the threat of relocation is real. Here we undertake an analysis of the determinants of credibility and *WTP* under threat of relocation. This is a contingent valuation methodology (CVM) issue faced by all CVM practitioners. Using a sample selection model we find that respondents who think that the Vikings may leave give different answers than those who do not.[2] The key to any reliable survey is the credibility of the scenario. Using a situation with serendipitous timing, we are able to examine the *WTP* of respondents who believe that the team would relocate. We contrast these findings with those of respondents who do not believe that the team will relocate. The estimates help us to shed some light on the broader CVM question of the divergence in *WTP* estimates due to credibility of the payment scenario. The purpose of this paper is to develop and estimate an unbiased estimator of a respondent's household welfare generated by a professional sports franchise when the respondent perceives a risk of losing the franchise.

There is copious economic literature on the costs and benefits of sports teams to communities. Some of the reasons cited for keeping or attracting a major league team are boosting the local economy and a heightened sense of civic pride (Siegfried and Zimbalist 2000). The majority of studies (Baade and Dye 1990; Noll and Zimbalist 1997; Rappaport and Wilkerson 2001; Baade, Bauman, and Matheson 2008) suggest that stadiums do not generate a large enough increase in income to be viable solely on the grounds of boosting the economy. A direct attempt to measure the fanaticism of team supporters using consumer surplus concluded that for most teams the consumers' surplus from attending games alone might be insufficient to justify building a publicly funded stadium (Alexander, Kern, and Neil 2000). However, for teams that have sell-out seasons, not all fans may be able to attend games. Moreover, National Football League (NFL) games for teams that sell out demonstrate public-good characteristics. These games are aired on television, and thus the performances are nonrival and nonexcludable for the local television audience. An analogous surplus may exist for fans who watch the games on television. The issue comes down to the value of the public-good aspects of the franchise to the residents of the area. Most studies in the literature (Baade and Dye 1990; Noll and Zimbalist 1997; Sanderson 2000; Siegfried and Zimbalist 2000) acknowledge that the public-good aspects of a team need to be valued. The public-good aspects for fans that are generated from discussing the team's fortunes, a sense of civic pride from having a major league team in town, and so forth, need to be valued. However, as is the case with all public goods, direct market valuation is not possible. Proponents of CVM, including Arrow et al. (1993) and Hanemann (1994), claim that if the methodology is properly applied, the results from CVM surveys can be trusted.

Johnson, Mondello and Whitehead (2007) have examined the *WTP* for a stadium in the context of keeping the Jacksonville Jaguars in Jacksonville, Florida. They find that the *WTP* estimates of $36.5 million lie far below the subsidies paid to attract the Jaguars to the city of Jacksonville. Johnson, Groothius, and Whitehead (2001) investigate the positive externalities associated with building a new hockey arena for the Pittsburgh Penguins. They use CVM and model the survey respondents' *WTP* as a function of the suggested tax, the survey respondents' income, the number of games attended, public-good characteristics of the team, and other variables. They find that, while the team does display public-good characteristics, the public-good value generated by the team does not justify the cost of a new arena. They point out the need for additional studies on other teams in other cities.

---

[2] The authors are grateful to the anonymous referee who suggested that we study this issue.

Unfortunately, Johnson, Groothius, and Whitehead (2001) conducted their survey in 2000, just after a consortium of investors had bought the team in 1999, and the credible threat of relocation or contraction had passed. In addition, the survey was conducted in February, during the hockey season. One might argue that responses by fans may be biased by the current performance of the team. While in-season surveys may bias the *WTP* upward, out-of-season surveys (although they are free from current team performance) may represent a lower *WTP* because the respondents are not currently deriving utility from watching the team. The out-of-season *WTP* estimates may be viewed as a lower bound on the *WTP*, and the fans' in-season *WTP* (contained in Appendix A) may be viewed as an upper bound on the *WTP*.

A similar approach was employed by Johnson and Whitehead (2000) to investigate the public-good aspects associated with building a new basketball stadium for the University of Kentucky Wildcats and a minor league baseball stadium in Lexington, Kentucky. One might argue that college teams are not capable of relocating. Thus the threat of losing the team is not as credible as in the case of a professional team that is for sale. This phenomenon may have impacted the *WTP* valuation. The Johnson and Whitehead paper uses the payment card format, which typically results in a more conservative estimate of *WTP*. We use a dichotomous choice elicitation format that may result in a larger *WTP* value than if we had used the payment card format. We use the dichotomous choice format because it has been shown to be incentive compatible and easier to answer (Boyle and Bishop 1988).[3]

We hope to learn more about the *WTP* for a stadium when the threat of relocation is credible, as it was with the Minnesota Vikings at the time of our survey. We also conducted our survey during the off-season to mitigate the biases that may come from the latest victory or defeat. We draw upon the recreational demand literature from environmental economics to include travel cost measures of expenditures by respondents who watch games at the stadium or on television. Finally, the scope of this survey is much larger than previous studies, with about half of the surveys being sent to nonmetropolitan households.

We begin with a brief description of the literature addressing the connection between credibility and *WTP*. Following that, we present our survey methodology and sample characteristics. Then we proceed to a description of the CVM methodology and the "naïve" empirical model not treating the uncertainty in team relocation. Next, we present the empirical results for this naïve model. After that, we update our model to account for uncertainty in team relocation and include a section that models the respondents' credibility beliefs. Finally, we empirically estimate our revised random utility model with prior-determined relocation beliefs and develop our conclusions from this study. Appendix A contains a description and analysis of a data set gathered by on-site interviews with Vikings fans outside the stadium. These results are provided for comparison in Appendix B.

2. Credible Threat of Relocation and *WTP*

One of the biggest criticisms of CVM surveys is that if respondents do not find the scenario to be credible, then the responses lack meaningful information about the resource being studied (Diamond and Hausman 1994). This is a key methodological issue faced by all

[3] We are grateful to an anonymous referee for pointing this out.

practitioners of CVM. In our survey, more than 50% of the respondents state that they believe the Vikings would move if the team did not get a new stadium. Our *WTP* estimates are also much higher than those obtained for similar scenarios. The lessons from this survey may be used to benefit other CVM surveys where timing is critical, as well as to model the respondent decision-making mechanism under uncertainty.

This idea is separate from the nomenclature of biases described at length in the work of Mitchell and Carson (1989) and in pieces like the recommendations of the National Oceanic and Atmospheric Administration (NOAA) panel (Arrow et al. 1993). Our ideas deal mainly with the timing of a survey as it pertains to the information about the issue that is currently available. Early scholars have pointed out that it is important for respondents to understand the choices in the scenario exactly as the investigators intended them (Mitchell and Carson 1989). Our contribution to the literature is much more fundamental than "scenario misspecification." Basically, we deal with timing issues that speak to the heart of scenario credibility. If the respondent did not believe that the Vikings would move, then the valuation of the team would be substantially different from the one obtained. Given the relatively recent move of their hockey team, the Minnesota North Stars, to Dallas and the moves of other NFL teams from Cleveland to Baltimore and from Houston to Tennessee, fans were more likely to believe the payment scenarios posed in this paper than at any other time in recent history.

Carson, Groves, and Machina (2000) point out that unless the survey matters to the individual, and he believes that his response matters, there is no way to consider the survey question "consequential." Our ideas are perhaps closer to their paper than to any other strand in the literature. We pose our question in an "incentive compatible" framework as per their guidelines. The value added by our paper is that we spell out some of the details of how to execute a credible scenario in a situation where the public's perception is altered daily by reports from the news media on a popular topic. We believe that the issue is connected to the "cheap talk design" idea introduced by Cummings and Taylor (1999). If individuals do not perceive that the team will move, then there is not likely to be a difference in their responses from, say, the responses of the fans of the Pittsburgh Penguins who answered their questionnaire shortly after the team had been sold and whose team was believed to be staying in Pittsburgh. If the threat to move is not a credible one, then the question reduces to a hypothetical scenario, which may undermine the perception that payment will indeed be collected. That, however, was clearly not the case with the Vikings. In face-to-face interviews during the fan questionnaire, several fans pulled out their checkbooks and were willing to write a check on the spot.

Cummings and Taylor (1999) also address the issue of "realism" in a CVM survey. They state that CVM researchers have previously acknowledged that the realism of the survey is directly connected to the accuracy of the responses. They evaluate the relationship between the accuracy of responses and the probability that survey responses will result in real consequences. Their results support the notion that there is a significant relationship between the "realness" of a survey and the accuracy of the results. In our case, the majority of the sample did believe that the Vikings would move out of the area if the team did not get a new stadium. The question, of course, is, when does one know that the threat is credible in the minds of respondents? If the survey is administered too soon, then respondents may not believe that the team is likely to leave. If it is administered too late, the team may already have moved or the perception of relocation may have been tempered by the statements of a new owner to work things out in the area.

There is an entire body of work on the idea of a credible threat in game theory. The essential idea has been incorporated by CVM practitioners. The gist is that, if the scenario is not believable to the respondent, then the results of the survey do not allow us to infer value. We will estimate separate samples for believers and nonbelievers and contrast the estimates in the empirical results, ignoring relocation uncertainty.

3. Survey Methodology and Sample Characteristics

A random sample of 1400 households was purchased from a professional sampling firm. The socioeconomic and demographic characteristics of the sample are designed to reflect those of the state of Minnesota. Half of these households are located in the seven-county metropolitan area of the Twin Cities of Minneapolis and St. Paul. The other half of the sample comes from the rest of the state. The contact procedures follow the methods outlined in Dillman (1978).

