

Estimating Local Welfare Generated by a Professional Sports Team: An Application to the
Minnesota Vikings under Threat of Relocation

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Abstract: The issue of public financing for a professional sports team is one that has seen vigorous debate in the state of Minnesota. This study offers the opportunity to examine the welfare contribution of the Minnesota Vikings to Minnesota households in the context of a credible threat to team relocation. We find the credibility 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. Our study suggests a 95% confidence interval on the welfare contribution of the Vikings to households in Minnesota is \$435.4 million to \$1,499.1 million.

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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 Minnesota North Stars (a National Hockey League team that relocated to Dallas), and the recent relocation 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 the previous owner Red McCombs had the team up for sale. In April of 2003, the former owner of the Vikings, Red McCombs stated (in a speech to a country club audience near Fort Worth, Texas) that he had turned down two offers to sell the team because he believed that the offers were too low. He went on to say that he would definitely sell the team if he got his asking price. 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. We undertake an analysis of the determinants of credibility and WTP under threat of relocation. This is a 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 be sold and relocated. We contrast these findings with those of respondents that do not believe that the team will relocate. The estimates help us to shed some

¹ Taken from the Minnesota Vikings Official Team Web Site (<http://www.vikings.com/Stadium/>)

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

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 for 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 in town are boosting the local economy and a heightened sense of civic pride. (Siegfried and Zimbalist, 2000). The majority of studies (Baade et al., 2008), (Rappaport and Wilkerson, 2001), (Baade and Dye, 1990), (Noll and Zimbalist, 1997) etc. suggest that stadiums do not generate enough increases 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 et al, 2000). However, for teams that have sell out seasons, not all fans may be able to attend games. Moreover NFL games for teams that sell out demonstrate public good characteristics. These games are aired on television and thus the performances are non-rival and non-excludable for the local television audience. An analogous surplus may exist for fans that watch the games on television. The issue comes down to the value of the public good aspects of the franchise to the citizens of the area. Most studies in the literature (Siegfried and Zimbalist, 2000), (Baade and Dye, 1990), (Noll and Zimbalist, 1997) and (Sanderson, 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 etc. need to be valued. However, as is the case with all public goods direct market valuation is not possible. Proponents of CVM

including Michael Hanneman, (Hanneman, 1994) and Kenneth Arrow, (Arrow, 1993) claim that if the methodology is properly applied, the results from CVM surveys can be trusted.

Johnson, Mondello and Whitehead have examined the WTP for a stadium in the context of keeping the Jacksonville Jaguars in Jacksonville. (Johnson et al, 2007). They find that the WTP estimates of \$36.5 million lies far below the subsidies paid to attract the Jaguars. Johnson, Groothius and Whitehead investigate the positive externalities associated with building a new hockey arena for the Pittsburgh Penguins (Johnson et al., 2001). They use CVM and model the respondents' WTP as a function of the suggested tax, 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.

Unfortunately, Johnson et al conducted their survey in the year 2000 after a consortium of investors had bought the team in 1999 and the credible threat of relocation or contraction had passed. Finally, 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 upwards, out of season surveys (although they are free from current team performance) may represent a lower WTP because the respondent is 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 the Appendix) 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 (Johnson and Whitehead, 2000). 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 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 the 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 TV. Finally, the scope of this survey is much larger than previous studies with about half of the surveys being sent to non-metropolitan households.

We will 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 will proceed to a description of the CVM methodology and the “naïve” empirical model not treating the uncertainty in team relocation. Next, we will 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 respondent’s credibility beliefs. Finally, we will empirically estimate our revised RUM model with prior determined relocation beliefs and develop our conclusions from this study. The appendix contains a description and analysis

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

of a dataset gathered by onsite interviews with Vikings fans outside the stadium. These results are provided for comparison.

