Investigation of Stated and Revealed Preferences for an Elk Hunting Raffle

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ABSTRACT. *The charter forest experiment at the Valles Caldera National Preserve (VCNP) in New Mexico provides land managers, policymakers, and researchers a unique opportunity to examine an alternative public land management institution. The VCNP mature bull elk permit lottery has been the largest revenue-generating recreation program at the preserve since the program's inception in 2002. This paper uses stated and revealed preference ticket purchase data, collected through an online survey, to estimate a set of ticket demand equations for the purpose of assessing revenue generation, access, and the willingness to donate to this program.* (JEL Q20)

I. INTRODUCTION

The charter forest experiment at the Valles Caldera National Preserve (VCNP) in New Mexico provides land managers, policymakers, and researchers a unique opportunity to examine an alternative public land management institution. Located in the Jemez Mountains of Northern New Mexico, the 89,000-acre VCNP is not only defined by its unique topography and relatively pristine landscape, but also by its status as the first federal land acquisition specifically devoted to the charter forest concept. Although the VCNP is a component of the National Forest System (NFS) an independent nine-member trust board, known as the Valles Caldera Trust (VCT or Trust), manages the site.[1] As envisioned, the VCT would have considerable autonomy and a "blank slate" to design and implement policy (VCT 2004). The Valles Caldera Preservation Act (VCPA) of 2000 sets out the objectives of the Trust. Two objectives stand out. The Trust must provide reasonable access to the public and strive for financial self-sufficiency (VCPA 2000). A recent independent evaluation was critical of the Trust's early efforts and commitment to pursuing financial self-sufficiency (GAO 2005).

It is anticipated that fee-based outdoor recreation programs will serve as both a significant source of revenue and as the primary way the public accesses the preserve (VCT 2004). Given the preserve's reputation for having a high-quality elk herd, it is no surprise that the elk permit lottery has been the largest revenue-generating recreation program at the VCNP since 2002. Unlike more traditional hunting permit lotteries; the program exhibits the revenue-generating characteristics of a raffle. Participants may purchase more than one ticket to improve their chances of winning a permit, but are not guaranteed access. This structure allows the Trust to capture reve-

Land Economics • November 2006 • 82 (4): 623–640
ISSN 0023-7639; E-ISSN 1543-8325

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[1] The Valles Caldera Trust is comprised of individuals representing federal, state, local interests.

nues from individuals who may not access the site. Along with valuing the permit, donation to a worthy cause (habitat preservation at this unique site) may be an important motivation for many participants (ticket buyers). This logic is consistent with the raffle literature (Duncan 2002; Amegashie and Myers 2003) and underscores why the mechanism is frequently used to solicit donations.

Unfortunately, the Trust has seen revenues from the mature bull elk raffle (MBR) fall in recent years. The decline in permit raffle revenue stems from a New Mexico elk hunting permit law which requires that, for elk hunting permits issued through public lottery (but not private sales); New Mexico residents must receive 78% of the total allocated for the given hunt. The hunt access distribution mandated by the quota brings to light a divided resource control conflict between the Trust, which controls access, and the State, which "owns" the elk on the preserve. Along with potential revenue effects, the quota is also problematic because it discriminates against out-of-state hunters and appears to conflict with the Trust's responsibility to provide reasonable and fair access to a national resource. States with comparable residency quotas (i.e., Arizona, Nevada, and Wyoming) have been sued on these grounds.[2]

This paper uses stated and revealed preference ticket purchase data (SP and RP, respectively), collected through an online survey of 2003 MBR participants, to estimate a set of ticket demand equations. Our interest, within the context of the Trust's financial self-sufficiency requirement, is to examine ticket demand, price-elasticity, and revenue generation under varying institutional arrangements (with and without the resident permit quota) at the VCNP. As an extension, we use the estimated equations to examine how the willingness to donate might affect ticket demand. The paper concludes with policy recommendations.