Initially, a random subsample (which we call the presample) of 200 households, with a 50/50 split between urban and other households, was mailed to respondents. This was done to ensure readability of the questions and to obtain feedback on the various bid amounts. The remaining 1200 surveys were then mailed. Forty-six of the surveys were undeliverable, and 565 surveys were returned. The response rate was 42%. For comparison, Johnson and Whitehead (2000) had a response rate of about 36% based on a smaller sample size of 293 mail surveys.

Table 1 summarizes the descriptive statistics of the key variables. This section of the paper addresses some of the additional details about the data. The survey is available upon request. It comprises 33 questions and is divided into three sections. The first section deals with games viewed and fan interest questions. The second section outlines a payment scenario and solicits payment amounts using a yes/no format in response to a specific amount. The last section of the survey solicits demographic information.

The first few questions pertain to games attended at the Vikings' stadium (the Metrodome) and/or viewed on television by the respondent. This section also solicits information about money spent on team merchandise, travel time to the stadium from the respondent's home, and the number of Minnesota sports teams that the respondent follows. The average number of games attended by respondents was 0.33, and the average number of games watched on television was 8.2. The median number of games watched on television was 10.

The next few questions pertain to the public-good characteristics of the team. Forty-one percent of the respondents claim to read about Viking football on a daily basis, either in the paper, in magazines, or online. Fifty-four percent of the respondents discuss the Vikings' fortunes with friends, co-workers, or family members on a daily or weekly basis. Eighteen percent describe themselves as die-hard fans who "live and die with the Vikings." About 13% of the respondents felt that in the absence of Vikings football, their level of fun would decrease by "a great deal." This number climbs to 35% when we add the respondents who felt that in the absence of the Vikings the level of fun would fall "slightly."

The next section elicits the *WTP* for a new stadium. It quotes the Vikings' Website for the total cost of a new stadium, which is $450 million to $500 million. The survey goes on to say that private and university economists have estimated the individuals' cost of this stadium to be the amount quoted below. This amount is a one-time payment of $5, $10, $25, or $100,

Table 1. Summary Statistics

Variable	Definition	Mean	Standard Deviation	Maximum	Minimum
AMOUNT	Bid amount $5, $10, $25 or $100	37.26	36.71	100	5
READ	1 if "A few days per week" or "Daily"	0.41	0.49	1	0
INTEREST	1 if "I am a die-hard fan"	0.18	0.39	1	0
DISCUSS	1 if "A few days per week" or "Daily"	0.54	0.50	1	0
FUN	1 if "Fall slightly" or "Fall a great deal"	0.35	0.48	1	0
PUBGOOD	Public good (sum of *READ*, *INTEREST*, *DISCUSS*, *FUN*)	1.48	1.47	4	0
SPEND	Money spent on tickets, merchandise, and travel costs	323.80	325.57	1879.14	0
PRESTGE	1 if "A new stadium will bring more prestige to the area"	0.44	0.50	1	0
WINSUPER	1 if "A new stadium will help the Vikings win a Super Bowl"	0.11	0.31	1	0
LEAVE	1 if "The Vikings will leave if they do not get a new stadium"	0.55	0.50	1	0
TWINS	1 if "Support the Twins over the Vikings for a new stadium"	0.16	0. 37	1	0
UOFM	1 if "Support joint stadium with University of MN football"	0.47	0.50	1	0
NONWHT	1 if race is nonwhite	0.07	0.26	1	0
COLGRD	1 if college or graduate school education	0.51	0.50	1	0
INCOME	Annual income	56,766.24	27,781.22	100,000	7500
SINGLE	1 if single	0.19	0.39	1	0
MALE	1 if male	0.73	0.45	1	0
KIDS	Number of kids	2.01	1.72	9	0
TIMINST	1 if respondent has been in the state for over 20 years	0.82	0.38	1	0
URBAN	1 if respondent is from seven-county metropolitan area	0.50	0.50	1	0
$N = 565$					

depending upon the survey.[4] The next few questions allow the respondent to explain their reasons for agreeing or disagreeing to finance a new stadium.

At the $5 level, 51.5% agreed to pay for a new stadium, and at the $15 level, 50.8% agreed to pay. At the $25 level, 50% agreed to pay that amount, and at the $100 level, 33.33% were willing to pay. On the whole, at all bid amounts, 25% of the respondents who were willing to pay claimed that they would do so because they either liked to attend Vikings games or liked to watch them on television. The other 75% claimed that they would be willing to pay for other reasons.

The last section solicited demographic data from the respondent. About 73% of the respondents were male, 19% were single, 93% were white, and 82% have lived in Minnesota for 20 or more years. Fifty-one percent of the survey participants had some college and/or graduate school education, and the average annual income was about $57,000.

[4] Lower bid amounts ranging from $1 to $5 demonstrated a very high acceptance rate during pretesting of the survey.

4. The Contingent Valuation Model

This section illustrates the theoretical methodology of CVM. We are interested in estimating the respondents' *WTP* for a new stadium. To consider values estimated with CVM, the following question was proposed to a random sample of respondents: "Would you be willing to pay \$B out of your own household budget for the next year to make a new stadium possible?"

The respondent may answer with either a "yes" or "no" response. The researcher models the response according to the following:

$$R_i = \begin{cases} \text{Yes} & WTP_i \geq B_i \\ \text{No} & \text{otherwise.} \end{cases} \tag{1}$$

R_i is respondent i's response to the contingent question, WTP_i is the respondent's *WTP* for the stadium, and B_i is the bid level put forth by the interviewer to this particular respondent. Subscripting the bid amount with i allows us to offer different bids to various respondents.[5]

Another issue that we must resolve in this investigation is the specification of the bid levels. Bid design has received much attention in the CVM literature (Cameron and Huppert 1991; Duffield and Patterson 1991; Nyquist 1992; Alberini and Carson 1993; Cooper 1993; Kanninen 1993a, b; Alberini 1995). A thorough discussion of this literature is found in Hanemann and Kanninen (1998). In this application, we wish to choose the bid levels that result in the greatest precision in estimating *WTP*. Our approach to selecting bid design was the sequential design procedure.

To estimate *WTP* for the population of Minnesota precisely using the sequential bid design procedure, we used several sources of information. First, we interviewed Minnesotans and discussed their interest in the Vikings and asked for their thoughts on a new stadium. On the basis of this information, we created initial survey questions that we posed to students on a campus near Minneapolis and to Vikings fans on game day outside the stadium (intercept and in-person interviews). The interviews at the stadium included bid amounts of \$500 (see Appendix A). Using these results as prior information, we formulated statistically optimal bid levels (that is, the bid levels that generate the most precise estimate of mean *WTP*). For the next iteration, we conducted a pretest of Minnesota residents. Upon receiving the results of this pretest, we again formulated statistically optimal bid levels that we used in the full sample.

In terms of the range of bids used, we point out that the general rule discussed in the CVM literature is to avoid using bid levels in the outer 12% tails. This is because those bids are considered to be uninformative (Hanemann and Kanninen 1998). Our bids are somewhat tight, as three of the four bid amounts were less than \$30. Respondents seem to have rejected each of the three bid levels less than \$30 at about the same rate. Distributing bids more evenly up to the top bid amount of \$100 may have provided more information on the sensitivity of respondents to the bid amount. Also, more evenly dispersed bid levels would likely have improved the

[5] There is a strand in the CVM literature exploring the timing of payments; Johnson, Mondello, and Whitehead (2006) address this question. (In particular, it would seem if capital markets are not perfect, the ability to make payments over time would enable respondents to contribute more to the resource.) However, Kahneman and Knetsch (1992) find that a one-time payment and an annual payment design generate equivalent results. Stevens, DeCoteau, and Willis (1997) and Stumborg, Baerenklau, and Bishop (2001) find the implicit discount rate in the annual payment design is unrealistically high. As there are concerns regarding the multiple-period design, and there is some empirical support for the one-time payment, the latter is the design we have adopted in this investigation.

performance of the Turnbull nonparametric technique. Later, we reconsider the bid design after controlling for relocation credibility beliefs.

5. The Naïve Empirical Model—Ignoring Relocation Uncertainty

This section lists and explains the determinants of the *WTP* for a new Vikings stadium.

$$WTP = f(AMOUNT, INCOME, PUBGOOD, SPEND, PRESTGE, WINSUPER, LEAVE, TWINS, UOFM, Z, \varepsilon) \quad (2)$$

The dependent variable, *WTP*, takes on the value of 1 if the fan responds with a "yes" to the bid amount on the survey and a value of 0 if the fan responds with a "no" to the bid amount. Equation 2 tests the hypothesis that the *WTP* for a new stadium depends on the following variables: the dollar value of the bid amount (*AMOUNT*), the respondent's income (*INCOME*), the extent to which the Vikings are a public good (*PUBGOOD*), the prestige associated with having a new stadium (*PRESTGE*), the explicit and implicit costs incurred in the previous seasons by respondents who watch games either at the stadium or on television (*SPEND*), the belief that a new stadium will help the team win a Super Bowl (*WINSUPER*), the belief that the team will relocate if not given a new stadium (*LEAVE*), the Minnesota Twins baseball stadium drive (*TWINS*), a joint stadium with the University of Minnesota (*UOFM*), and a vector of demographic variables (*Z*). ε is the error term in the model.