Credible Threat of relocation and WTP

One of the biggest criticisms of CV 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 CV methodological issue faced by all practitioners of CVM. In our survey over 50% of the respondents' state that they believe the Vikings would move if they 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 CV surveys where timing is critical as well as modeling 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 NOAA panel. (NOAA, 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 intend them to (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 Minnesota North Stars to Dallas, and the moves of other National Football League Teams from Cleveland to Baltimore and 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 et al point out that unless the survey matters to the individual and he/she believes that their response matters there is no way to consider the survey question “consequential” (Carson et al., 2000). Our ideas are perhaps closer to theirs 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 on 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 (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 than say the responses of the fans of the Pittsburgh Penguins who answered their questionnaire shortly after the team had been sold and 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 also address the issue of “realism” in a CV survey. They state that CV 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 they 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. These essential ideas have been incorporated by CV practitioners. The gist is basically that if the payment scenario and the suggested results of non-payment by the respondents are not believable then the results of the survey are not worth much. We will estimate separate samples for believers and non-believers and contrast the estimates in the results section of this paper.

Survey Methodology and Sample Characteristics

A random sample of fourteen hundred households was purchased from a professional sampling firm. The socio-economic 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 sub-sample (which we call the pre-sample) of two hundred households with a fifty-fifty 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 twelve hundred surveys were then mailed. Forty-six of the surveys were undeliverable. Five hundred and sixty-five surveys were returned. The response rate was forty

two percent. Johnson et al. had a response rate of about thirty six percent based on a smaller sample size of two hundred and ninety three mail surveys.

Table 1 summarizes the descriptive statistics of the key variables. This section will address some of the additional details about the data. The survey is available upon request. It is comprised of thirty-three 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 piece 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 respondents' home, and the number of Minnesota sports teams that the respondent follows. The average number of games attended by respondents was 0.33. However, the average number of games watched on TV was 8.2. The median number of games watched on TV 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 thirteen percent 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 thirty-five percent when we add in the respondents who felt that in the absence of the Vikings the level of fun would fall 'slightly' to those who felt that their level of fun would 'fall a great deal'.

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 \$450 - \$500 million. It 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 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 percent agreed to pay for a new stadium and 50.8 percent agreed to pay at the \$15 level. At the \$25 level, 50.0 percent agreed to pay and finally at the \$100 level 33.33 percent were willing to pay that amount. On the whole, at all bid amounts twenty-five percent of the respondents that were willing to pay claimed that they would do so because they either liked to attend Vikings games or watch them on TV. The other seventy five percent claimed that they would be willing to pay for other reasons.

The last section solicited demographic data from the respondent. About seventy-three percent of the respondents were male. Nineteen percent of the respondents were single. Ninety-three percent of the survey participants were White. Eighty two percent of the respondents have lived in Minnesota for twenty or more years. Fifty one percent of the survey participants had some college and/or graduate school education. The average annual income was about fifty-seven thousand Dollars.

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:

⁴ Lower bid amounts ranging from \$1 to \$5 demonstrated a very high acceptance rate during pre-testing of the survey.

"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:

$$R_i = \begin{cases} \text{Yes} & WTP_i \geq B_i \\ \text{No} & \text{otherwise} \end{cases} \quad (1)$$

where R_i is respondent i 's response to the contingent question, WTP_i is the respondent's willingness-to-pay for the stadium and B_i is the bid level put forth by the interviewer to this particular respondent. Subscripting the bid amount with an i allows us to offer different bids to various respondents⁵.

Another issue that we must resolve in this investigation is the specification of the bid levels. Bid design has received much attention in the CV literature (Alberini 1995b, Alberini and Carson 1993, Cameron and Huppert 1991, Cooper 1993, Duffield and Patterson 1991, Kanninen 1993a, 1993b, Nyquist 1992). 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

⁵ There is a strand in the CV literature exploring the timing of payments. Johnson et al address this question in their forthcoming paper in the *Journal of Sports Economics*. (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 *et al* (1997) as well as Stumborg *et al* (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, this is the design we have adopted in this investigation.

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 posited to students on a campus near Minneapolis and Vikings fans on gameday outside the stadium (intercept and in-person interviews). The interviews at the stadium included bid amounts of \$500 (see the Appendix). Using these results as prior information, we formulated statistically optimal bid levels (i.e., the bid levels that generate the most precise estimate of mean WTP). For the next iteration, we conducted a pre-test of Minnesota residents. Upon receiving the results of this pre-test, 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 CV 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 performance of the Turnbull nonparametric technique. Later, we reconsider the bid design after controlling for relocation credibility beliefs.

The Naïve Empirical Model - Ignoring Relocation Uncertainty

This section will list and explain the determinants of the WTP for a new Vikings stadium.

