Contingent Valuation of Sports:
Temporal Embedding and Ordering Effects

BRUCE K. JOHNSON
Centre College

MICHAEL J. MONDELLO
Florida State University

JOHN C. WHITEHEAD
Appalachian State University

Past research measures the nonmarket benefits of sports stadiums and arenas but does not address the issues of temporal embedding or ordering effects. Temporal embedding exists if survey respondents do not differentiate between payment-period lengths and leads to unrealistic implicit discount rates. Multiple scenarios with alternative sports teams can lead to ordering effects that influence the nonmarket value of teams. This study elicits annual payments over different fixed time horizons (e.g., 5 or 10 years) for two teams in a city with a single professional sports team. We find that willingness to pay is sensitive to the length of the payment period. In one of two cases the ordering of the scenario weakly affects willingness to pay.

Keywords: nonmarket benefits of sports; contingent valuation method; temporal embedding; ordering effects

Many state and municipal governments have rushed to build new stadiums and arenas for their professional sports teams despite the lack of market benefits deriving from them (Coates & Humphries, 2000; Noll & Zimbalist, 1997; Siegfried & Zimbalist, 2000). During the 1990s, more than U.S. $6 billion was spent on the construction of new stadiums and arenas (Rappaport & Wilkerson, p. 55), with nearly

$4 billion of additional construction in progress in 2003 (compiled from figures in "Stadiums and arenas under construction," 2002, pp. 48-49). A potential explanation for the continuing flow of subsidies to sports teams is that teams produce nonmarket benefits that are valued highly by the local population (e.g., cultural amenities). When the value of cultural amenities is included in the benefit-cost analysis the total benefits of a new stadium may exceed total costs.

Noll and Zimbalist (1997) suggested that the value of cultural amenities is probably substantial but hard to measure. In an attempt at such measurement, Johnson and Whitehead (2000) employed a contingent valuation method (CVM) survey to estimate the total benefits that would have been generated by a new basketball arena for the University of Kentucky and by a minor league baseball stadium for Lexington, Kentucky. For both projects, they found that construction costs far exceeded the total benefits and that most of the benefits would have accrued to fans attending games. Johnson, Groothuis, and Whitehead (2001) used a CVM survey to value the total benefits generated by a major league professional sports team, the Pittsburgh Penguins. Although they found large total benefits, their value amounted to 25% or less of the cost of a new arena. Fenn and Crooker (2003) found similar results for a new Minnesota Vikings stadium.

The existing studies do not address several issues of importance to the valuation of the cultural amenities generated by sports teams. One issue is the temporal nature of the payment streams. As first defined by Kahneman and Knetsch (1992) temporal embedding exists if survey respondents do not consider the length of payment periods leading to unrealistic implicit discount rates. Most contingent valuation applications, including the sports studies mentioned previously, elicit annual payments in perpetuity assuming the annual budget constrains the annual willingness to pay (WTP). Aggregation over time is then conducted by multiplying annual payments by the time period of the project and applying a market discount rate. The present value of annual WTP is the discounted sum of annual payments.

An alternative is to assume that respondents are constrained by their lifetime wealth and elicit a lump-sum payment or an annual payment over a fixed time horizon (e.g., 10 years). In this case, the respondents would apply their individual rates of time preference to the project and state the present value of WTP. A comparison of the two question formats in the same survey allows estimation of the implicit discount rate used by respondents.

Comparisons of WTP amounts with different payment periods show that respondents answer WTP questions with temporal embedding; i.e., with high implicit discount rates. Kahneman and Knetsch (1992) find that a lump-sum payment and annual payments are not significantly different. Smith (1992) argued that the survey design used by Kahneman and Knetsch is flawed leading to the anomalous result. Stevens, DeCoteau, and Willis (1997) find that the lump-sum payment is larger than the annual payments; however, the implicit discount rates are unreal-

istically high—annual rates between and 50% and 270% for a public good and weekly rates of 20% to 34% for a private good. The current study employed college students, who have higher rates of time preference than other adults, as respondents. Instead of comparing lump-sum and annual payments, Stumborg, Baerenklau, and Bishop (2001) compared WTP with 3-year and 10-year payment periods. Perhaps this is one reason they find a more realistic 40% implicit discount rate. Kim and Haab (2003) find implicit discount rates that range from 20% to 131%.

These studies have been used to question the validity of the CVM. Comparing these results to the implicit discount rates obtained from studies of the demand for appliances with varying energy use reviewed by Loewenstein and Thaler (1989), which range from 25% to 243%, suggests that it is not just consumers in contingent markets who have high implicit discount rates.

Another issue is the effect of alternative sports teams on WTP values. Johnson and Whitehead (2000) valued two teams but do not vary the order of the valuation scenarios ignoring the role that the valuation sequence can play. When the same CVM survey asks for WTP for multiple government policies or public goods in sequence, respondents tend to indicate a lower WTP for the second project (Hoehn & Loomis, 1993). Independent valuation, in effect valuing at the beginning of a sequence, will lead to the largest of the possible WTP estimates. This result is expected for the value of public goods estimated with the CVM because of substitution and income effects (Carson, Flores, & Hanemann, 1998; Hoehn & Randall, 1989).

Boyle, Welsh, and Bishop (1993) argued that respondent experience plays a role in the ordering effects of WTP. In an empirical application the order of the valuation scenarios is influential for respondents who are unfamiliar with the survey topic. Those who have experience with whitewater rafting have better formed WTP values and are not influenced by the ordering of the scenario. Stewart, O'Shea, Donaldson, and Shackley (2002) also find evidence that respondent experience mitigates ordering effects.

The current study considers temporal embedding and ordering effects applied to the contingent valuation of sports. The case study is professional sports in Jacksonville, Florida, a city with only one major league sports team. We develop WTP estimates for keeping the Jacksonville Jaguars, a National Football League team, in Jacksonville and attracting a National Basketball Association team to Jacksonville. In the next section, we describe the CVM survey and the different scenarios. Respondents received different versions of the survey based on the number of years that an annual payment is required and the sequence of the two valuation scenarios. We develop the economic theory and describe tests for temporal embedding and ordering effects. Then we describe the data and how the tests are implemented empirically. The results are then described, and conclusions follow.