Each respondent received a bid *AMOUNT* of \$5, \$15, \$25, or \$100 on his particular survey. The respondent then answered "yes" or "no" as to whether he would pay the particular bid amount on the survey. The overall "yes" response rate is 47%. This suggests that the bid amounts have not been set too high or too low. *INCOME* corresponds to the midpoint of the income range that respondents circled. Some respondents did not answer the income question.[6] In keeping with Johnson and Whitehead (2000), the index *PUBGOOD* is the sum of four dummy variables: *READ*, *DISCUSS*, *INTEREST*, and *FUN*. These variables are coded as either 0 or 1. *READ* is equal to 1 if the survey respondent answered "daily" or "weekly" when asked about how often he reads about the Vikings in newspapers, magazines, or online. *DISCUSS* was coded as 1 if the respondent claimed that he discussed the team's fortunes with friends, family, or co-workers on a daily or weekly basis and was coded as 0 otherwise. *INTEREST* was coded as 1 if the respondent claimed to be a die-hard fan and was coded as 0 otherwise. *FUN* measures the change in the quality of life of the respondent if the Vikings were to leave town. If the respondent answered "fall slightly" or "fall a great deal," this variable was coded as 1 and was coded as 0 otherwise.

We create a variable called *SPEND* to account for the explicit and implicit costs incurred in past seasons by people who purchase team merchandise and watch games either at the stadium or on television. *SPEND* is defined as follows:

$$SPEND = EXPLICIT\ COSTS + IMPLICIT\ COSTS, \quad (3)$$

[6] We replaced the missing values with the sample mean in model 1 and with predicted values of income from a semi-logarithmic regression of income on various demographic variables in models 2 and 3.

where *EXPLICIT COSTS* are the dollars spent on tickets for the total number of games that the respondent attends plus the value of team merchandise that the respondent purchases. *IMPLICIT COSTS* are the travel costs (in terms of forgone wages) of attending games or the opportunity costs (again in terms of forgone wages) of watching games on television. These costs are calculated in accordance with the recreational demand literature from environmental economics (Freeman 1993). *IMPLICIT COSTS* can be further broken down into the implicit costs of attending games at the stadium and the implicit costs of watching games on television. Implicit costs of attending stadium games (*ICSG*) are given specifically by Equation 4:

$$ICSG = \frac{1}{3}(Hourly\ Wage\ Proxy) * [(Travel\ Time) + (Game\ Length)] * (Games\ Attended). \quad (4)$$

The hourly wage proxy is discounted by a factor of one-third, in keeping with the recreation demand literature.[7] The hourly wage proxy itself is calculated by dividing the respondent's annual income by the number of working hours in the year, assuming a 40-hour workweek. For each game that the respondent attends, she gives up the round trip travel time (*Travel Time*) to and from the stadium in addition to the length of the game (*Game Length*). The length of the average NFL game is assumed to be three and a half hours. Implicit costs of watching games on television (*ICTV*) are calculated along the same lines as *ICSG*. This is described by Equation 5.

$$ICTV = \frac{1}{3}(Hourly\ Wage\ Proxy)[Game\ Length] * (Games\ Watched\ on\ TV). \quad (5)$$

Notice that the *SPEND* variable is only concerned with variables that were determined in previous seasons; hence, it is exogenous at the time of the survey. *PRESTGE* is a dummy variable that is coded as 1 if the respondent believes that a new stadium will "bring greater prestige to the Twin Cities area." *LEAVE* is a dummy variable coded as 1 if the respondent believes that "The Vikings will leave town if they do not get a new stadium within the next few years." Fifty-five percent of respondents believe that the Vikings will relocate if they do not get a new stadium. *WINSUPER* is a dummy variable that is coded as 1 if the respondent believes that a new stadium will "help the Vikings win the Super Bowl." *TWINS* is a dummy variable that is coded as 1 if the respondent chose the Twins when she indicated that she would not pay for a Vikings stadium because she would rather pay for a Twins stadium. *UOFM* is a dummy variable that is coded as 1 if the respondent indicated that she would be willing to pay for a Vikings stadium because of the possibility of a joint stadium with the University of Minnesota football team. The two teams currently share the same facility. Furthermore, at the time of the survey, the Vikings were in talks with the University of Minnesota about a joint facility. We also include a vector of demographic variables, Z, to pick up the impact of race, gender, education, etc. The entire list of these variables along with their definitions is displayed in Table 1.

We use probit to estimate *WTP* for a new stadium. The results of this first model (model 1) are contained in Table 2. Probit is a common technique in the CVM literature and has good

[7] There is a long strand of literature concerning the appropriate opportunity cost of time in recreational valuation studies. Seminal works include Knetsch (1963), Scott (1965), and Cesario and Knetsch (1970). However, there is no general consensus on what the appropriate opportunity cost should be. Cesario (1976) estimated the opportunity cost of time to be one-third the wage rate in an investigation of transportation and community studies. McConnell and Strand (1981) estimated the opportunity cost of time to be 0.6 of the wage rate. In our study, we use one-third the wage rate.

Table 2. Model 1

Variable	Regression Coefficient	*t*-Statistic	Marginal Impact on *WTP*
CONSTANT	−1.60	−5.033	−228.23
AMOUNT	−0.01	−3.73	NA
PUBGOOD	0.29	4.49	41.15
SPEND	0.00	2.17	0.10
PRESTGE	0.60	4.18	83.90
WINSUPER	0.57	2.11	79.85
LEAVE	0.39	2.77	55.51
TWINS	0.34	1.97	48.20
UOFM	0.87	6.29	123.01
NONWHT	0.07	0.23	10.25
COLGRD	0.20	1.35	27.52
INCOME	−0.00	−0.55	−0.00
SINGLE	0.02	0.13	3.48
MALE	0.10	0.60	13.89
KIDS	−0.03	−0.65	−3.80
TIMINST	−0.00	−0.02	−0.55
URBAN	−0.01	−0.06	−1.23
Log-likelihood function	−227.84		

performance relative to other techniques, even if normality is questioned (Creel and Loomis 1997). Though some concern arises regarding the potential for negative estimates of *WTP* with probit, Creel and Loomis have found that the probit model provides a better fit of mean *WTP* than other techniques that force *WTP* to be nonnegative. Explanatory variables that are missing values have been replaced by their respective sample means. We used a semi-logarithmic model of income as a function of various demographic variables to predict the missing values of income. The use of this proxy instead of the mean value of income for missing values did not alter the results significantly. These results are presented in Table 3 under the "Model 2" heading. (The *t*-statistics are reported in parentheses beneath the coefficient estimate in the table.)

6. Empirical Results from the Naïve Model

The results from our probit estimation of model 1 are reported in Table 2.[8,9] We use the 1% significance level. We find that the bid amount (*AMOUNT*) is negative and significantly related to the respondents' *WTP*. The public-good aspect of the existence of a team (*PUBGOOD*) is also a positive and significant variable. These results are in keeping with Johnson and Whitehead's (2000) findings. In addition, we find that the explicit and implicit costs associated with watching games as captured by *SPEND* are positively and significantly related to the *WTP* for a new stadium. In terms of magnitude of coefficients (apart from the constant term), *PRESTGE*, *WINSUPER*, *UOFM*, and *LEAVE* are the largest significant

[8] The significance of variables and their signs remain unchanged for alternative limited dependent variable techniques, such as logistic or extreme valued distributions.

[9] Additionally, we applied the dichotomous choice normality test specified in Bera, Jarque, and Lee (1984). The results of the test suggest that we fail to reject the null hypothesis that the residuals are normally distributed.

Table 3. Specification Sensitivity

Variable	Model 2	Model 3
CONSTANT	−1.55146	−1.72193
	(−4.9)	(−5.4)
AMOUNT	−0.00728	−0.00737
	(−3.8)	(−3.8)
PUBGOOD	0.28994	0.28445
	(4.46)	(4.11)
SPEND	0.00066	—
	(2.06)	
GAMES	—	0.02839
		(1.89)
PRESTGE	0.62459	0.65245
	(4.39)	(4.57)
WINSUPER	0.55291	0.57423
	(2.05)	(2.12)
LEAVE	0.38508	0.37059
	(2.72)	(2.61)
TWINS	0.25443	0.27357
	(0.92)	(0.98)
UOFM	0.85779	0.81279
	(6.14)	(5.80)
NONWHT	−0.00401	0.0624
	(−0.0)	(0.19)
COLGRD	0.19355	0.21357
	(1.31)	(1.45)
INCOME	−1.7E-06	1.6E-06
	(−0.5)	(0.61)
SINGLE	−0.00299	0.01511
	(−0.0)	(0.07)
MALE	0.10678	0.08634
	(0.64)	(0.51)
KIDS	−0.02915	−0.02684
	(−0.6)	(−0.6)
TIMINST	−0.02404	−0.06338
	(−0.1)	(−0.3)
URBAN	0.0322	0.03184
	(0.23)	(0.22)
Log-likelihood function	−229.225	−229.616

[a] *t*-stats are in parentheses.

coefficients. These findings suggest that respondents are more willing to pay for a new stadium because of the prestige it will bring to the area, the threat of team relocation, and the increased chance of winning a Super Bowl. Approximately 47% of the respondents who were willing to pay for a new stadium indicated that they would do so because of the possibility of a joint stadium with the University of Minnesota football team.