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

The dependent variable WTP takes on the value of one if the fan responds with a ‘yes’ to the bid amount on their survey and a value of zero 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 respondents 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 TV (SPEND), the belief that a new stadium will help the team win a Superbowl (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 or \$15 or \$25 or \$100 on their particular survey. The respondent then answered ‘yes’ or ‘no’ as to whether they would pay the particular bid amount on their survey. The overall ‘yes’ response rate is forty-seven percent. This suggests that the above 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 one if the survey respondent answered ‘daily’ or ‘weekly’ when asked about how often they read about the Vikings in newspapers, magazines or online. DISCUSS was coded as one if the respondent claimed that they discussed the team’s fortunes with friends, family or co-workers on a daily or weekly basis. It was coded as zero otherwise. INTEREST was coded as one if the respondent claimed to be a die-hard fan. It was coded as zero otherwise. FUN measures the change in the quality of life of the respondent if the

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

Vikings were to leave town. If the respondent answered ‘fall slightly’ or ‘fall a great,’ deal this variable was coded as one. It was coded as zero otherwise.

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

$$\text{SPEND} = \text{EXPLICIT COSTS} + \text{IMPLICIT COSTS} \quad (3)$$

where EXPLICIT COSTS are the Dollars spent on tickets for the total number of games that the respondent attends plus the value of team merchandize that the respondent purchases. IMPLICIT COSTS are the travel costs (in terms of foregone wages) of attending games or the opportunity costs (again in terms of foregone wages) of watching games on TV. 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 cost of watching games on TV. Implicit costs of attending stadium games(ICSG) and are given specifically by equation (4).

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

The hourly wage proxy is discounted by a factor of one-third in keeping with the recreation demand literature⁷. The hourly wage proxy itself is calculated by dividing the respondent’s annual income by the number of working hours in the year by assuming a forty-hour work-week. 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

⁷ There is a long strand of literature concerning the appropriate opportunity cost of time in recreational valuation studies. Seminal work 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 1/3 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 1/3 the wage rate.

average NFL game is assumed to be three and a half hours. Implicit costs of watching games on TV (ICTV) are calculated along the same lines as ICSG. This is described by equation (5).

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

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 one if the respondent believes that a new stadium will “bring greater prestige to the Twin Cities area”. LEAVE is a dummy variable coded as one 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 one if the respondent believes that a new stadium will “help the Vikings win the superbowl”. TWINS is a dummy variable that is coded as one if the respondent chose the Twins when they indicated that they would not pay for a Viking’s stadium because they would rather pay for a Twins stadium instead. UOFM is a dummy variable that is coded as one if the respondent indicated that they 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 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 title Model 2.

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 et al's 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 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 Superbowl.

Approximately forty-seven percent of the respondents who were willing to pay for a new

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 *et al* (1984). The results of the test suggest that we fail to reject the null hypothesis that the residuals are normally distributed.

stadium indicated that they would do so because of the possibility of a joint stadium with the University of Minnesota football team. The two teams currently play in the same facility.

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 (Cameron, 1988). The public good value to Minnesotans, as indicated by the marginal effect in the fourth column of Table 2 is approximately 41 Dollars. The sum of the marginal effects of team relocation, added prestige from a new stadium and a better chance at winning the Superbowl increase the respondents WTP by about two 219 Dollars. 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 Dollars. The possibility of a joint stadium with the University of Minnesota football team had a positive and significant effect. It boosted WTP by \$123.01.

Approximately five percent 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.

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 TV. The results of this third model are contained in Table 3 under the heading Model 3. Once again the results remain more or less the same as models 1 and 2.

Credible Threat of Viking Relocation and the CVM

If the respondent does not perceive the Vikings re-location as a credible threat, are they valuing the Vikings? Johnson and Whitehead (2000) perform a valuation study for sports stadiums using a CV format. They proposed to value a new basketball arena for the University of Kentucky. As the University of Kentucky would not re-locate if a new stadium fails to be approved, Johnson and Whitehead (2000) point out that their CV study may not be interpreted as a valuation of the University of Kentucky basketball program in Lexington, KY. Analogously in our survey provided the respondent does not believe the Vikings will move from Minnesota without a new stadium, the respondent is not necessarily valuing the Vikings franchise in our CV 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 that perceive the Vikings will leave without a new stadium. To examine how the individuals who felt the Vikings will relocate without a new stadium, 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 6. Again, 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.