II. BACKGROUND AND PROGRAM DESIGN

Mature bull and related trophy elk hunting opportunities in New Mexico are highly valued, and allocated through a complex mix of state-run lotteries and auctions, tribal offerings, and an active and growing private market ranch permit system (Torrell et al. 2004; Little, Berrens, and Champ 2005). Within this state-regulated, but increasingly competitive mix, the MBR began operation prior to the 2002 elk-hunting season.[3] The program is designed to generate revenues for preserve operations and to allocate scarce hunt access in a reasonably equitable fashion. Participants may purchase as many tickets as they wish at a price of $25. The ticket price has remained unchanged for each year of operation. Each ticket purchased provides another entry in the pool from which permit winners are selected and, ostensibly, improves the odds of winning. Permit draws are conducted without replacement and participants are only allowed to win a single permit. Permit winners are required to pay the appropriate license fee ($69 for residents, $481 for non-residents) to the state and a $175 access fee to the Trust. Permits are allocated across both time (hunt date) and weapon type. Three

[2] The Arizona case is Montoya v. Shroup. The suit was filed by a group of New Mexico outfitters who claimed that the Arizona elk permit quota violated the interstate commerce clause of the constitution. The Ninth Circuit Court of Appeals found in favor of the plaintiffs and stated that the quota unduly restricted non-resident hunting access. Given that a significant portion of big game hunting in New Mexico (approximately 65%) takes place on federal land, it will be interesting to see how the Arizona court case affects the New Mexico permit quota.

[3] Besides the MBR, the VCNP elk-hunting program includes a state-run lottery is used to allocate cow elk permits, with proceeds accruing to the VCNP (approximately $100,000 or less annually). Additionally, in 2002 and 2003 an auction was used to allocate five permits in each year. Except for one permit sold on E-bay in 2002, non-profit organizations such as the Rocky Mountain Elk Foundation auctioned permits at their annual conventions. Total auction revenue for the two-year period was $133,500, with $92,600 going to the VCNP. In 2004, the New Mexico Game and Fish Commission redesignated the VCNP as a federal land unit and blocked the auction (see Little, Berrens, and Champ 2005).

general weapon classifications are available, archery, muzzleloading rifle, and standard rifle. Hunters access the preserve from early September to early November, with the archery hunts in September and rifle hunts starting late October. Participants may distribute their ticket purchase across different weapon classes or may limit their purchase to only a single weapon type. Individual win probabilities will vary and depend on the hunt and ticket choices made by the participant.[4]

In principle, the MBR is used to allocate a quasi-private good (i.e., the hunting permit), and to generate funds that also help provide and protect those ecological services at the VCNP with public good characteristics (e.g., relatively pristine watershed and species habitat protection over more than 89,000 acres in a dramatic high-elevation setting). As long as the increase in ticket sales is greater than the cost of the prize, it is expected that a raffle will outperform a comparable voluntary contribution mechanism in terms of generating revenues for public good provision (Duncan 2002).

To explain why people accept what is, essentially, an unfair gamble, Duncan (2002) and others (Walker 1998; Cohen 2001) have argued that there is a donation motive—the positive feeling individuals may derive from donating to a good cause. If present, the raffle mechanism can capitalize on the donation motive by reducing the realized cost of contribution (Duncan 2002). For example (following Duncan 2002), assume an organization wishes to generate $2,500 for elk habitat improvements. Also assume that the cost of the offered prize to the organization is $2,500 and that participants hold the same value for the prize. At a ticket price of $25, the raffle achieves the revenue objective when 100 participants each purchase two raffle tickets. At this point, net raffle revenues equal $2,500 and each participant has donated $50 to buy an expected return of $25. If one participant chooses to purchase a third ticket, the organization receives $2,575. The individual will find that the marginal ticket increases the expected return to $37.31, which implies a realized marginal donation cost of $12.69. If we hold the cost of the prize to the organization constant and then increase the value of the prize to the individual we find that, in expectation, the cost of donation falls (Duncan 2002). An added benefit is that raffles partially offset "free-riding" behavior because the purchase of additional tickets by one individual reduces the expected return to other participants (Morgan 2000; Amegashie and Myers 2003). To offset this reduction other participants must purchase additional tickets.