The marginal effects are obtained by multiplying the regression coefficients by the negative of the reciprocal of the coefficient on the bid amount in keeping with Cameron (1988). The public-good value to Minnesotans, as indicated by the marginal effect in the fourth column of Table 2, is approximately $41. The sum of the marginal effects of team relocation, added prestige from a new stadium and a better chance at winning the Super Bowl, increase the

Table 4. Marginal Impact Estimates in Dollars by Variable for Rural, Urban, and Pooled Samples

Variable	Rural Marginal Impact	Urban Marginal Impact	Pooled Marginal Impact
AMOUNT	NA	NA	NA
	(−1.983)	***(−3.813)***	***(−3.731)***
CONSTANT	−339.61	−122.10	−228.23
	(−4.045)	***(−2.734)***	***(−5.033)***
PUBGOOD	25.83	37.30	41.15
	(1.414)	***(4.247)***	***(4.489)***
SPEND	0.31	0.02	0.10
	(2.78)	(0.435)	***(2.169)***
PRESTGE	123.14	48.16	83.90
	(3.32)	***(2.433)***	***(4.175)***
WINSUPER	127.22	63.83	79.85
	(1.46)	***(1.875)***	***(2.111)***
LEAVE	89.00	33.76	55.51
	(2.344)	***(1.702)***	***(2.769)***
TWINS	17.93	57.65	48.20
	(0.359)	***(2.589)***	***(1.970)***
UOFM	154.61	86.43	123.01
	(4.243)	***(4.562)***	***(6.294)***
NONWHT	142.41	−19.55	10.25
	(1.359)	(0.522)	(0.227)
COLGRD	58.27	9.66	27.52
	(1.51)	(0.49)	(1.347)
INCOME	0.00	0.00	0.00
	(1.52)	(0.091)	(0.584)
SINGLE	−24.58	23.55	3.48
	(0.457)	(0.93)	(0.128)
MALE	48.20	−4.69	13.89
	(1.166)	(−0.203)	(0.598)
KIDS	−9.12	2.98	−3.80
	(−0.867)	(0.506)	(−0.648)
TIMINST	52.69	−31.86	−0.55
	(0.931)	(−1.244)	(−0.021)
URBAN	—	—	−1.23
			(−0.062)
Log-likelihood	−100.983	−118.816	−227.839

respondents' *WTP* by about $219. The actual explicit and implicit costs that respondents incur while watching games do little ($0.10) to boost their *WTP* for a new stadium. The Minnesota Twins stadium drive (*TWINS*) affected the respondents' *WTP* for a Vikings stadium by $48. The possibility of a joint stadium with the University of Minnesota football team had a positive and significant effect, boosting *WTP* by $123.01.

Approximately 5% of those who did not want to pay for a stadium claimed that it was because they did not care about Vikings football. The model is re-estimated without these observations. The results and significance of the variables are largely the same. These estimation results are available upon request. *URBAN* is insignificant, so the model is estimated for urban, rural, and the pooled sample. These results are contained in Table 4. The *t*-statistics are reported in parentheses beneath the coefficient estimate in the table. Statistically significant coefficients are indicated by the bold and italicized *t*-statistics.

Another concern that may arise with models 1 and 2 is the potential multicollinearity between ticket prices and the number of games attended in the *SPEND* variable. In order to remedy this, we replace *SPEND* with the number of games attended in person plus the number of games watched on television. The results of this third model are shown in Table 3 under the heading "Model 3." Once again, the results remain more or less the same as those in models 1 and 2.

7. Credible Threat of Viking Relocation and the CVM

If the respondent does not perceive the Vikings relocation to be a credible threat, is he valuing the Vikings? Johnson and Whitehead (2000) perform a valuation study for sports stadiums using a CVM format. They proposed to value a new basketball arena for the University of Kentucky. As the University of Kentucky would not relocate if a new stadium fails to be approved, Johnson and Whitehead (2000) point out that their CVM study may not be interpreted as a valuation of the University of Kentucky basketball program. Analogously, in our survey, provided the respondent does not believe the Vikings will move from Minnesota without a new stadium, he is not necessarily valuing the Vikings franchise in our CVM question. Instead, the respondent may solely be valuing the new stadium. If we wish to estimate value for the franchise, we may consider only those who perceive the Vikings will leave without a new stadium. To examine how the individuals who felt the Vikings will relocate without a new stadium value the franchise, we split the full sample into those who felt relocation was credible and those who did not find the threat credible. We estimated these model splits, and the estimated results are indicated in Table 5. As in Tables 3 and 4, the *t*-statistics are reported in parentheses beneath the coefficient estimate in the table, and statistically significant coefficients are indicated by the bold and italicized *t*-statistics.

PUBGOOD, *WINSUPER*, and *TWINS* are statistically significant in the credible subsample and pooled sample but not in the noncredible subsample. *SPEND* and *PRESTGE* are statistically significant in the noncredible subsample and pooled sample but not in the credible subsample. *UOFM* is statistically significant in all three sample splits. Also, in the credible pool, *COLGRD* is positive and statistically significant.

Interestingly, the coefficient on bid amount is insignificant in the noncredible subsample model. This is troublesome for estimating *WTP* for at least two reasons. First, this suggests respondents are not strongly reacting to the bid amount in answering the CVM question. Second, the coefficient on bid amount is the negative reciprocal of the estimated standard deviation in *WTP* across the sample. This is empirically unsurprising, as we do see a large range in estimated *WTP* for this subsample (−$792.21 to $1,320.53). The noncredible subsample average value for the Vikings is −$252.03. This empirical result for this sample split likely stems from at least two issues. First, this value does not necessarily reflect a low value for the Vikings franchise, as this subsample does not perceive the Vikings will leave without a new stadium. This implication is that the low value reflects a low value for constructing a new stadium. Second, we argue above that a negative *WTP* is theoretically plausible. The low acceptance rate of our CVM question by this subsample indicates that the precision in estimating the coefficient on the bid amount would have been assisted if we learned about the *WTP* distribution in the left tail (or left of the mean). This would have

Table 5. Marginal Impact Estimates in Dollars by Variable for Credible, Noncredible, and Pooled Samples

Variable	Credible Move Marginal Impact	Noncredible Move Marginal Impact	Pooled Marginal Impact
AMOUNT	NA	NA	NA
	(−4.113)	(−0.953)	***(−3.731)***
CONSTANT	−81.68	−665.79	−228.23
	(−1.882)	***(−4.040)***	***(−5.033)***
PUBGOOD	39.21	36.61	41.15
	(4.719)	(0.99)	***(4.489)***
SPEND	0.04	0.48	0.10
	(0.966)	*(2.603)*	***(2.169)***
PRESTGE	18.68	408.15	83.90
	(1.000)	***(5.234)***	***(4.175)***
WINSUPER	77.77	308.46	79.85
	(2.498)	(1.291)	***(2.111)***
LEAVE	—	—	55.51
			(2.769)
TWINS	60.31	42.18	48.20
	(2.624)	(0.447)	***(1.970)***
UOFM	87.86	311.03	123.01
	(4.943)	***(4.083)***	***(6.294)***
NONWHT	−27.75	151.12	10.25
	(0.622)	(0.967)	(0.227)
COLGRD	38.42	−41.15	27.52
	(2.081)	(0.509)	(1.347)
INCOME	0.00	0.00	0.00
	(0.840)	(0.246)	(0.584)
SINGLE	−29.75	98.03	3.48
	(1.167)	(0.905)	(0.128)
MALE	−0.32	86.36	13.89
	(0.014)	(1.011)	(0.598)
KIDS	−1.05	−11.91	−3.80
	(0.186)	(0.569)	(−0.648)
TIMINST	−2.79	23.21	−0.55
	(0.115)	(0.208)	(−0.021)
URBAN	−11.38	13.03	−1.23
	(−0.632)	(0.167)	(−0.062)
Log-likelihood	−135.299	−77.513	−227.839

required negative bid amounts.[10] We are not aware of a published CVM study that has investigated this phenomenon. This may be an interesting issue to consider in future investigations.

The inability to estimate a statistically significant coefficient on the bid amount in the noncredible subsample is not critical to our stated purpose of valuing the Minnesota Vikings franchise. It is not clear that individuals who feel the Vikings will remain in Minnesota without a new stadium are valuing the franchise in responding to our hypothetical stadium initiative. Hence, we do not consider the results of this subsample in projecting a value for the Vikings franchise.

[10] It is not trivial how researchers could propose a policy mechanism that proposes negative bid levels in a believable context.

The individuals who feel the Vikings will relocate without a new stadium are valuing the Vikings franchise in their response to the CVM question. The range of values in this credible subsample is −$158.85 to $322.68, with an average of $73.26. We tolerate negative estimated *WTP* values out of convenience and to illustrate that the model we have developed so far may not be adequately assessing the welfare Minnesotans place on the Vikings. As these results indicate, the respondents' beliefs about the Vikings' relocation are critical to the estimated *WTP*. In the following section, we extend our model to account for heterogeneous relocation beliefs. We find that this richer model substantially improves our analysis of the attitude of Minnesotans toward the Vikings.

8. Modeling the Respondents' Decision-Making Problem with Heterogeneous Credibility Beliefs

As noted in the preceding section, CVM studies present a contingent scenario and ask the respondents' willingness to contribute at a specified bid to guarantee a specific outcome. In our case, we ask respondents for their willingness to contribute to construction of a new stadium for the Minnesota Vikings. On the surface, this question would allow us to infer value for a new stadium for the Vikings. However, previous researchers have noted that if there is a perception that the professional sports team will relocate without a new stadium, respondents' answers to this question may be used to infer value that includes the welfare received by respondents from the sports team. This is the focus of our investigation: to measure the value Minnesotans place on the Vikings.

Reviewing the summary statistics in Table 1, we see that only 55% of the respondents indicated they believed the Vikings would relocate without a stadium. As this suggests, our valuation estimate from the CVM question may not include a value for the sports team; ignoring the differences in credibility beliefs likely biases our valuation estimate. This is because a respondent who does not believe the Vikings will relocate does not perceive a potential loss of the Vikings if he or she answers our CVM question with a "no." For this reason we find we must formally model the respondents' decision-making mechanism given their perception of the likelihood the Vikings would relocate without a new stadium.[11] For notational convenience, we define respondent i's belief regarding relocation as θ_i. Once we allow for heterogeneous credibility beliefs in our sample, we find the logical approach to modeling this decision-making process is with a random utility model (RUM), similar to the approaches of Hanemann (1984a, b), Smith and Desvousges (1990), Ott , Huang, and Misra (1991), and Eom (1994). In these studies, the researchers model the discrete selection of goods by consumers under uncertainty.