PUBGOOD, WINSUPER and TWINS are statistically significant in the credible subsample and pooled sample but not in the non-credible subsample. SPEND and PRESTGE are statistically significant in the non-credible 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 non-credible 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 CV 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 non-credible 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 argued above that a negative WTP is theoretically plausible. The low acceptance rate of our CV 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 required negative bid amounts¹⁰. We are not aware of a published CV 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 non-credible subsample is not critical to our stated purpose of valuing the Minnesota Vikings franchise. It is not clear that individuals that 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 CV 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 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 towards the Vikings.

Modeling the Respondent's Decision-Making Problem with Heterogeneous Credibility Beliefs

As noted in the preceding section, CVM studies present a contingent scenario and ask the respondent's willingness to contribute at a specified bid to guarantee a specific outcome. In our case, we ask respondents for their willingness to contribute to construct 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 respondent’s decision-making mechanism given their perception of the likelihood the Vikings would relocate without a new stadium¹. 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, 1984b), Smith and Desvousges (1990), Ott et al (1991), and Eom (1994). In these studies, the researcher’s 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 individuals belief regarding relocation, which we call θ_i , the individual’s expected utility from answering our CVM question with a ‘no’ is:

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

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 non-stochastic portion of his or her indirect utility function), M_i is individual i ’s income, 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 re-locate outside of Minnesota. We assume the noise

terms $\varepsilon_{00i}, \varepsilon_{01i}$ are normally distributed. The subscripts ‘00’ reflect that no stadium was constructed and the Vikings relocated. The subscripts ‘01’ reflect that no stadium was constructed while the Vikings remained in Minneapolis. Notice that the terms $\varepsilon_{00i}, \varepsilon_{01i}$ 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 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 CV 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 $1 - \theta_i$.

Consistent 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:

$$\Pr[\varepsilon_{11i} - \theta_i \varepsilon_{00i} - (1 - \theta_i) \varepsilon_{01i} > \theta_i V(M_i, S_0, K_0) + (1 - \theta_i) V(M_i, S_0, K_1) - V(M_i - B_i, S_1, K_1)]$$

(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 zero mean normal processes for each individual. For convenience, we assume

$$\sigma_\varepsilon^2 \equiv \text{Var}(\varepsilon_{11i}) = \text{Var}(\varepsilon_{01i}) = \text{Var}(\varepsilon_{00i}) \quad \text{and} \quad \psi \equiv \text{Cov}(\varepsilon_{11i}, \varepsilon_{00i}) = \text{Cov}(\varepsilon_{11i}, \varepsilon_{01i}) = \text{Cov}(\varepsilon_{01i}, \varepsilon_{00i}).$$

This allows us to write:

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

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 statistical 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

$$V(M, S, K) = \alpha + \alpha_M M + \alpha_S S + \alpha_K K. \quad \text{Given the respondent answers the CV question with a}$$

'yes,' our model suggests the nonstochastic indirect utility is

$$V(M_i - B_i, 1, 1) = \alpha + \alpha_M (M_i - B_i) + \alpha_S + \alpha_K. \quad \text{The agent's expected indirect utility with a 'no'}$$

response is $E[V_i | y_i = 0] = \alpha + \alpha_M M_i + (1 - \theta_i) \alpha_K$. Notice that observing respondent's 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 zero and solving for $B_i = 0$ 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. This is $P_C = \frac{\alpha_S}{\alpha_M}$.

Provided the respondent is convinced the Vikings will leave without a new stadium, our CV 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 zero and solving for the bid amount. This produces $P'_C = \frac{\alpha_S + \alpha_K}{\alpha_M}$. Calculating the difference $P'_C - P_C$ identifies the value attributable solely to the Vikings franchise. Formally, this is $\frac{\alpha_K}{\alpha_M}$.

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 a several important ways. First, while many other studies exist seeking to measure the value of a franchise, most other studies 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.