The relationship between the prize and cost of contribution provides the foundation for the revenue-generating capacity of the mechanism and helps explain why individuals participate. Some state game agencies and non-profit organizations use permit raffles to obtain funds for hunting and conservation programs. As just one example, since 1992 the Oregon Department of Fish and Wildlife has raffled Bighorn Sheep and Mountain Goat permits to raise funds for habitat conservation projects (ODFW 2003). Participants not only value the permit being allocated but also know their money will be used to protect habitat.

The MBR allows the Trust to solicit contributions in exchange for a small return on the ticket purchase. Previous examination of the program by Little, Berrens, and Champ (2005) found that, across a wide array of assumptions, the expected value of participating in the program ranged from −$4 to −$19.[5] Key to this conclusion was that the donation component of participation was assumed to be zero. They rea-

[4] In a traditional permit lottery, individuals are allowed to choose which hunts they would like to pursue but are only allowed to submit a single application for each hunt. The final probability of winning a permit is a function of the total number of applications submitted by all participants and will be distributed uniformly (Scrogin and Berrens 2000).

[5] The Little, Berrens, and Champ (2005) analysis was made using varying assumptions about the objective win probability, permit value, travel costs, licensing costs, and ticket expenditures.

soned that participants might be either risk seeking, miscalculating their odds, or may have other sources of utility from contributing to a public good (Little, Berrens, and Champ 2005). The latter explanation echoes Duncan (2002) and suggests that the individual's willingness to donate is an important component in the decision to participate. Assuming a small donation value would have led Little, Berrens, and Champ (2005) to find a positive expected return.

For the inaugural 2002 season, MBR permits were transferable, and ticket revenues totaled $336,000 for 85 permits. This was achieved with limited marketing. By 2003 active marketing had increased awareness of the program. For the 2003 season, permit transferability was suspended, 48 permits were allocated and revenues of $255,000 were generated.[6] While overall ticket revenues declined between the 2002 and 2003 seasons, average ticket revenue per permit increased from $3,953 to $5,200. Finally, in 2004, ticket revenues were $201,000. The decline in revenues occurred even in the presence of an increased number of permits and hunts (72 permits and 7 hunts). The only other major alteration to the program from 2003 to 2004 was the resident permit quota.

The quota requires that a minimum of 78% of elk permits allocated through public draw be given to New Mexico residents, while the remaining 22% are available for non-resident hunters.[7] It is important to note that the quota alters the relative share of permits made available to resident and non-resident hunters but, in this circumstance, is not directly applied to the number of tickets that may be purchased by participants. Prior to 2004, the Trust was able to allocate permits at their own discretion because the New Mexico Department of Game and Fish (NMDFG) treated VCNP permits as they had been treated under private ownership. A New Mexico attorney general (NMAG) opinion specifically stated that the MBR, as a type of lottery, did not satisfy the provisions of the law (NMAG 2003). Coinciding with this ruling, a newly appointed New Mexico Game and Fish Commission opted to treat VCNP permits like other publicly-available permits for state hunts occurring on federal land. The opinion coupled with the re-classification forced the Trust to alter permit distributions to be consistent with state law. Although the Trust must adhere to state game regulations, including the quota, they retain the right to decide when and where hunting can take place on the preserve.