As it is not clear that all respondents believe the Vikings would definitely relocate or definitely remain in Minnesota without a stadium, we find this uncertainty of outcome is important to capture unbiased estimates of welfare generated by the sports franchise in Minnesota. Given the individual's belief regarding relocation, which we call θ_i, the individual's expected utility from answering our CVM question with a "no" is

$$E[U_i|y_i = 0] = \theta_i[V(M_i, S_0, K_0) + \varepsilon_{00i}] + (1 - \theta_i)[V(M_i, S_0, K_1) + \varepsilon_{01i}], \qquad (6)$$

[11] We thank an anonymous referee who made this suggestion. This suggestion substantially improves the development of our paper.

where y_i is the individual's response to the CVM question, with a 1 indicating a "yes" response and a 0 indicating a "no" response; $V\cdot + \varepsilon_{00i}$ is individual i's indirect utility function (with $V\cdot$ being the respondent's nonstochastic portion of his or her indirect utility function); M_i is individual i's income; and S_1 indicates the stadium will be constructed, while S_0 indicates the stadium will not be constructed. The variable K_1 indicates the Vikings remain in Minneapolis, while K_0 indicates the Vikings relocate outside of Minnesota. We assume the noise terms ε_{00i}, ε_{01i} are normally distributed. The subscript 00 reflects that no stadium was constructed and the Vikings relocated. The subscript 01 reflects that no stadium was constructed while the Vikings remained in Minneapolis. Notice that the terms ε_{00i}, ε_{01i} are not stochastic from the respondent's perspective. The researcher, however, does not observe these terms, which drive differences in behavior across the population. Given the respondent answers "no" and the Vikings will leave Minnesota without a stadium, the indirect utility $V(M_i, 0, 0) + \varepsilon_{00i}$ is realized. That is, the respondent receives the satisfaction level associated when no stadium is built and the Vikings relocate. According to the respondent's estimated beliefs, this occurs with probability θ_i. On the other hand, given the Vikings will not relocate without a stadium and the respondent answers the CVM question with a "no," the indirect utility $V(M_i, 0, 1) + \varepsilon_{01i}$ is realized. That is, the individual receives the satisfaction level from no stadium, and the Vikings remain in Minnesota. This outcome occurs according to the respondent's estimated beliefs with probability $1 - \theta_i$.

In keeping with Hanemann (1984a), we would expect the respondent to answer the CVM question with a "yes" when $E[U_i|y_i = 1] > E[U_i|y_i = 0]$ and a "no" otherwise. Notice that from the respondent's perspective, the level of indirect utility is certain in the case of a "yes" answer. That is, $E[U_i|y_i = 1] = V(M_i - B_i, 1, 1) + \varepsilon_{11i}$. When a "yes" answer is given, the respondent pays the bid amount B_i but is certain that the Vikings receive a new stadium and remain in Minnesota. Given this structure, we anticipate a "yes" response with probability

$$\begin{aligned}&\Pr[\varepsilon_{11i} - \theta_i\varepsilon_{00i} - (1 - \theta_i)\varepsilon_{01i} > \theta_i V(M_i, S_0, K_0)\\&+(1 - \theta_i)V(M_i, S_0, K_1) - V(M_i - B_i, S_1, K_1)].\end{aligned} \tag{7}$$

For our purposes in this paper, we suppose that θ_i is uncorrelated with each of the noise terms ε_{11i}, ε_{01i}, and ε_{00i}. Further, we model the noise terms ε_{11i}, ε_{01i}, and ε_{00i} as being 0 mean normal processes for each individual. For convenience, we assume $\sigma_\varepsilon^2 \equiv \mathrm{Var}(\varepsilon_{11i}) = \mathrm{Var}(\varepsilon_{01i}) = \mathrm{Var}(\varepsilon_{00i})$ and $\psi \equiv \mathrm{Cov}(\varepsilon_{11i}, \varepsilon_{00i}) = \mathrm{Cov}(\varepsilon_{11i}, \varepsilon_{01i}) = \mathrm{Cov}(\varepsilon_{01i}, \varepsilon_{00i})$.

This allows us to write

$$\begin{aligned}&\Pr[y_i = 1]\\&= 1 - \Phi\left[\frac{\theta_i V(M_i, S_0, K_0) + (1 - \theta_i)V(M_i, S_0, K_1) - V(M_i - B_i, S_1, K_1)}{\sigma_\delta}\right],\end{aligned} \tag{8}$$

where we define $\delta \equiv \varepsilon_{11i} - \theta_i\varepsilon_{00i} - (1 - \theta_i)\varepsilon_{01i}$, and the variance of δ is $\sigma_\delta^2 = 2(\sigma_\varepsilon^2 - \psi)(1 - \theta_i + \theta_i^2)$. Estimation of the model will allow us to measure the value of a new stadium separately from the franchise value of the Vikings. Also, as we are presenting a bid amount, we can statistically explore the trade-off respondents are willing to make between these amenities and income. We leverage this trade-off to implicitly value the Vikings franchise.

Formally, the nonstochastic portion of a respondent's indirect utility function is $V(M, S, K) = \alpha + \alpha_M M + \alpha_S S + \alpha_K K$. Given the respondent answers the CVM question with a "yes," our model suggests the nonstochastic indirect utility is $V(M_i - B_i, 1, 1) = \alpha + \alpha_M(M_i - B_i) + \alpha_S +$

α_K. The agent's expected indirect utility with a "no" response is $E[V_i|y_i = 0] = \alpha + \alpha_M M_i + (1 - \theta_i)\alpha_K$. Notice that observing respondents who believe the Vikings will not relocate in the event the stadium initiative fails allows us to implicitly value a new stadium. That is, these respondents do not perceive the Vikings will leave, and so their response does not allow us to make inferences regarding their value for the Vikings. Our model illustrates that given $\theta_i = 0$, the difference $E[U_i|y_i = 1] - E[U_i|y_i = 0]$ collapses to $-\alpha_M B_i + \alpha_S$. This allows us to explore the trade-off between income and the value of a stadium. Setting this expected utility difference to 0 and solving for B_i allows us to identify the choke price for a new stadium, that is, the maximum amount the respondent is willing to pay solely for a stadium, which is $P_C = \alpha_S/\alpha_M$.

Provided the respondent is convinced the Vikings will leave without a new stadium, our CVM question allows us to infer the respondent's value for both the new stadium and the Vikings franchise. This is $E[U_i|y_i = 1] - E[U_i|y_i = 0] = -\alpha_M B_i + \alpha_S + \alpha_K$. In this case, our analysis allows us to explore the trade-off between income and the composite combination of a new stadium with the Vikings franchise. As we identified the choke price for a new stadium, we may also infer the choke price of the composite combination of a new stadium and the Vikings franchise by setting the expected utility difference to 0 and solving for the bid amount. This produces $P'_C = (\alpha_S + \alpha_K)/\alpha_M$. Calculating the difference $P'_C - P_C$ identifies the value attributable solely to the Vikings franchise. Formally, this is α_K/α_M.

Allowing $\theta_i \in [0, 1]$ we may also identify each of the parameters α_M, α_S, and α_K. This builds upon the existing literature in several important ways. First, while many studies measure the value of a franchise, most do not take place when there is a general perception that the team will leave. As our theoretical model suggests, these investigations are likely fraught with bias, as individuals do not perceive a threat to their sports franchise–related welfare. That is, if respondents do not perceive a team will relocate, their behavior does not put the amenity in question in jeopardy. Hence, it would be a mistake to model their behavior as if it does. Certainly, investigations that do this will generally undervalue the amenity in question. Second, we present a formal framework to model the credibility of relocation and distinguish franchise value from the value of a new stadium. This is the task we undertake in the following section.

9. Modeling the Respondent's Credibility Belief

In the survey, we asked the respondents if they believed the Vikings would relocate outside of Minnesota without a new stadium. This binomial choice framework allows us to use probit to predict the likelihood of the respondent saying "yes" as a function of her sociodemographic characteristics. Using these nonstochastic sociodemographic variables, we model this response according to

$$\Pr(L_i = 1) = \Pr(\gamma' x_i + \varepsilon_i > 0) = \Pr(\varepsilon_i > -\gamma' x_i) = 1 - \Phi(-\gamma' x_i), \tag{9}$$

given ε_i is distributed standard normal, L_i takes on the value of 1 if the respondent believes the Vikings will leave without a new stadium and 0 if the Vikings remain in Minnesota without a new stadium, and γ is an unknown vector of coefficients. The estimated model results appear in Table 6. To arrive at the variables used in this credibility belief model, we parsed the variables that t-statistics indicated did not add explanatory power to the model.

Given $1 - \Phi(-\hat{\gamma}' x_i) > 0.5$ and $L_i = 1$, we score a correct prediction for the model. Similarly, when $1 - \Phi(-\hat{\gamma}' x_i) \leq 0.5$ and $L_i = 0$, we score a correct prediction for the model.