THE SURVEY

In April 2002 we sent a CVM survey to a random sample, purchased from a professional sampling firm, of 1,200 households located in Duval County, Florida. The city of Jacksonville and Duval County share a merged government. According to the census of 2000, Duval County contains 72.8% of the population in the Jacksonville metropolitan statistical area (MSA). The U.S. Postal Service returned 69 of the surveys as undeliverable, or 5.75% of the total. Of the 1,131 delivered surveys, 421 produced responses, for a response rate of 37.2%. Because some respondents failed to complete the surveys, particularly the questions about the demographic variables, 367 surveys are usable for this analysis.

We employed several strategies to boost the response rate. First, we mailed a postcard to all survey recipients informing them of the survey and asking them to watch for it in their mail in the next few days. The survey cover letter informed recipients that if they sent back the completed survey postmarked within the next week and if they also included their name and address on a separate piece of paper, they would be eligible for a $100 lottery prize. A week after the survey was mailed out, we mailed a reminder postcard to all recipients. The postage-paid survey return envelopes were coded so that 1 month after the original mailing we could send another copy of the survey to all nonrespondents. We offered another $100 lottery prize for respondents to the follow-up mailing.

As in many CVM surveys, the typical respondent is older than the typical resident. About 73.7% of the Duval population is age 18 years or older and about 19% is age 55 years or older. The average respondent is age 52 years. As in previous sports CVM surveys, men respond disproportionately more often than women, constituting 69% of the sample. Whites make up 67% of the Duval County population but 83% of the sample. The census says the average Duval household contains 2.51 people. The average sample household size is 2.53. Given the relationship between these demographic variables and income, it is not surprising that the self-reported average household income in the sample, about $58,000, exceeded the estimated Duval household income of $52,949. Of the useable sample, 23 respondents did not report income. Income values for these respondents were imputed with the conditional mean from a multivariate regression model predicting income.

The survey presented two contingent valuation scenarios designed to elicit WTP for government policies to (a) ensure that the NFL Jaguars remain in Jacksonville and (2) to attract an NBA team to Jacksonville. One half of the surveys presented the NFL scenario first and the NBA scenario second. The other one half reversed the order of the scenarios.

The football scenario was titled, "Should Jacksonville keep the Jaguars from moving away?" It informed readers that seven times since 1984 NFL teams have moved to new cities. It then asked readers to suppose that within the next decade the

owner of the Jaguars decides to sell the team to someone who wanted to move them to another city. It then said:

> Suppose the city of Jacksonville was able to buy a majority of the team. If the city owned a majority of the team the Jaguars would never have to leave Jacksonville. Large sums of money from Duval County taxpayers would be needed to buy a majority of the team. It has been estimated that it would take annual tax payments of $A for the next T_1 years from each Duval County household to buy a majority of the team. Your total payment would be $A \times T_1$.

The annual tax payments $A and the number of years T_1 varied across the surveys, as explained below.[1]

A dichotomous choice WTP question followed: "Would you be willing to pay the annual tax payments of $A for the next T_1 years out of your own household budget so that the city of Jacksonville could buy a majority of the Jaguars?" A follow-up question asked: "What is the highest annual tax payment you would be willing to pay for the next T_1 years out of your own household budget to keep the Jaguars in Jacksonville?" Response categories are zero, between $0.01 and $4.99, between $5 and $9.99, between $10 and $19.99, between $20 and $39.99, between $40 and $75, and more than $75.

The basketball scenario was titled, "Should Jacksonville try to attract an NBA team?" After informing readers that NBA teams also move to new cities, it asked them to suppose that Jacksonville is able to attract an NBA team at some point in the next decade if Jacksonville upgrades its new arena, currently being built, to NBA standards. It then said:

> Consider the following situation. Large sums of money from Duval County taxpayers would be needed to upgrade the new arena in Jacksonville to NBA standards. It has been estimated that it would take annual tax payments of $A for the next T_2 years from each Duval County household to upgrade the new arena. Your total payment would be $A \times T_2$.

The annual tax payments $A and the number of years T_2 varied across the surveys, as explained below. A dichotomous choice WTP question identical to the first dichotomous choice question followed.

In the football scenario, the annual tax payment could take the values of $5, $10, $20, or $40 per year, and the number of years could take values of 10 or 20 years. In the basketball scenario, the annual tax payment took the same values as those in the football scenario. The basketball scenario always presented a payment period one half as long as in the football scenario, either 5 or 10 years.

The frequency distributions for NFL and NBA annual WTP by length-of-payment period and ordering are presented in Table 1. More than one half of the WTP amounts are zero. Very few respondents are willing to pay more than $75 each year. Of all respondents, 46% are willing to pay a positive amount (POSITIVE) to keep

TABLE 1: Frequency Distribution of Annual Willingness to Pay

| | NFL | | | | NBA | | | |
| | Short | | Long | | Short | | Long | |
	First	Second	First	Second	First	Second	First	Second
Zero	56	45	49	49	59	60	68	40
Between U.S. $.01 and $4.99	11	9	12	8	6	11	7	13
Between $5 and $9.99	13	7	10	14	4	9	9	13
Between $10 and $19.99	2	6	3	10	7	2	6	6
Between $20 and $39.99	7	4	1	6	3	7	2	5
Between $40 and $75	10	9	4	4	2	9	2	6
More than $75	4	4	7	2	1	5	1	3
Total	103	84	86	93	82	103	95	86

NOTE: NFL = National Football League; NBA = National Basketball Association.

the Jaguars in Jacksonville (Table 2). For those who are willing to pay, the midpoint of the annual WTP category is used with the exception of "more than $75" that is coded as $75. Including the zero WTP responses, the average sum of annual WTP for the Jaguars across the payment periods (TWTP) is $161. Of all respondents, 46% have attended Jaguars games (USE). The average number of games attended during the 2001 season (GAMES) was 1.53. Of all respondents, 38% are willing to pay a positive amount to attract an NBA team to Jacksonville. The average sum of annual WTP across the payment periods is $60 for the NBA team. Of all respondents, 38% say that they would attend NBA games. The average number of games that they would attend is 2.9.