Modeling the Respondent's Credibility Belief

In the survey, we asked the respondent 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 their socio-demographic characteristics. Using these nonstochastic socio-demographic variables we model this response according to:

$$\Pr(L_i = 1) = \Pr(\gamma'x_i + \varepsilon_i > 0) = \Pr(\varepsilon_i > -\gamma'x_i) = 1 - \Phi(-\gamma'x_i) \quad (9)$$

given ε_i is distributed standard normal, L_i takes on the value of 1 if the respondent views the Vikings 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 7 below. As the table indicates, WINSUPER, TWINS, NONWHT, COLGRD, INCOME, SINGLE, and MALE are not statistically significant at the 5% level. Eliminating these variables and re-estimating the model produces the results indicated in table 8.

Given $1 - \Phi(-\hat{\gamma}'x_i) > 0.5$ and $L_i = 1$ we score a correct prediction for the model. Also, when $1 - \Phi(-\hat{\gamma}'x_i) \leq 0.5$ and $L_i = 0$ we score a correct prediction for the model. Using this criterion for the observed sample and fitted model results in accurately predicting the respondent's belief 78.23% of the time. One concern regarding our survey responses is the relatively uniform bid acceptance rate across bid levels. This information is presented in table 4. Theory would suggest that as the bid level increases, respondent 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 re-examine this bid acceptance rate controlling for the predicted credibility belief. This information is presented in table 12. Across the columns of table 12, we report the respondents' credibility beliefs in 5 categories. These categories are those that 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 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 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 do observe the behavior we find consistent with economic theory. That is, the bid acceptance rate declines as the bid level increases. This suggests that controlling for the respondents credibility of relocation is important to understanding how the respondent 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.

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) above. Using our prior estimator $\hat{\theta}_i = 1 - \Phi(-\gamma'x_i)$, our log-likelihood function becomes:

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

where $d_i = \frac{\alpha_M B_i - \alpha_S - \hat{\theta}_i \alpha_K}{\sqrt{2(\sigma_\varepsilon^2 - \psi)(1 - \hat{\theta}_i + \hat{\theta}_i^2)}}$. Estimation results are presented in table 9. Notice 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 respondent's willingness to contribute to the stadium initiative and the bid level, consider figure 1 below. 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 Vikings credibility of relocating is 43.2%, the estimated household welfare value falls to zero. Notice that 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 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, the 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 excessive preponderance of including or excluding football fans. Further, the variable FUN was gathered from the respondent by gauging how they felt their quality of life would be impacted by the Vikings moving. Those that 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 13.81% of respondents indicated their quality of life would ‘fall slightly’ or ‘fall a great deal.’ The variable INTEREST was coded as a 1 if the respondent indicated they were a ‘diehard fan’ and a 0 otherwise. Summary statistics reveal that 13.98% of respondents classified themselves as ‘diehard 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

$$\frac{\hat{\alpha}_K}{\hat{\alpha}_M} = \frac{4.2260}{0.0082} = \$515.37. \text{ii}$$

Interestingly, our model estimates suggest the average household

welfare Minnesotans associate with a new stadium is $\frac{\hat{\alpha}_S}{\hat{\alpha}_M} = \frac{-1.8258}{0.0082} = -\222.66 . Average

household welfare for the stadium and the Vikings is \$292.71. Aggregating across Minnesota households suggest the Vikings franchise in Minneapolis provides \$756.6M in welfare to Minnesota residents. However, construction of a stadium for the Vikings would harm Minnesota welfare by \$332.0M. This suggests a net welfare contribution of the Vikings playing in a new stadium of \$321.5M. 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 into 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 we based on our observed sample we are 95% confident the true welfare Minnesotans associate with the Vikings franchise being located in Minnesota is between \$435.4M and \$1,499.1M. The average welfare value for the Vikings alone is \$756.6M. The 95% confidence interval for the welfare contributions of a new stadium are between -\$706.8M and -\$169.1M. The average welfare value associated with a new stadium for the Vikings is -\$322.0M. The 95% confidence interval for welfare Minnesotans associate with the Vikings franchise and a new stadium is \$198.4M and \$600.9M. The average welfare associated with combining a new stadium and the Vikings is \$321.5M.

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 downwards. The previous models that ignored the respondent's belief regarding relocation resulted in a significantly smaller estimate. The result in this paper 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 a vis the credibility of relocation.