Table 6. Modeling the Credibility of the Vikings Relocating

Variable	Coefficient	*t*-Statistic
Constant	−1.6835	−12.2334
Past spending	0.0007	3.0124
Prestige	0.6754	4.9610
University of Minnesota	0.8598	6.3523
Twins	0.3591	2.1471
Discuss	0.4447	2.8128
Win Super Bowl	0.6619	2.5992
Fun	1.5157	5.7724

Using this criterion for the observed sample, the fitted model accurately predicts the respondent's belief 79.3% of the time. One concern regarding the responses to our survey is the relatively uniform bid acceptance rate across bid levels. This information is presented in Table 7. Theory suggests that as the bid level increases, the respondents' willingness to contribute to the stadium initiative should wane. Though our bids are relatively tight, we see some undulating behavior regarding the bid acceptance rate as the bid level increases. Now that we have estimated the respondent's credibility belief, we reexamine this bid acceptance rate controlling for the predicted credibility belief. This information is presented in Table 8. Across the columns of Table 8, we report the respondents' credibility beliefs in five categories. These categories represent those who believe the Vikings are 0–20%, 20–40%, 40–60%, 60–80%, and 80–100% likely to relocate without a new stadium, respectively. The rows of the table indicate the bid levels the respondent received. Generally, we see that in moving across the columns in a particular row, the likelihood of the respondent accepting the stadium initiative increases. This suggests that as the respondent believes the Vikings are more likely to relocate without a new stadium, he or she becomes more willing to fund the stadium initiative. Moving down the rows in a given column indicates how respondents with similar credibility beliefs are impacted by higher bid levels. As we look down a column, we observe behavior consistent with economic theory. That is, the bid acceptance rate declines as the bid level increases. This suggests that controlling for the respondent's credibility of relocation is important to understanding how he or she will react to the stadium initiative CVM question.

For the RUM characterization of the decision-making process regarding the CVM question we developed in the proceeding section, we need an estimate of θ_i. The predicted value $1 - \Phi(-\hat{\gamma}' x_i)$ is a reasonable choice for this belief credibility. Now that we have an estimator for the respondent's belief regarding the likelihood of the Vikings relocating in the event a new stadium is not funded, we may return to the respondent's behavioral mechanism regarding the contingent valuation question.

Table 7. Bid Levels and the Proportion of "Yes" Responses

Bid	Rural "Yes" Responses	Urban "Yes" Responses
$5	44%	58%
$15	53%	48%
$25	44%	61%
$100	32%	36%

Table 8. "Yes" Responses by Bid Level and Predicted Credibility Beliefs

Relocation Belief Bid Level	0–20%	20–40%	40–60%	60–80%	80–100%
$5	4.88%	40.00%	61.54%	88.24%	90.32%
	$n = 41$	$n = 15$	$n = 26$	$n = 17$	$n = 31$
$15	8.82%	43.75%	58.82%	60.87%	90.00%
	$n = 34$	$n = 16$	$n = 17$	$n = 23$	$n = 30$
$25	10.42%	36.36%	69.57%	90.91%	88.10%
	$n = 48$	$n = 22$	$n = 23$	$n = 11$	$n = 42$
$37.2	0%	0%	66.67%	100%	0%
	$n = 22$	$n = 2$	$n = 3$	$n = 2$	$n = 2$
$100	7.69%	16.67%	45.83%	40%	75.86%
	$n = 52$	$n = 18$	$n = 24$	$n = 15$	$n = 29$

10. RUM with Prior Credibility Belief Estimated

With a consistent estimator of the respondent's credibility belief of the Vikings relocating, we can return to the respondent's decision mechanism in the CVM setting. Specifically, we developed the probability the respondent answers the CVM question with a "yes," as indicated in Equation 8. Using our prior estimator $\hat{\theta}_i = 1 - \Phi(-\hat{\gamma}' x_i)$, our log-likelihood function becomes:

$$\ln(L) = \sum_{i=1}^{n} \{y_i \ln(1 - \Phi(d_i)) + (1 - y_i)\ln(\Phi(d_i))\}, \tag{10}$$

where

$$d_i = \frac{\alpha_M B_i - \alpha_S - \hat{\theta}_i \alpha_K}{\sqrt{2(\sigma_\varepsilon^2 - \psi)\left(1 - \hat{\theta}_i + \hat{\theta}_i^2\right)}}.$$

The results are presented in Table 9. Note that the coefficients on income, the Vikings franchise, and the new stadium are statistically significant at any reasonable level of significance.

To gauge the sensitivity of respondents' willingness to contribute to the stadium initiative and the bid level, consider Figure 1. Figure 1 identifies the bid level that makes the respondent indifferent to agreeing to pay the bid amount as a function of the individual's belief regarding the Vikings relocation credibility (θ_i). Notice that when the respondent views the credibility of the Vikings relocating is 43.2%, the estimated household welfare value falls to 0. This welfare value includes the sum of the value of the Vikings franchise together with a new stadium. Recall that as the coefficient on stadium is negative, respondents are less likely to agree to the bid amount when they do not perceive the Vikings will move. The figure illustrates that as this

Table 9. Random Utility Model

Variable	Coefficient	*t*-Statistic
Constant	0.0993	0.164
New Stadium	−1.8582	−10.503
Vikings	4.2983	14.669
Income	0.0081	3.531

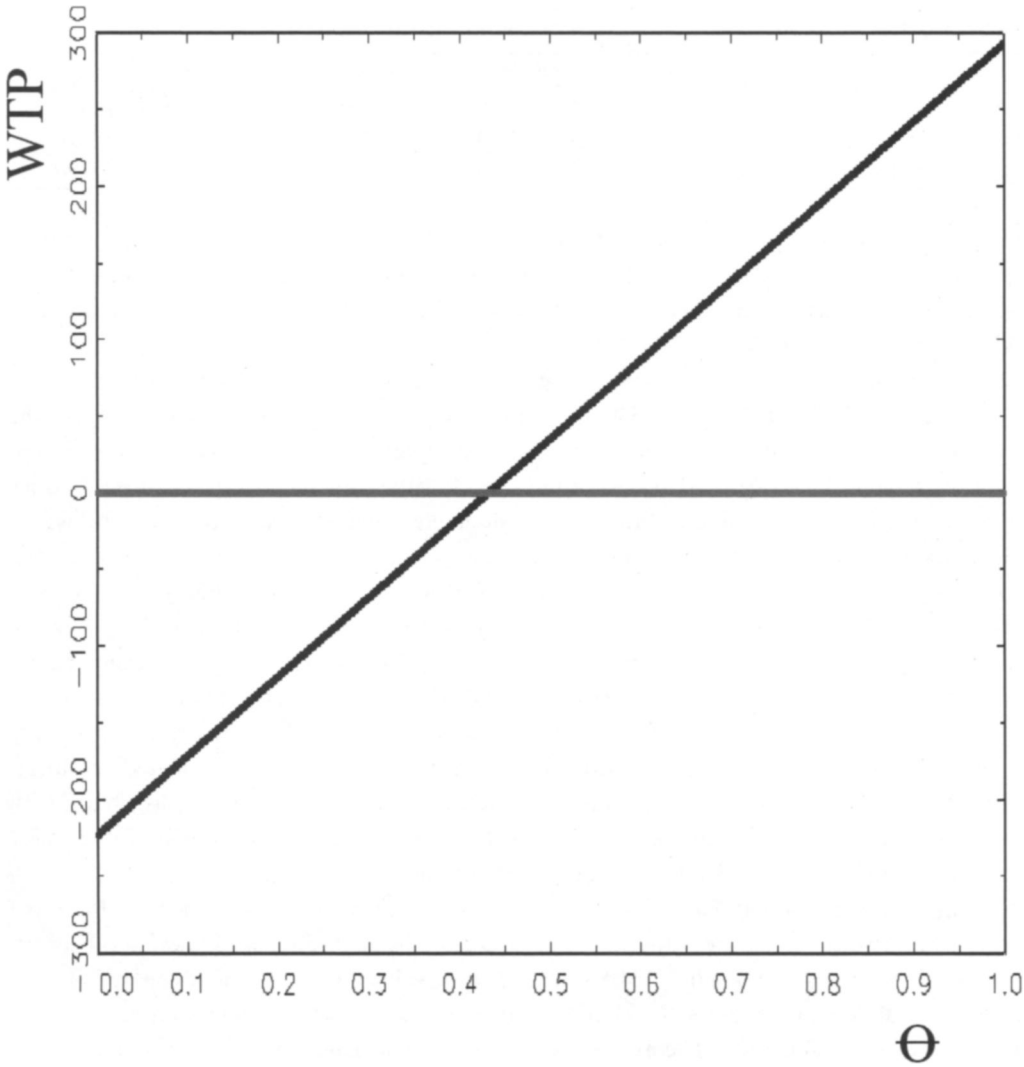

Figure 1. Predicted Household Welfare Value of the Vikings and Credibility Belief

credibility of relocation rises, the households are willing to pay greater amounts to keep the Vikings by funding the stadium.

There may be some concern that our model is simply picking up a dichotomy between football fans in Minnesota and nonfans. That is, fans are anxious to keep the Vikings in Minnesota and much more readily accept the stadium initiative bid amount. This argument would also suggest nonfans, on the other hand, do not expect to use the stadium and reject the stadium initiative. We do not find this to be an issue in our study. Recall that respondents were randomly selected from throughout Minnesota. This reduces any preponderance of including or excluding football fans. Further, the variable *FUN* was gathered from respondents by gauging how they felt their quality of life would be impacted if the Vikings moved. Those who indicated their quality of life would "fall slightly" or "fall a great deal" were coded as a 1 for the *FUN* variable and 0 otherwise. Summary statistics indicate that a third of respondents indicated their quality of life would "fall slightly" or "fall a great deal" if the Vikings relocated.