THEORY

First, to focus on the relationship between the interest rate and the rate of time preference, consider a two-period utility maximization problem (Silberberg & Suen, 2000). Assume that utility is additively separable over time, $U(z,Q) = u(z_1,Q_1) + \frac{u(z_2,Q_2)}{1+\rho}$ where U is the intertemporal utility function, u is the utility function in each time period, z_t is a composite commodity of market goods in time period t, $t = 1, 2$, Q_t is the local sports team and ρ is the rate of time preference. The wealth constraint is that the sum of discounted consumption is equal to the sum of discounted income, $W = z_1 + \frac{z_2}{1+r} = y_1 + \frac{y_2}{1+r}$, where W is wealth and r is the market interest rate.

Maximization of utility subject to the wealth constraint leads to the marginal rate of substitution of present for future consumption, $\frac{u'(z_1,Q_1)}{u'(z_2,Q_2)} = \frac{1+r}{1+\rho}$. If consumers are not impatient, $\rho = 0$, then future consumption will be traded for present consump-

TABLE 2: Data Summary (Cases = 367)

		NFL Scenario		NBA Scenario	
Variable	*Description*	M	SD	M	SD
LONG	1 if NFL (NBA) pay period 10 (20) years	.49	.50	.50	.50
FIRST	1 if NFL (NBA) scenario presented first	.49	.50	.51	.50
TWTP	Total willingness to pay	161.04	321.20	60.15	135.05
POSITIVE	1 if TWTP > 0	.46	.50	.38	.49
USE	1 if does attend NFL (NBA) games	.46	.50	.38	.49
GAMES	Number of games attended and/or would attend	1.50	2.39	2.97	6.85

NOTE: NFL = National Football League; NBA = National Basketball Association; LONG = a dummy variable equal to one for the long payment period; FIRST = a dummy variable equal to one if the scenario was presented first; TWTP = total willingness to pay; POSITIVE = 1 if total willingness to pay > 0, 0 otherwise ; USE = a dummy variable equal to one if the respondent attends at least one Jaguars game or would attend at least one NBA game, GAMES = the number of Jaguars games the respondent attended or the number of NBA games the respondent would attend.

tion at the market interest rate, $\frac{u'(z_1,Q_1)}{u'(z_2,Q_2)} = 1 + r$, and future consumption will be greater than present consumption, $z_1 < z_2$. If the rate of time preference is equal to the market interest rate, $\rho = r$, then consumption will be constant across time, $z_{1 = z_2}$. If consumers are impatient, $\rho > r$, then more will be consumed in the present than in the future, $z_{1 > z_2}$.

Consider now the time-independent maximization problem. Utility from the sports team can be achieved from attendance at the games, x, or enjoying the cultural amenities, q, generated by the team. The utility function is:

$$u = u[z, Q(x, q)]. \tag{1}$$

While game attendance is a private good and cultural amenities are public goods, each of these activities has a cost. The full cost of game attendance, p, includes the admission price, a, travel costs, t, and time costs, c. The costs of enjoying cultural amenities are the time costs. The budget constraint is

$$y = z + (a + t + c)x + cq = z + px + cq \tag{2}$$

where y is income and the price of the composite commodity is fixed at one.

The expenditure function is attained by minimizing expenditures (i.e., the budget constraint) subject to the constraint that utility does not fall below a reference level of utility

$$e(p, c, Q, \bar{u}) = \min(z + px + cq) \text{ s.t. } u[u, Q(x, q)] \geq \bar{u}. \tag{3}$$

The expenditure function measures the minimum expenditures necessary to achieve the reference utility level and is increasing in the costs of consumption and utility. A necessary condition for consumption of goods related to the local sports team is that the team is in the local market; $Q = 1$ indicates that the team is located in the local market and $Q = 0$ indicates that it is located somewhere else.

The indirect utility function is found by maximizing utility subject to the budget constraint

$$v(p, c, Q, y) = \max u[z, Q(x, q)] \text{ s.t. } y \geq z + px + cq. \tag{4}$$

The indirect utility function is decreasing in costs and increasing in income. Note that substitution of the indirect utility function into the expenditure function yields income when terms in the two functions are equivalent. For example, when the expenditure function is evaluated with the indirect utility function when the sports team is in the local market, $Q = 1$

$$y = e[p, c, Q = 1, v(p, c, Q = 1, y)]. \tag{5}$$

The annual WTP to keep a professional sports team in the local market can be defined by comparing expenditure functions

$$\begin{aligned} AWTP^e &= e[p, c, Q = 0, v(p, c, Q = 1, y)] - e[p, c, Q = 1, v(p, c, Q = 1, y)] \\ &= e[p, c, Q = 0, v(p, c, Q = 1, y)] - y_1. \end{aligned} \tag{6}$$

where $AWTP^e$ is the equivalent surplus and y_1 is the income level associated with having a team. When the team moves out of the local market, the expenditures necessary to achieve the utility level associated with the team is higher than income. In other words, the annual WTP to keep the sports team in the local market is positive.

The annual WTP to attract a professional sports team in the local market can also be defined by comparing expenditure functions

$$\begin{aligned} AWTP^c &= e[p, c, Q = 0, v(p, c, Q = 0, y)] - e[p, c, Q = 1, v(p, c, Q = 0, y)] \\ &= y_0 - e[p, c, Q = 0, v(p, c, Q = 1, y)]. \end{aligned} \tag{7}$$

where $AWTP^c$ is the compensating surplus and y_0 is the income level associated with not having a team. When the team moves into the local market, the expenditures necessary to achieve the utility level associated with the team are lower than income. The annual WTP to attract the sports team in the local market is positive.