It is the distribution of hunt access mandated by the permit quota that most directly conflicts with VCPA provisions meant to promote fair and reasonable public access. In 2004, a total of 72 mature bull permits were allocated which, after accounting for the quota, left a maximum of 16 permits for non-residents. When compared to 2003, where 48 permits were allocated and no quota was in place, it becomes evident that non-resident hunters have fewer opportunities to access the preserve for hunting. The reduction in access is problematic because non-residents purchased approximately 70% of the tickets sold in both 2002 and 2003 (Little, Berrens, and Champ 2005). Thus, the quota forces the Trust to discriminate against those individuals who provided the majority of MBR revenues. In addition, the reduced probability of winning also increases the expected cost of contribution for non-residents who may be

[6] The suspension of transferability was a direct response to an emerging secondary market for VCNP permits, which included the Trust finding it trying to auction a permit on E-bay alongside raffle winners (see Little, Berrens, and Champ 2005). Thus, all survey responses and analysis in this paper involved nontransferable permits (clearly identified). As discussed by Boyce (1994), total revenues for lotteries with prize transferability can exceed revenues for lotteries without transferability when the participant pool is comprised of risk neutral agents. While the empirical effects of permit transferability on total revenue (and the proportion captured by the agency) are not examined here, this is an important research topic for lotteries and raffles.

[7] Of the 22%, 12% of the permits are reserved for out-of-state hunters who use the services of a guide or outfitter. The remaining 10% is for out-of-state hunters who do not use such services.

willing to donate through the raffle. While anecdotal, evidence suggests that the resident permit quota may be behind a fall in program revenue from $255,000 in 2003 to $201,000 in 2004, despite the 50% increase in permits (Little, Berrens, and Champ 2005).

III. THE STATED AND REVEALED PREFERENCE SURVEY

The VCT has adopted an "adaptive management" approach to manage the preserve. However, it is hard to know how to adapt if the implications of management actions are not understood. Therefore, we conducted a study that allowed us to estimated ticket demand and analyze the changes in the rules associated with the MBR. Stated and revealed preference (SP and RP) raffle ticket data were obtained from an online survey of 2003 MBR participants.[8]

Before we describe the survey, we briefly summarize the benefits of combining SP and RP data.[9] The combined approach gives the researcher an opportunity to identify the economic effects of a proposed (i.e., hypothetical) policy change while anchoring intended or planned responses to actual market behavior (Englin and Cameron 1996; Boyle 2003). The combined approach not only expands the range over which there is data on individual behavior, improving parameter estimates; but also allows a researcher to separate the effects of a price change from the effects of other factors (Englin and Cameron 1996; Rosenberger and Loomis 1999).[10] The primary caveat associated with the combined approach centers on the consistency of the preference structure underlying the SP and RP observations (Adamowicz et al. 1997; Huang, Haab, and Whitehead 1997). Researchers must also address how much information is contained within the SP relative to the RP data (Herriges, Kling, and Azevedo 1999). The approaches taken to address these issues vary considerably across studies, and numerous methodological considerations remain. Against this backdrop, the focus here is on the practical issue of estimating ticket demand, price elasticity, and revenues under different policy regimes. Such basic information is critical to gaining a better understanding of how the Trust approaches the matter of financial self-sustainability.

The 2003 MBR ticket orders provided the population frame for the survey (see Table 1).[11] Most ticket orders included an e-mail address. Mail surveys were sent to individuals who did not provide a complete e-mail address. Respondents who were con-

[8] Given the dissemination of Internet technology, Web-administered surveys have received increasing attention (Champ 2003). The validity of estimates derived from data acquired by online survey is questioned because many individuals (in the United States) still do not have access to the Internet (Champ 2003). The lack of technical penetration suggests that estimates may suffer from sample selection bias and coverage error problems. In one examination, researchers found that backgrounds of Internet users diverge, significantly, from the general populace (Best et al. 2001). In addition, the design methods used in the development of online surveys and the effects that such factors have on response rate, sampling bias, and coverage error are just now receiving attention (Best et al. 2001). Results of these studies indicate that precautions must be taken to develop a reliable survey instrument (e.g., testing Web browser compatibility, employing a user-friendly interface, and providing alternative modes) (Dillman 2000; Champ 2003).

[9] Sample copies of the survey are available at: www.faculty.uaf.edu/ffjml1/.