Table 10. Distribution Characteristics for Valuation Estimates by Household

Variable	2.5% Percentile	Mean	97.5% Percentile
Vikings value	\$336.41137	\$584.89800	\$1187.1641
New stadium value	−\$550.82819	−\$252.17771	−\$128.25530
Team and stadium composite	\$205.39184	\$332.72029	\$638.75790

The variable *INTEREST* was coded as a 1 if the respondent indicated she was a "die-hard fan" and a 0 otherwise. Summary statistics reveal that 18.2% of respondents classified themselves as die-hard fans. Thus we find that our survey respondents are an adequate representation of Minnesotans and their views on the Vikings.

Based on our estimated parameters, we may infer an average welfare per household of $\hat{\hat{\alpha}}_K / \hat{\hat{\alpha}}_M = (4.2983/0.0081) = \$530.65$.[12] Interestingly, our model estimates suggest the average household welfare Minnesotans associate with a new stadium is $\hat{\hat{\alpha}}_S / \hat{\hat{\alpha}}_M = (-1.8582/0.0081) = -\$229.41$. Average household welfare for the stadium and the Vikings is \$301.24. Aggregating across Minnesota households suggests the Vikings franchise in Minneapolis provides \$702.3 million in welfare to Minnesota residents (given 1,323,569 households in Minnesota). However, construction of a stadium for the Vikings would harm Minnesota welfare by \$303.6 million. This suggests a net welfare contribution of the Vikings playing in a new stadium is \$398.7 million. It should also be kept in mind that these estimates are point estimates. As we fitted the coefficients with statistical techniques, there is some uncertainty in the precise value of these coefficients. To demonstrate how variable the resulting welfare valuation amounts may be, we performed a parametric bootstrap using the estimated parameter variance-covariance matrix and the assumption that the parameters are normally distributed with a mean given by our maximum likelihood estimates. We reproduce the results in Table 10 for household estimates and in Table 11 for aggregate Minnesota estimates.

Table 11 suggests that, based on our observed sample, we are 95% confident that the true welfare Minnesotans associate with the Vikings franchise being located in Minnesota is between \$445.3 million and \$1,571.3 million. The average welfare value for the Vikings alone is \$774.2 M. The 95% confidence interval for the welfare contributions of a new stadium is between −\$729.1 million and −\$169.8 million. The average welfare value associated with a new stadium for the Vikings is −\$333.8 million. The 95% confidence interval for welfare Minnesotans associate with the Vikings franchise and a new stadium is \$271.9 million and \$845.4 million, respectively. The average welfare associated with combining a new stadium and the Vikings is \$440.4 million.

11. Conclusions

This paper provides evidence that the relocation threat is important to inducing respondents to reveal their preferences for the franchise. As our theoretical portion regarding the credibility of relocation suggests, simply treating the relocation threat as a certainty biases the willingness-to-pay estimate downward. The previous models that ignored the respondents' belief regarding relocation resulted in a significantly smaller estimate. The result in this paper

[12] We use double-carats on our parameter estimates to indicate that these estimates are a function of the prior estimates of Viking relocation credibility.

Table 11. Aggregate Minnesota Distribution Characteristics for Valuation Estimates (in millions)

Variable	2.5% Percentile	Mean	97.5% Percentile
Vikings value	\$445.3	\$774.2	\$1,571.3
New stadium value	−\$729.1	−\$333.8	−\$169.8
Team and stadium composite	\$271.9	\$440.4	\$845.4

that addresses relocation credibility produces larger valuation estimates. In fact, our results suggest that researchers interested in valuing a sports franchise must pay attention to the beliefs of the respondent vis-à-vis the credibility of relocation.

The estimation results do seem to mesh well with the observed sample. The estimated model accurately predicts the respondents' answers to the CVM question (79.3% of respondents' answers are accurately predicted). One of the concerns regarding the estimated value for the Vikings we postulated with the traditionally estimated model (that is, without modeling the credibility of the Vikings to relocate) was the relatively low value suggested for the Vikings. However, our credibility model does suggest the Vikings are much more valuable to Minnesotans if it is believed that the Vikings would relocate. From an economics perspective, determining the pure Vikings franchise value is only possible if we are able to calculate a "choke price," that is, a threshold that, if not met, results in loss of the resource. In the present context, this is the Vikings relocating with probability of 1 if there is no new stadium.

Does our study suggest a stadium should be constructed for the Vikings? The answer to this question really is not the focus of our investigation. We view the CVM question under the threat of relocation as a unique opportunity to tease out the welfare value of the Vikings to Minnesotans. Our model of the respondents' decision-making mechanism suggests we can do this. Again, as the results reported above illustrate, the typical household associates a welfare value of \$530.65 with the Vikings. Given the 1,323,569 households in Minnesota with a typical value of \$530.65 for the Vikings, we estimate an aggregate \$702,351,890 welfare value for the Vikings franchise from Minnesotans (a 95% confidence interval of \$445.3 million and \$1,571.3 million). However, this does not suggest that the best use of public funds would be to construct a stadium. Like all decisions, the benefits of the action must be weighed against the sacrifice the decision would entail. We do not possess any unique insights into the opportunities and needs in Minnesota that could not be met if a new stadium was constructed. Yet this is a worthwhile consideration policy makers must explore to evaluate such a decision. As our model indicates a negative value for the stadium initiative, we do have strong statistical evidence that Minnesotans are not in favor of such construction at the time of the survey.

Appendix A: The On-Site Survey and Sample Characteristics

A sample of 209 respondents was collected through personal on-site interviews outside the Metrodome in 1999. This sample was collected as part of a teaching exercise designed to give students exposure to survey techniques and CVM. The sample is not random, and hence the results are presented only for comparison to the perfectly random sample used in the body of the paper. The *WTP* estimates obtained from this sample may be viewed as an upper bound on the *WTP* of the average person. Fans were interviewed before the Monday night Tampa Bay–Vikings game. At the time, the Vikings were undefeated in the regular season with a record of 5-0. Prior to the on-site interviews, various pretest bid amounts were determined by surveying students at the University of St. Thomas. In particular, bid amounts ranging from $1 to $5 were tested. Due to a high positive response rate in these pretests and the fact that the per capita income of fully employed fans exceeds that of college students, the bid amounts on the on-site surveys were raised to $50 to $500. Each survey contained a specific amount rather than a range of values in order to avoid starting point bias.

The on-site survey comprises 30 questions and is divided into three sections. The first section deals with games viewed and fan interest questions. The second section outlines a payment scenario and solicits payment amounts using a yes/no format in response to a specific amount. The last section of the survey solicits ticket pricing, parking, and demographic information.

The first seven questions pertain to past, present, and future viewing of games at the Metrodome and on television. Of the 209 respondents, 43% claimed to have attended or planned to attend 7 to 10 games in the present season. Thirty-seven percent claimed to have attended 7 to 10 games at the Metrodome in the previous year. Approximately 50% of the respondents watched more than 10 games on television in both the present year and in the previous year. About 47% of the respondents plan to watch more than 10 games on television next year.

The next few questions pertain to fan interest and indirect measures of the public-good aspects of the Minnesota Vikings. Fifty-three percent of the respondents claim to read about Viking football on a daily basis, either in the paper, in magazines, or online. Almost 60% of those surveyed discuss the Vikings' fortunes with friends, co-workers, or family members on a daily basis. Seventy-six percent of the respondents describe themselves as die-hard or casual fans who follow the Vikings closely. About 60% of the respondents felt that in the absence of Vikings' football their level of fun would decrease considerably.

The next section elicits the willingness to pay (*WTP*) for a new stadium. It quotes the Vikings' Website for the total cost of a new stadium, which is $350 million to $425 million. The survey goes on to say that private and university economists have estimated the individuals' cost of this stadium to be the amount quoted below. This amount varies from $50 to $500 depending on the survey. The next few questions allow the respondents to explain their reasons for agreeing or disagreeing to finance a new stadium.

Sixty-four percent of the respondents said that they would be willing to pay the amount stated on their survey. Thirty-one percent of the respondents that were willing to pay claimed they would do so because they liked to attend Vikings games. Twelve percent felt that they would pay for a new stadium because having a team in town that may win the Super Bowl would be good for the area. Of the 23% who were not willing to pay for a new stadium, approximately 13% claimed it was because the Vikings' owner, Red McCombs, had enough money. Fifty-three percent of the respondents believed that the Vikings would leave town if they did not get a new stadium in the near future. Seventy-eight percent claimed that a new stadium would bring greater prestige to the area.

The average ticket price paid was approximately $50. On average, respondents planned to spend about $27 on concessions. The average parking fee was $13. Fifty-two percent of the respondents said that they planned to attend an average of 7 to more than 10 games in a new stadium.

The last section solicited demographic data from the respondent. The median household size was three. About 72% of the respondents were male; 93% of the survey participants were white. The average respondent has lived in Minnesota for approximately five years. Forty percent of the survey participants had a college diploma. The average income of respondents was between $45,000 and $59,9999. The modal number of kids that respondents had was 0.

Appendix B: The Empirical Model

$$WTP = f(AMOUNT, GAMES, INCOME, PUBGOOD, PRSTGE, SPEND, NONWHT, COLGRD) \tag{A1}$$

All the variables are defined identically to those in the body of the paper with the exception of *GAMES* and *SPEND*. In this data set, *SPEND* is the amount of money spent by the fan on parking, tickets, and concessions. *GAMES* is the number of games that a fan has attended in the current season.