The estimation results do seem to mesh well with the observed sample. The estimated model accurately predicts the respondent's answer to the CVM question (78.41% of respondent's 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, pure Viking's 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 respondent's decision making mechanism suggests we can do this. Again, as the results reported above illustrate, the typical household associates a welfare value of \$571.60 with the Vikings. Given the 1,323,569 households in Minnesota with a typical value of \$571.60 for the Vikings, we estimate an aggregate \$756,552,040 welfare value for the Vikings franchise from Minnesotans (a 95% confidence interval of \$435.4M and \$1,499.1M). However, this does not suggest 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 policymakers 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.

TABLE 1

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, merchandize 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 Superbowl"	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 Non-White	0.07	0.26	1	0
COLGRD	1 if College or Grad School education	0.51	0.50	1	0
INCOME	Annual Income	56766.24	27781.22	100000	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 twenty 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					

TABLE 2**MODEL 1**

Variable	Regression Coefficient	t-stat	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		

TABLE 3

Variable	MODEL2*	MODEL3*
CONSTANT	-1.55146 (-4.9)	-1.72193 (-5.4)
AMOUNT	-0.00728 (-3.8)	-0.00737 (-3.8)
PUBGOOD	0.289945 (4.46)	0.284453 (4.11)
SPEND	0.000655 (2.06)	—
GAMES	—	0.028394 (1.89)
PRESTGE	0.624588 (4.39)	0.652453 (4.57)
WINSUPER	0.552912 (2.05)	0.574229 (2.12)
LEAVE	0.38508 (2.72)	0.370588 (2.61)
TWINS	0.254433 (0.92)	0.273571 (0.98)
UOFM	0.857795 (6.14)	0.812788 (5.80)
NONWHT	-0.00401 (-0.0)	0.062398 (0.19)
COLGRD	0.193554 (1.31)	0.213567 (1.45)
INCOME	-1.7E-06 (-0.5)	1.62E-06 (0.61)
SINGLE	-0.00299 (-0.0)	0.015113 (0.07)
MALE	0.106783 (0.64)	0.086341 (0.51)
KIDS	-0.02915 (-0.6)	-0.02684 (-0.6)
TIMINST	-0.02404 (-0.1)	-0.06338 (-0.3)
URBAN	0.032204 (0.23)	0.03184 (0.22)
Log-likelihood	-229.225	-229.616

* t-stats are in parentheses

TABLE 4**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 5
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 (-1.983)	NA (-3.813)	NA (-3.731)
CONSTANT	-339.61 (-4.045)	-122.10 (-2.734)	-228.23 (-5.033)
PUBGOOD	25.83 (1.414)	37.30 (4.247)	41.15 (4.489)
SPEND	0.31 (2.78)	0.02 (0.435)	0.10 (2.169)
PRESTGE	123.14 (3.32)	48.16 (2.433)	83.90 (4.175)
WINSUPER	127.22 (1.46)	63.83 (1.875)	79.85 (2.111)
LEAVE	89.00 (2.344)	33.76 (1.702)	55.51 (2.769)
TWINS	17.93 (0.359)	57.65 (2.589)	48.20 (1.970)
UOFM	154.61 (4.243)	86.43 (4.562)	123.01 (6.294)
NONWHT	142.41 (1.359)	-19.55 (0.522)	10.25 (0.227)
COLGRD	58.27 (1.51)	9.66 (0.49)	27.52 (1.347)
INCOME	0.00 (1.52)	0.00 (0.091)	0.00 (0.584)
SINGLE	-24.58 (0.457)	23.55 (0.93)	3.48 (0.128)
MALE	48.20 (1.166)	-4.69 (-0.203)	13.89 (0.598)
KIDS	-9.12 (-0.867)	2.98 (0.506)	-3.80 (-0.648)
TIMINST	52.69 (0.931)	-31.86 (-1.244)	-0.55 (-0.021)
URBAN	---	---	-1.23 (-0.062)
Log-Likelihood	-100.983	-118.816	-227.839

TABLE 6
MARGINAL IMPACT ESTIMATES IN DOLLARS BY VARIABLE
FOR CREDIBLE, NON-CREDIBLE AND POOLED SAMPLES

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

Table 7: Modeling the credibility of the Vikings relocation

Variable	Coefficient	t-stat
Constant	-1.46	-4.75
Public Good	0.30	4.82
Spend	0.00066	2.21
Prestige	0.77	5.68
Win SuperBowl	0.09	-0.42
Twins	-0.24	-1.38
Univ. of Minn	0.88	6.47
NonWhite	-0.11	-0.36
College Grad	0.14	0.97
Income	-0.00	-0.59
Single	-0.08	-0.42
Male	0.09	0.57
Number of Kids	-0.05	-1.27
Time in Minn>20	-0.07	-0.39
Urban	0.07	0.51