The WTP to avoid a decrement when consumers have property rights to the initial resource allocation, $Q = 1$, is the equivalent surplus measure of welfare

(Bergstrom, 1990). The WTP to gain an increment when consumers have property rights to the initial resource allocation, $Q = 0$, is the compensating surplus measure of welfare. For the same good with equal increments and decrements, it is possible to make predictions about the relative size of $AWTP^e$ and $AWTP^c$. In our case, it is impossible to compare WTP based on different implicit property rights because we value different goods.

TEMPORAL EMBEDDING

Most contingent valuation applications elicit annual payments assuming the current-period budget constrains the WTP. Aggregation over time is then conducted by summing annual payments after applying the social discount rate. The present value of annual WTP is

$$PV = \sum_{t=1}^{T} \frac{AWTP_t}{(1+r)^t} \tag{8}$$

where r is the social discount rate. Eliciting annual WTP is problematic if the respondents assume they would only pay until the project is completely financed (paying their so-called fair share), say, $T = 5$, while the analyst aggregates over the life of the project, say $T = 30$.

An alternative is to assume that respondents are constrained by their lifetime wealth and elicit a lump-sum payment. In this case, the respondents would apply the individual rate of time preference to the project and state the present value of WTP as

$$LS = \sum_{t=1}^{T} \frac{\overline{AWTP}}{(1+\rho)^t} \tag{9}$$

where LS is the stated lump-sum WTP, $\overline{AWTP}$ is the implicit annual WTP of the policy, and ρ is the individual rate of time preference. This approach will tend to underestimate the present value of WTP if current income constrains respondents and if they do not have access to perfect capital markets in which to borrow.

If the average of the individual rates of time preference equals the social discount rate, the two approaches will yield the same WTP amount, $PV = LS$. In the empirical studies reviewed above, estimated rates of time preference are greater than market interest rates that serve as measures of the social discount rate. This implies that $PV > LS$ when $\rho > r$. In other words, the typical approach leads to overestimates of the present value of aggregate WTP because the rate of discount is too low.

In this article, in contrast to the typical lump-sum versus annual payments comparison, respondents face either short or long payment periods. Respondents are asked to state the maximum amount of money that they would be willing to pay annually for T years. The total WTP is the undiscounted sum of the annual WTP values

$$TWTP = \sum_{t=1}^{T} AWTP_t. \tag{10}$$

In the case of the Jaguars, respondents face either 10 or 20 years of increased taxes. In the case of the NBA team, respondents face either 5 or 10 years of increased taxes. In both cases, the short time period, $t = S$, is one half that of the long time period, $t = L$. The rate of time preference can be found by equating the present value of WTP associated with the annual WTP amounts from the short and long payment periods

$$\sum_{S=1}^{T_S} \frac{AWTP_S}{(1+\rho)^S} = \sum_{L=1}^{T_L} \frac{AWTP_L}{(1+\rho)^L}. \tag{11}$$

If respondents ignore the time dimension across surveys and respond with annual WTP amounts that do not differ across short and long time periods, $ATWP_S = ATWP_L$, the total WTP with the long time period will be twice as great as the total WTP with the short time period when $2 \times T_S = T_L$

$$2 \times \left(\sum_{S=1}^{T_S} AWTP_S \right) = \sum_{L=1}^{T_L} AWTP_L. \tag{12}$$

For a broad range of realistic WTP amounts when T_S is equal to 5 and 10 the rate of time preference will be greater than 100%. If respondents state annual WTP amounts so that the total WTP for the short and long payment periods are equal (i.e., $AWTP_S = 2 \times ATWP_L$) then

$$\sum_{S=1}^{T} AWTP_S = \sum_{L=1}^{T} AWTP_L. \tag{13}$$

and the rate of time preference will be zero. For a broad range of realistic WTP amounts when T_S is equal to 5 and 10 if respondents adjust their annual WTP amounts so that

$$2 \times \left(\sum_{S=1}^{T_S} AWTP_S \right) > \sum_{L=1}^{T_L} AWTP_L \tag{14}$$

the rate of time preference will be greater than zero and less than 100%.

ORDERING EFFECTS

We consider two issues related to ordering effects: substitution and income effects and respondent experience. Consider the independently elicited WTP values for two public goods, Q_1 and Q_2, and implicitly defined by the indirect utility functions. In this section of the article, the subscripts on Q will refer to different public goods and not different time periods. Annual WTP depends on the quantity of the cross-public good

$$v(Q_1 = 0, Q_2, y) = v(Q_1 = 1, Q_2, y - AWTP_1) \tag{15}$$

$$v(Q_1, Q_2 = 0, y) = v(Q_1, Q_2 = 1, y - AWTP_2). \tag{16}$$

WTP is the dollar value subtracted from income that makes the consumer indifferent between keeping the team, $Q = 1$, and not having the team, $Q = 0$.

Suppose in the valuation sequence M that WTP for Q_1 is elicited first and WTP for Q_2 is elicited second: $m = [AWTP_{11}, AWTP_{22}]$. If the respondent is willing to pay for the first public good the income available in the second scenario is reduced by $AWTP_{11}$

$$v(Q_1 = 0, Q_2 = 0, y) = v(Q_1 = 1, Q_2 = 0, y - AWTP_{11}) \tag{17}$$

$$v(Q_1 = 1, Q_2 = 0, y) = v(Q_1 = 1, Q_2 = 1, y - AWTP_{11} - AWTP_{22}). \tag{18}$$

Consider another valuation sequence N in which WTP for Q_2 is elicited first and WTP for Q_1 is elicited second: $N = [AWTP_{21}, AWTP_{12}]$. The WTP values are

$$v(Q_1 = 0, Q_2 = 0, y) = v(Q_1 = 0, Q_2 = 1, y - AWTP_{21}) \tag{19}$$

$$v(Q_1 = 0, Q_2 = 1, y) = v(Q_1 = 1, Q_2 = 1, y - AWTP_{21} - AWTP_{12}). \tag{20}$$