The results from our probit estimation are reported in Table B1. We use the 1% significance level. We find that the bid amount (*AMOUNT*) is negative and significantly related to the fans' *WTP*. *GAMES*, the number of games (a proxy for the use value of the facility), is a positive and significant contributor to the respondents' *WTP*. The public-good aspects of a team (*PUBGOOD*) is also a positive and significant variable. Nonwhites (*NONWHTS*) have a lower *WTP* than whites, but this variable is not significant. *COLGRD* is negative but insignificant. *PRESTGE* is positive and significant. Interestingly, we find that *SPEND*, the amount spent on tickets, parking, and concessions, is not significantly related to the willingness to pay for a new stadium.

The public-good value to the fans, as indicated by the marginal effect in the fourth column of Table 3, is \$107. The effect of attending one more game increases the fans' *WTP* by about \$27. Nonwhites are willing to pay \$187 less than whites for a new stadium.

The *WTP*, when evaluated at the sample means using the estimated regression coefficients, turns out to be \$312.52. The Metrodome was sold out on the night of the game during which the survey was administered. It has a capacity of 64,121. If we assume that the sample was representative of the general audience, then the total *WTP* of all fans at the Metrodome amounts to about \$20 million. When compared with the *WTP* of the general Minnesotan, it is not surprising to find that the average fan has a substantially larger *WTP*. In closing, we once again stress that the on-site survey was not from a perfectly random sample, and its results provide a benchmark of the upper bound on the *WTP* for the Vikings.

Table B1. WTP Estimates from Stadium Fan Survey

Variable	Regression Coefficient	*t*-Statistic	Marginal Impact on *WTP*
CONSTANT	−0.398635	−0.571526	−\$110.98
AMOUNT	−0.003592	−3.571777	N/A
GAMES	0.099864	2.423514	\$27.80
INCOME	−9.55E-06	−1.573298	\$0.00
PUBGOOD	0.384625	2.950841	\$107.08
NONWHT	−0.672187	−1.387339	−\$187.13
PRESTGE	0.974799	3.484399	\$271.38
SPEND	−0.002334	−0.710849	−\$0.65
COLGRD	−0.401847	−1.57488	−\$111.87

References

Alberini, Anna. 1995. Optimal designs for discrete choice contingent valuation surveys: Single-bound, double-bound and bivariate models. *Journal of Environmental Economics and Management* 28(3):287–306.

Alberini, Anna, and Richard T. Carson. 1993. Efficient threshold values for binary discrete choice contingent valuation surveys and economic experiments. Discussion Paper No. QE 93-14, Resources for the Future, Quality of the Environment Division, Washington, DC.

Alexander, Donald L., William Kern, and Jon Neil. 2000. Valuing the consumption benefits from professional sports franchises and facilities. *Journal of Urban Economics* 48(2):321–37.

Arrow, Kenneth, Robert Solow, Paul R. Portney, Edward E. Leamer, Roy Radner, and Howard Schuman. 1993. Report on the NOAA panel on contingent valuation. *Federal Register* 58:4601–14.

Baade, Robert A., Robert Bauman, and Victor A. Matheson. 2008. Selling the game: Estimating the economic impact of professional sports through taxable sales. *Southern Economic Journal* 74(3):794–810.

Baade, Robert A., and Richard F. Dye. 1990. The impact of stadiums and professional sports on metropolitan area development. *Growth and Change* 12:1–13.

Bera, Anil K., Carlos M. Jarque, and Lung-Fei Lee. 1984. Testing the normality assumption in limited dependent variable models. *International Economic Review* 25(3):563–78.

Boyle, Kevin J., and Richard C. Bishop. 1988. Welfare measurements using contingent valuation: A comparison of techniques. *American Journal of Agricultural Economics* 70(1):20–8.

Cameron, Trudy A. 1988. A new paradigm for valuing non-market goods using referendum data: Maximum likelihood estimation by censored logistic regression. *Journal of Environmental Economics and Management* 15:355–79.

Cameron, Trudy A., and Daniel D. Huppert. 1991. Referendum contingent valuation estimates: Sensitivity to the assignment of offered values. *Journal of the American Statistical Association* 86:910–8.

Carson, Richard T., Theodore Groves, and Mark J. Machina. 2000. Incentive and informational properties of preference questions. Working paper, University of California San Diego.

Cesario, Frank J. 1976. Value of time and recreation benefit studies. *Land Economics* 52(1):2–41.

Cesario, Frank J., and Jack L. Knetsch. 1970. Time bias in recreation benefits estimates. *Water Resources Research* 6(3):700–4.

Cooper, Joseph C. 1993. Optimal bid selection for dichotomous choice contingent valuation surveys. *Journal of Environmental Economics and Management* 24:25–40.

Creel, Michael, and John Loomis. 1997. Semi-nonparametric distribution-free dichotomous choice contingent valuation. *Journal of Environmental Economics and Management* 15:341–58.

Cummings, Ronald G., and Laura O. Taylor. 1999. Unbiased value estimates for environmental goods: A cheap talk design for the contingent valuation method. *American Economic Review* 89:649–65.

Diamond, Peter A., and Jerry A. Hausman. 1994. Is some number better than no number? *Journal of Economic Perspectives* 8:45–64.

Dillman, Don. 1978. *Mail and telephone surveys: The total design method.* New York: Wiley.

Duffield, John W., and David A. Patterson. 1991. Inference and optimal design for a welfare measure in dichotomous choice contingent valuation. *Land Economics* 67:225–39.

Eom, Young Sook. 1994. Pesticide residue risk and food safety valuation: A random utility approach. *American Journal of Agricultural Economics* 76:760–71.

Freeman, Myrick III. 1993. *The measurement of environmental and resource values: Theory and methods.* Washington, DC: Resources for the Future.

Hanemann, W. Michael. 1984a. Discrete/continuous models of consumer demand. *Econometrica* 52(3):541–61.

Hanemann, W. Michael. 1984b. Welfare evaluations in contingent valuation experiments with discrete responses. *American Journal of Agricultural Economics* 66(3):332–41.

Hanemann, W. Michael. 1994. Valuing the environment through contingent valuation. *Journal of Economic Perspectives* 8(4):19–44.

Hanemann, W. Michael, and Barbara Kanninen. 1998. The statistical analysis of discrete-response CV data. CUDARE Working Paper No. 798.

Johnson, Bruce K., Peter A. Groothius, and John C. Whitehead. 2001. The value of public goods generated by a major league sports team: The CVM approach. *Journal of Sports Economics* 2(1):6–21.

Johnson, Bruce, Michael J. Mondello, and John C. Whitehead. 2006. Contingent valuation of sports: Temporal embedding and ordering effects. *Journal of Sports Economics* 7(3):267–88.

Johnson, Bruce, Michael J. Mondello, and John C. Whitehead. 2007. The value of public goods generated by a National Football League team. *Journal of Sport Management* 21(1):123–36.

Johnson, Bruce K., and John C. Whitehead. 2000. Value of public goods from sports stadiums: The CVM approach. *Contemporary Economic Policy* 18(1):48–58.

Kahneman, Daniel, and Jack L. Knetsch. 1992. Valuing public goods: The purchase of moral satisfaction. *Journal of Environmental Economics and Management* 22(1):57–70.

Kanninen, Barbara. 1993a. Design of sequential experiments for contingent valuation studies. *Journal of Environmental Economics and Management* 25:1–11.

Kanninen, Barbara. 1993b. Optimal experimental design for double-bounded dichotomous choice contingent valuation. *Land Economics* 69(2):138–46.

Knetsch, Jack L. 1963. Outdoor recreation demands and benefits. *Land Economics* 39(4):387–96.

McConnell, Kenneth E., and Ivan E. Strand. 1981. Measuring the cost of time in recreation demand analysis: An application to sport fishing. *American Journal of Agricultural Economics* 63(1):153–6.

Mitchell, Robert Cameron, and Richard T. Carson. 1989. *Using surveys to value public goods: The contingent valuation method*. Washington, DC: Resources for the Future.

Noll, Roger G., and Andrew Zimbalist, eds. 1997. *Sports, jobs and taxes: The economic impact of sports teams and stadiums*. Washington, DC: Brookings Institution.

Nyquist, Hans. 1992. Optimal designs of discrete response experiments in contingent valuation studies. *Review of Economics and Statistics* 74(3):559–63.

Ott, S., C. Huang, and S. Misra. 1991. Consumers' perceptions of risks from pesticide residues and demand for certification of residue-free produce. In *Economics of food safety*, edited by Julie A. Caswell. New York: Elsevier Science, pp. 171–88.

Rappaport, Jordan, and Chad Wilkerson. 2001. What are the benefits of hosting a major league sports franchise? *Federal Reserve Bank of Kansas City Economic Review* 86(1):55–86.

Sanderson, Allen. 2000. In defense of new sports stadiums, ballparks and arenas. *Marquette Sports Law Journal* 10(2):173–92.

Scott, A. D. 1965. The valuation of game resources: Some theoretical aspects. *Canadian Fisheries Reports* 4:27–47.

Siegfried, John, and Andrew Zimbalist. 2000. The economics of sports facilities and their communities. *Journal of Economic Perspectives* 14(3):95–114.

Smith, V. Kerry, and William H. Desvousges. 1990. Risk communication and the value of information: Radon as a case study. *Review of Economics and Statistics* 72:137–42.

Stevens, Thomas H., Nichole E. DeCoteau, and Cleve E. Willis. 1997. Sensitivity of contingent valuation to alternative payment schedules. *Land Economics* 73(1):140–8.

Stumborg, B. E., K. A. Baerenklau, and R. C. Bishop. 2001. Nonpoint source pollution and present values: A contingent valuation study of Lake Mendota. *Review of Agricultural Economics* 23(1):120–32.