Table 8: Modeling the credibility of the Vikings relocating

Variable	Coefficient	t-stat
Constant	-1.6696	-11.8622
Past Spending	0.0006622	2.6984
Prestige	0.7767	5.7773
Univ of MN	0.8836	6.5430
Read	0.5715	2.9050
Discuss	0.5803	3.0049
Interest	0.8084	3.6465
Fun	1.5157	5.7724

Table 9: Random Utility Model

Variable	Coefficient	t-stat
Constant	0.0992	0.097
New Stadium	-1.8258	-10.390
Vikings	4.2260	14.530
Income	0.0082	3.580

Table 10: Distribution characteristics for valuation estimates by household

Variable	2.5% Percentile	Mean	97.5% Percentile
Vikings Value	\$328.93202	\$571.60241	\$1,132.6259
New Stadium Value	-\$534.00964	-\$250.87082	-\$127.78501
α_M	0.0037052801	0.0081854262	0.012671600

Table 11: Aggregate Minnesota distribution characteristics for valuation estimates

Variable	2.5% Percentile	Mean	97.5% Percentile
Vikings Value	\$435.4M	\$756.6M	\$1,499.1M
New Stadium Value	-\$706.8M	-\$332.0M	-\$169.1M
Team & Stadium Composite	\$198.4M	\$321.5M	\$600.9M

Table 12: 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% n=41	40.00% n=15	61.54% n=26	88.24% n=17	90.32% n=31
15	8.82% n=34	43.75% n=16	58.82% n=17	60.87% n=23	90.00% n=30
25	10.42% n=48	36.36% n=22	69.57% n=23	90.91% n=11	88.10% n=42
37.2	0% n=22	0% n=2	66.67% n=3	100% n=2	0% n=2
100	7.69% n=52	16.67% n=18	45.83% n=24	40% n=15	75.86% n=29