Implications for the direction of the ordering effects can be determined by comparing Equations (17) with (20) and (18) with (19). Because the left-hand side of (17) is less than the left-hand side of (20), the right-hand side of (17) is less than the right-hand side of (20)

$$v(Q_1 = 1, Q_2 = 0, y - AWTP_{11}) < v(Q_1 = 1, Q_2 = 1, y - AWTP_{21} - AWTP_{12}). \quad (21)$$

By definition, the increase in utility from the increment to Q_1 and the decrease in utility from the payment of $AWTP_{21}$ on the right-hand side of (21) are equal. Therefore, WTP when valued first in the sequence must be greater than WTP when valued second in the sequence, $ATWP_{11} > ATWP_{12}$, for the inequality to hold. When valued second in the sequence, WTP is lower because of an increasingly binding income constraint, $y - ATWP_{12} < y$. WTP is also negatively affected by the availability of a substitute good, $Q_1 = 1$.

A similar argument can be made for the effects of ordering on WTP for Q_2. In this case, the WTP when valued first in a sequence will be greater than the value for the same public good elicited second in the sequence, $ATWP_{21} > ATWP_{22}$, because of income and substitution effects. The implication of these comparisons is that WTP values are not unique; they depend on the policy context in which the public goods are delivered.

Consider next the role of respondent experience and a public good for which all respondents have experience, such as the consumption and other activities related to the Jacksonville Jaguars. When respondents formulate WTP values for the Jaguars they are familiar with the characteristics of the good that they are paying for. In contrast, respondents do not have experience with a NBA team and are not familiar with the characteristics of the public goods associated with a NBA team. When formulating WTP values, the lack of experience may create uncertainty about WTP and the order of the scenarios may affect the WTP estimates.

Whitehead, Blomquist, Hoban, and Clifford (1995) argue that prior knowledge of the resource, gained from experience, is a necessary condition for positive WTP. Survey information can lead to positive WTP; however, the WTP statements from uninformed respondents will be relatively less valid and reliable than those from informed respondents. In the context of ordering effects, this suggests that uninformed respondents will be more likely to be influenced by survey and other factors affecting WTP, such as the order of the scenario, starting point dollar amounts, and other survey information.

Yea saying may be a factor for uninformed respondents. Some survey respondents prefer to please the interviewer rather than answer survey questions honestly. Yea-saying behavior in CVM surveys leads to respondents stating that they would be willing to pay for the public good in an attempt to please the interviewer even if their utility would fall after payment. Yea-saying respondents will be less likely to respond that they would be willing to pay for a public good that is presented second in a sequence if they have already responded with a positive WTP to the first good in the sequence. Respondents with experience with the public good (i.e., Jaguar fans) might be less prone to yea-saying behavior.

EMPIRICAL MODEL

We focus our empirical modeling efforts on the continuous WTP data constructed from the follow-up interval WTP questions. With continuous WTP questions, respondents first decide whether to pay anything and then, conditional on positive WTP, the magnitude of WTP. Total annual WTP is positive if utility with the team is greater than utility without the team

$$TWTP = \begin{cases} AWTP \times T > 0 & \text{if } v(p,c,Q=1,y) \geq v(p,c,Q=0,y) \\ AWTP \times T = 0 & \text{if } v(p,c,Q=1,y) < v(p,c,Q=0,y) \end{cases} \quad (22)$$

The second decision, the magnitude of total WTP, is equal to annual WTP, as defined above, multiplied by the length of the payment period. The expected value of total WTP is the product of the probability that total WTP will be positive and expected total WTP given that WTP is positive

$$E(TWTP) = \pi(TWTP > 0) \times E(TWTP|TWTP > 0). \quad (23)$$

There are several approaches to analyzing these data. Two of the more obvious are the Tobit and the Cragg models (Bockstael, Strand, McConnell, & Arsanjani, 1990). The Cragg model allows the determinants of positive WTP and the magnitude of WTP to differ. The single-equation Tobit model constrains the determinants of both decisions to be equal. In the current study, more than one half of the respondents report zero WTP values, suggesting substantially different processes for deciding whether to pay and, if so, how much. In the empirical results below, likelihood ratio tests indicate that the Cragg model is superior to the Tobit for these data.

The Cragg model offers an alternative to the Tobit that decomposes WTP directly. The Cragg model first employs a probit model to estimate the probability of positive total WTP

$$\pi(TWTP > 0) = \Phi_1\left(\frac{X_1'\beta_1}{\sigma_1}\right) \quad (24)$$

where Φ is the standard normal distribution function, X is a vector of independent variables, β is a vector of coefficients, and σ is the standard deviation of the regression. The subscript refers to the first decision on whether to pay. The truncated regression model employs only the positive WTP data to estimate expected total WTP

$$E(TWTP|TWTP > 0) = X_2'\beta_2 + \sigma_2\lambda \quad (25)$$

$$\lambda = \frac{\phi_2(\theta)}{1 - \Phi_2(\theta)}$$

where ϕ_2 is the standard normal density function, λ is the inverse Mill's ratio, and $\theta = (-X_2' \beta_2 / \sigma_2)$. The subscript refers to the second decision on how much to pay.

To estimate the first step in the Cragg procedure, the following probit models are specified for the Jaguars and NBA team

$$\pi(TWTP > 0) = f(A, FIRST, LONG, USE, GAMES, INCOME) \qquad (26)$$

where A is the annual tax payment, $FIRST$ is a dummy variable equal to one if the scenario was presented first, $LONG$ is a dummy variable equal to one for the long payment period, USE is a dummy variable equal to one if the respondent attends at least one Jaguars game or would attend at least one NBA game, $GAMES$ is the number of Jaguars games the respondent attended or the number of NBA games the respondent would attend, and $INCOME$ is the annual household income in thousands. To estimate the determinants of WTP the following models are specified for the Jaguars and NBA team

$$E(TWTP|TWTP > 0) = f(A, FIRST, LONG, USE, GAMES, INCOME) \qquad (27)$$

where all variables are as defined previously. Demographic variables were included in earlier probit and truncated regression models. The coefficients were neither individually nor jointly significant. All models are estimated using the LIMDEP statistical software (Greene, 2002).

Theory suggests that the exogenous access price (i.e., the admission price and travel costs of attending Jaguar games) should be included as an independent variable. However, in our sample, everyone faces the same range of ticket prices and similar travel costs to the games. We, therefore, include two variables to proxy for choke and access prices. The dummy variable USE takes a value of one if the respondent attends one or more Jaguars games per year and zero otherwise. The number of Jaguars games attended during the past year, GAMES, allows a distinction between those who attend frequently and those who attend occasionally. This specification follows Johnson and Whitehead (2000) and Johnson et al. (2001).

We estimate a log-linear truncated regression model where the log of expected total annual WTP is

$$\log(E(TWTP\}TWTP > 0)) = \alpha_0 + \alpha_1 A + \alpha_2 LONG + \alpha_3 USE + \alpha_4 GAMES \qquad (28)$$
$$+ \alpha_5 FIRST + \alpha_6 INCOME + \sigma\lambda$$

where the αj (j = 0, . . . , 6) coefficients represent estimated coefficients in the coefficient vector as described above (i.e., $\alpha = \hat{\beta}$). The exponential of the log of WTP is the median of the WTP distribution, $medianWTP = \exp(\log(E(TWTP)))$.

The effect of the tax amount on total WTP is a test of starting point bias from the initial dichotomous choice WTP question. Starting point bias exists when a suggested value serves as an anchor for subsequent valuation responses. Because ordering effects are more likely to occur when consumers lack experience with goods, starting point bias is more likely to affect the NBA scenario than the Jaguars scenario. When measuring the log of expected total WTP, starting point bias can be purged by setting the tax amount equal to zero

$$\log(TWTP) = \alpha_0 + \alpha_1(A = 0) + \sum_{j=2}^{6} \alpha_j X_j + \sigma\lambda. \tag{29}$$

TESTING FOR TEMPORAL EMBEDDING AND ORDERING EFFECTS

The long scenario, measured by the LONG dummy variable, may affect WTP. Given a positive WPT, it may affect the magnitude of WTP. However, there are no obvious theoretical reasons why the long scenario should affect the probability of a positive amount. Even if respondent total WTP is $1 spread over 20 years, the correct survey response is the interval "between $.01 and $4.99." Therefore, we do not expect a statistically significant effect unless respondents wish to avoid longer payment commitments.

The magnitude of the LONG dummy variable on expected total WTP is a measure of the log sum of the annual WTP amounts during the second one half of the long payment period. The coefficient on the LONG dummy variable will be positive if total WTP is higher with the longer payment period. In other words, α_2 will be zero if respondents have a zero rate of time preference and positive if the rate of time preference is greater than zero.

Alternatively, setting LONG equal to zero and one when measuring expected WTP measures the log of total WTP for the short and long payment periods

$$\log(TWTP_S) = \alpha_0 + \alpha_1(A = 0) + \alpha_2(LONG = 0) + \sum_{j=3}^{6} \alpha_j X_j + \sigma\lambda \tag{30}$$

$$\log(TWTP_L) = \alpha_0 + \alpha_1(A = 0) + \alpha_2(LONG = 1) + \sum_{j=3}^{6} \alpha_j X_j + \sigma\lambda. \tag{31}$$

The hypothesis test for temporal embedding is

$$H0: 2 \times TWTP_S \leq TWTP_L \tag{32}$$
$$HA: 2 \times TWTP_S > TWTP_L.$$

TABLE 3:   Probit Regression Models: Dependent Variable = Positive (Cases = 367)

	NBA		NFL	
	b	t *Ratio*	b	t *Ratio*
Constant	−1.295	−5.36	−.564	−2.73
TAX (A)	−.009	−1.68	.001	.20
FIRST	.616	3.94	.044	.32
LONG	.303	1.94	−.013	−.09
USE	.991	4.75	.727	3.82
GAMES	.082	2.93	.050	1.24
INCOME	.001	.42	.0001	.03
Model χ^2	138.08	50.29		

NOTE: NBA = National Basketball Association; NFL = National Football League; TAX (A) = annual tax payment; FIRST = a dummy variable equal to one if the scenario was presented first; LONG = a dummy variable equal to one for the long payment period; USE = a dummy variable equal to one if the respondent attends at least one Jaguars game or would attend at least one NBA game; GAMES = the number of Jaguars games the respondent attended or the number of NBA games the respondent would attend; INCOME = the annual household income in thousands.

If twice the total WTP amounts in the short payment period is greater than the total WTP in the long payment period then the implicit rate of time preference will be between 0% and 100%. This indicates that respondents are cognizant of the temporal dimensions of the scenario, and temporal embedding does not arise. Note, however, that unrealistically high implicit discount rates could still be a problem even though temporal embedding, as defined here, does not arise.

By contrast, the tests for ordering effects are straightforward. If the placement of the CVM scenario affects the probability of a positive WTP amount then the probit coefficient on the FIRST variable will be statistically different from zero. With ordering effects, we expect a positive coefficient. In other words, the size of the WTP market is expected to be larger when the CVM scenario is placed first in a sequence. In the truncated regression model, a positive and statistically significant coefficient estimate on the FIRST variable, $\alpha_5 > 0$, indicates that total annual WTP is greater when the NFL team or NBA team and/or arena is valued first in the sequence. A statistically insignificant coefficient indicates that WTP is not affected by the order of the CVM scenario.

RESULTS

The estimation results from the probit models conducted as the first step in the Cragg model appear in Table 3. The NBA and NFL models use the same vector of independent variables to estimate the probability that a respondent reports a positive WTP value for the basketball and football teams. This allows for a direct comparison between the factors that affect positive WTP in the two scenarios.