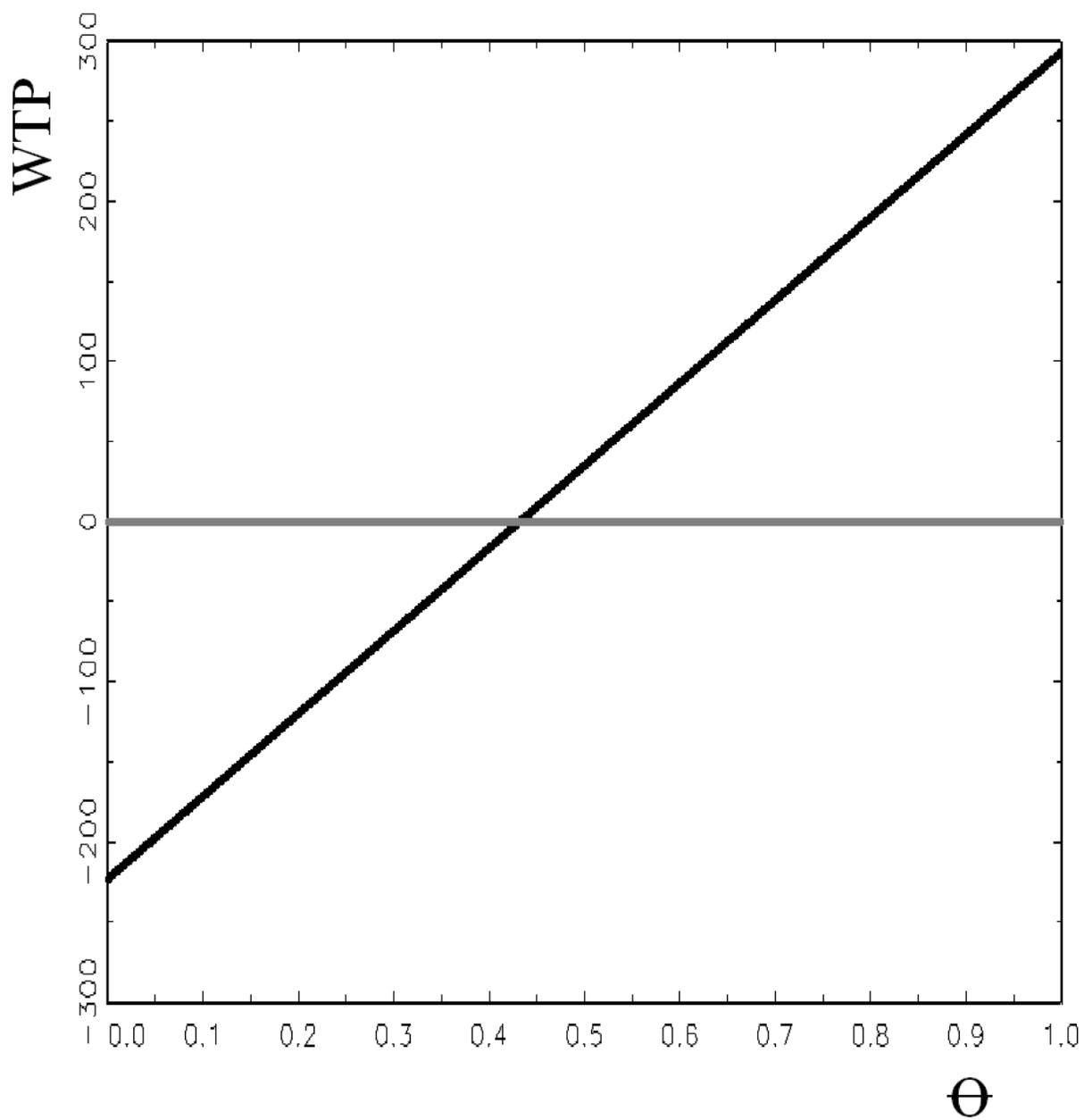


Figure 1: Predicted household welfare value of the Vikings and credibility belief

APPENDIX

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 Vikings-Tampa Bay game. At the time, the Vikings were undefeated in the regular season with a record of 5 and 0. Prior to the on-site interviews various pre-test 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 pre-tests 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 - \$500. Each survey contained a specific amount rather than a range of values in order to avoid starting point bias.

The on-site survey is comprised of thirty 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 piece 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 seven to ten games in the present season. 37% claimed to have attended seven to ten

games at the Metrodome in the previous year. Approximately 50% of the respondents watched more than ten games on television in both the present year and in the previous year. About 47% of the respondents plan to watch more than ten 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. 53% 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. 76% of the respondents describe themselves as die-hard or casual fans that 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 - \$425 million. It 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 respondent to explain their reasons for agreeing or disagreeing to finance a new stadium.

64% of the respondents said that they would be willing to pay the amount stated on their survey. 31% of the respondents that were willing to pay claimed they would do so because they liked to attend Vikings games. 12 % felt that they would pay for a new stadium because having a team in town that may win the Superbowl would be good for the area. Of the 23% that were not willing to pay for a new stadium approximately 13% claimed it was because the Vikings' owner, Red McCombs, had enough money. 53% of the respondents believed that the Vikings

would leave town if they did not get a new stadium in the near future. 78% 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. 52% of the respondents said that they planned to attend an average of seven to more than ten games in a new stadium.

The last section solicited demographic data from the respondent. The median household size was 3. 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. 40% of the survey participants had a college diploma. The average income was between \$45,000 and \$59,999. The modal number of kids was zero.

The Empirical Model:

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

All the variables are defined identically to those in the body of the paper with the exception of GAMES and SPEND. In this dataset, 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.

Empirical Results:

The results from our PROBIT estimation are reported in Table A1. 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 (which is a proxy for the use value of the facility) is a positive and significant contributor to the respondent's WTP. The public good aspects of the a team (PUBGOOD) is also a positive and significant variable. Non-Whites

(NONWHTS) have a lower WTP than Whites but this variable is not significant. COLGRD is negative but insignificant. PRESTGE is positive and significant. Interestingly enough 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. Non-Whites 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. 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 to 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 A1

Variable	Regression Coefficient	t-stat	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

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

ⁱⁱ We use double-hats on our parameter estimates to indicate that these estimates are a function of the prior estimates of Viking relocation credibility.