TABLE 4:   Truncated Regression Models: Dependent Variable = Log (TWTP)

	NBA		NFL	
	b	t *Ratio*	b	t *Ratio*
Constant	2.63	8.77	3.75	14.55
TAX (A)	.03	4.62	.02	3.94
FIRST	.16	.89	.03	.21
LONG	.44	2.61	.41	2.49
USE	−.09	−.42	.06	.28
GAMES	.04	3.86	.13	3.27
INCOME	.01	3.66	.01	2.36
σ	.99	16.64	1.07	18.27
Log Liklihood	−195.52	−247.99		
Cases	139	167		

NOTE: TWTP = total willingness to pay; NBA = National Basketball Association; NFL = National Football League; TAX (A) = annual tax payment; FIRST = a dummy variable equal to one if the scenario was presented first; LONG = a dummy variable equal to one for the long payment period; USE = a dummy variable equal to one if the respondent attends at least one Jaguars game or would attend at least one NBA game; GAMES = the number of Jaguars games the respondent attended or the number of NBA games the respondent would attend; INCOME = the annual household income in thousands...

In the basketball scenario, the magnitude of the tax amount from the discrete-choice WTP question has a negative effect on the probability of a positive WTP. This indicates a form of starting point bias in which high stated costs lead to avoidance of paying anything. The bias does not appear in the NFL model. The long payment period leads to a greater probability of a positive WTP in the NBA scenario but not in the football scenario. This is a surprising result and may indicate that the 5-year payment period was unrealistically short leading to zero WTP responses that indicate a protest of the unrealistic contingent market.

Those respondents who would attend at least one game are more likely to pay a positive amount for basketball, as would those who reported attending at least one football game would be more likely to pay in the football scenarios. The probability of a positive amount in the NBA scenario increases with the number of games that the respondent expects to attend; however, the number of games does not affect the probability of being willing to pay for the NFL. If the basketball scenario was presented first, the probability of a positive WTP for the NBA is greater. However, no ordering effect appears in the NFL model. Given the differences in the results across basketball and football scenarios, respondents distinguish between the two scenarios and regard football and basketball differently.

The truncated regression models with the log of the total WTP for the basketball and football teams as the dependent variables appear in Table 4. Total WTP is measured as the undiscounted product of the annual WTP values and the payment period length. The WTP dependent variables are logged because the total WTP

TABLE 5:   Total (Median) Willingness-to-Pay Estimates

Payment Period	Sequence	NBA		NFL	
		TWTP	t Ratio	TWTP	W4t Ratio
Short	First	43.32	5.78	97.59	5.34
Short	Second	37.02	4.95	94.24	5.75
Long	First	67.23	5.98	147.70	5.49
Long	Second	57.44	5.24	142.63	5.43

NOTE: NBA = National Basketball Association; NFL = National Football League; TWTP = total willingness to pay.

variables are nonnormally distributed, and the truncated regression model assumes a normal distribution. Because of the log-linear functional form the coefficient estimates are interpreted as the percentage change in total annual WTP.

In the NBA model, the coefficient on the annual tax amount variable is statistically significant. The coefficient on this variable indicates that for each one-dollar increase in the annual tax amount, total WTP increases by 3%. This is evidence that respondents anchored their WTP amounts to the tax amount. If the basketball scenario is presented first, WTP is no higher. WTP in the long scenario is 44% greater than in the short scenario. The dummy variable for whether the respondent would attend at least one game has no effect on WTP; however, WTP does increase with the number of games. The coefficient indicates that an additional game increases total annual WTP by 4%, above and beyond the expected ticket price and other costs of game access. Income is a statistically significant variable. As income increases by $1,000, WTP increases by 1% indicating that the basketball team is a normal good.

Estimation of the NFL WTP model yields results qualitatively similar to those of the NBA model in that the same variables tend to be statistically significant. As in the NBA model, starting point bias exists, with each one-dollar increase in the annual tax amount increasing total WTP by 2%. The order of the scenario does not significantly affect the total WTP amount. Total WTP is 41% higher in the long scenario. The dummy variable for whether the respondent attended at least one football game has no effect on total WTP. However, as in the case of the NBA, the number of games the respondent attends increases total WTP. An additional game increases total WTP by 13%. Note that the effect of games on total WTP increases with game scarcity (i.e., 8 home games compared to 41). Although the coefficient on income is positive, it is not statistically significant.

The log of total WTP is estimated by setting the tax amount equal to zero in a conservative effort to avoid starting point bias (Table 5). All other variables are set at their mean values. The median of the WTP distribution is the exponential of the log. The standard errors are constructed using the Delta method (Greene, 1997).

The (median) total WTP for the basketball team and/or arena during the short payment period (5 years) is $43. The implied annual WTP is $8.66. During the long payment period (10 years), total WTP is $67, and the annual WTP is $6.72. The total WTP during the short payment period is $24 greater than that of the additional WTP during the second half of the long payment period. This difference is statistically different from zero ($t = 2.43$). In other words, twice the total WTP in the short payment period is greater than total annual WTP in the long payment period. This indicates no temporal embedding. The implicit rate of time preference that equates the present value of the WTP amounts, assuming that the first payment occurs in the first year of the payment period (not the current year), for these two payment schedules is 28%.

In the second NBA scenario, total WTP is $37 in the short payment period and $57 in the long payment period. The annual WTP amounts are $7.40 and $5.74, respectively. The difference of $20 in total WTP between payment periods is statistically different from zero ($t = 2.40$). Again, the total WTP amount in the long payment period is less than twice the total WTP in the short payment period. The implicit rate of time preference is 28%.

In the first scenario, total WTP for the football team is $98 over the short payment period (10 years) and $148 over the long payment period (20 years). The annual WTP amounts are $9.76 and $7.39, respectively. The total WTP amount in the long payment period is less than twice the total annual WTP in the short payment period. The $50 difference in total annual WTP during the payment periods is statistically different from zero ($t = 2.30$). Again, we find no evidence of temporal embedding. The implicit rate of time preference is 12% in the first football scenario.

Total WTP in the second scenario is $94 and $143 with the short and long payment periods, respectively. The annual WTP amounts are $9.42 and $7.13, respectively. Again, the total WTP amount in the long payment period is less than twice the total WTP in the short payment period. The $48 difference in WTP is statistically different from zero ($t = 2.23$). The implicit rate of time preference is 12% in the second football scenarios.

For the NBA team, there is a $6 and $10 decrease in the total WTP amounts from the first to second scenarios in the short and long payment periods, respectively. The ordering effects are an increase of $3 and $5 in total WTP from the first and second scenarios for the football team. However, none of these differences are statistically different from zero at the $p = .10$ level.

CONCLUSIONS

In this article, we estimate the WTP for two professional sports teams and consider temporal embedding and ordering effects. Temporal embedding is an issue when the length of the payment period is not made explicit and survey respondents and researchers use different lengths of payment periods. In this case, aggregated

benefit estimates will be biased. Ordering effects are an issue when multiple WTP scenarios are presented to respondents. Typically, WTP for the same good is lower when placed second in a sequence of scenarios relative to when it is placed first. We find no evidence of temporal embedding and ordering effects. Furthermore, the WTP estimates are internally valid. Respondents are more likely to be willing to pay if they attend games. The magnitude of WTP is greater for those who attend games and for those with higher incomes (in one of two scenarios).

In our tests for temporal embedding, the total annual WTP amounts in the long payment period are less than twice the total annual WTP in the short payment period. This indicates that respondents applied a positive discount rate to their WTP statements, agreeing to pay higher annual WTP amounts if the number of years required to pay is lower. The implicit discount rates for the NFL scenario, 12%, are very reasonable. The implicit discount rates for the NBA scenario are more than twice as high, 28%, but still lower than estimates of the implicit discount rate from the CVM literature. These discount rates are in the range of market interest rates offered by credit card companies and finance companies to households with high default risk and lower than most of the implicit discount rates obtained from revealed behavior reviewed by Loewenstein and Thaler (1989).

The difference in discount rates between the NBA and NFL scenarios is of some concern. It should be expected that respondents will have similar rates of time preference across commodities. The difference in discount rates may be because of the different length of time periods for the two scenarios. This result is similar to that obtained by Kim and Haab (2003) who find that shorter payment schedules lead to higher implicit discount rates. The result may also be due to the valuation of different commodities and the lack of respondent experience with the NBA. Stevens et al. (1997) find that implicit discount rates differ for different commodities with the discount rate for a private good exceeding the discount rate for a public good.

This and other CVM studies to date that estimate implicit discount rates have found that the rates are greater than market interest rates that are typically used to discount annual WTP values when aggregating over time. For example, many studies contrast the present value of discounted benefits from the 2% and 7% rates recommended by the U.S. General Accounting Office and the U.S. Office of Management and Budget. Use of either of these discount rates will lead to overestimates of aggregate benefits when CVM respondents state annual WTP values with higher rates of time preference greater than market interest rates.

In our tests for ordering effects, we find no ordering effects in the NFL models. Past research has argued that experience with the good might lead to a lack of ordering effects. This is consistent with our NFL results because Jacksonville residents have a number of years of experience with the Jaguars. The probability of positive WTP is greater when the NBA team and/or arena appears first in the valuation sequence. This type of ordering effect, which affects the market size of WTP, may be due to a lack of experience with an NBA team and will lead to an increase in

WTP when aggregated to the population. The bias in total WTP from ordered CVM scenarios is not statistically significant.

These results suggest that the typical CVM that elicits annual WTP amounts should explicitly state the length of the payment period to avoid aggregating WTP estimates over a time period longer than respondents perceive. This may be especially true with the contingent valuation of sports teams, stadiums, and arenas that have large up-front costs. However, if stadiums and arenas are financed by municipal bonds the payment period could be 30 years or longer. Even so, the length of the payment period should always be made explicit when it could be interpreted in various ways by respondents.

Another concern is that this, and other, CVM studies focused on temporal issues assume that expected inflation is zero. As is well known in the macroeconomics literature, positive expected inflation will lead to growing expected nominal income over time. As with fixed rate mortgages and automobile loan payments, the ability to pay fixed nominal amounts increases over time. Therefore, positive expected inflation will lead to larger nominal WTP for normal goods over time. In our case, the effect of expected inflation will narrow the difference in the nominal annual WTP amounts for the short and long payment periods. Discounting for expected inflation will cause real total WTP amounts in short and long payment periods to converge and lead to smaller implicit discount rates than those reported here. As expected inflation increases, the implicit discount rate decreases. Future studies of temporal embedding should consider the issue of expected inflation, expected future income, and their effects on WTP.

Other than an ordering effect for the size of the WTP market, ordering of CVM scenarios does not appear to be a major problem with this sports economics application. However, this result could be an artifact of some characteristic of the current study. Best practice is not to ignore the potential for ordering effects. Future studies with multiple scenarios should vary the appearance of each scenario in the sequence of scenarios.

NOTES

1. As pointed out by a referee, saying that "large sums of money . . . would be needed" may negatively bias WTP. Bohara et al. (1998) found that information about the total cost of a project has no effect on WTP elicited with a dichotomous choice question but negative effects on WTP elicited with an open-ended question. We recognize that the cost information may lead to a negative bias in WTP.

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John C. Whitehead obtained his Ph.D. in economics from the University of Kentucky. He is an associate professor in the Department of Economics at Appalachian State University. His research interests include various applications of stated preference methods including the contingent valuation of sports.

Michael Mondello obtained his Ph.D. from the University of Florida in higher education with a finance concentration. He currently teaches sport finance in the Graduate Sport Management Program at The Florida State University. His research interest focus on financial and/or economical issues related to sports including revenue sharing, contingent valuation, ticket pricing, and the professional development of the academic field of sport management.

Bruce K. Johnson earned his Ph.D. in economics from the University of Virginia and is the James Graham Brown Professor of Economics at Centre College in Danville, KY. His research and writing interests include economic policy and the economics of sports.