[10] The question when combining RP-SP data is whether or not the underlying preferences are the same (Nestor 1998). Englin and Cameron (1996) found that they were not. Nestor (1998) finds mixed results in her analysis of the same issue. As generally discussed, the fundamental problem is one of hypothetical bias in the SP responses. In this context, we only have RP ticket purchase data at a single price. This limits the number of tests for preference consistency that could be constructed (e.g., a test of equality between slope parameters for RP and SP observations).

[11] Our sample frame (participants from 2003) limits what can be said about movements into and out of the market at different prices. In particular, we cannot identify non-participants who would enter because of a lower price, rules change, or both. We do have information on those sample respondents who indicate an intention to leave as their choke prices are reached. Finally, it should be noted that given an unchanged ticket price and a decline in revenues between 2003 and 2004, any actual program entry that might have occurred because of the quota appears to have been at least offset by those individuals choosing to leave due to the policy.

TABLE 1
STUDY SAMPLE SIZE

2003 Elk Hunt orders	3,475
Duplicate orders	232
Initial sample	3,243
Orders with E-mail address	2,254
Duplicate E-mail addresses	296
Initial E-mail sample	1,958
Initial standard mail sdample (with no e-mail but complete addresses)	902

TABLE 2
SURVEY RESPONSE RATES

	E-Mail Survey (with two follow-ups)	Standard Mail Survey (with single contact)
Number of surveys sent	1,958	1,273[a]
Undeliverable or duplicate address	384	51
Number of surveys returned	567	154
Response rate	36%	13%

[a] This includes 371 individuals who had invalid e-mail addresses, but complete mailing addresses, and 902 remaining respondents with complete mailing addresses (and no e-mail address).

tacted by e-mail accessed the online survey for a six-week period that ran from the middle of November to the end of December 2004. Along with information that clarified the intent of the survey, participants were given the Web address to a secure login site, an individualized user name, and a four-digit access code. During the login process, respondents' user names and access codes were entered into an electronic registry that was used to update the follow-up contact list. To ensure that the online format would not deter individuals from participating, the letter clearly stated that e-mail and paper formats were available upon request (Dillman 2000). The paper and e-mail versions were identical in content to the online instrument. Response rates are shown in Table 2.

To address the quota, three alternative rules (or policy) scenarios were used. The first scenario was based on the 2003 MBR rules in place prior to the resident permit quota. This scenario serves as the basis of comparison for the analysis. The second scenario employed the 2004 MBR rules, including the resident permit quota. The third scenario used the same 2004 MBR rules but eliminated the resident permit quota. While the resident quota is the primary policy question of interest, it should be noted that there were some minor differences between the number of allocated permits and hunts in 2003 (4 hunts, 48 permits) and 2004 (7 hunts, 72 permits).[12] To ensure respondents understood scenario guidelines, on screen descriptions and explanations of scenario specific rules were provided.[13]

The price of an MBR ticket has remained unchanged at $25 since the program's inception. Respondents were asked to provide the actual number of tickets they purchased at the $25 price for both the 2003 and 2004 quota scenarios. A set of contingent prices was then used to obtain purchase observations at different prices. Stated preference purchases were provided at the prices of $10, $15, $20, $30, $40, and $50. The vector of SP prices used in each scenario was determined based on input from the VCNP staff, a review of the literature, and survey pretests.[14] Nestor

[12] In addition, respondents were allowed to allocate their ticket purchase across the three general weapon categories.

[13] When answering the SP and RP ticket questions participants could refer back to the scenario specific rules by "clicking" on an icon that had been placed on screen.

[14] Two concerns were made apparent in our discussions with VCNP staff. First, the Trust interpreted their mandate as prohibiting charging fees that would be considered excessive across a wide array of visitors. This was interpreted as ruling out charging $100 for a raffle ticket, but left the increase to a $50 price as representing a more reasonable possibility. Second, the Trust, at the time of the survey, was considering reducing the fee for cow-elk raffle permits to $10 (presumably also bounding how low the MBR might theoretically go). As an additional caveat, we note that similarly as with the choice of bid structure in a dichotomous choice contingent valuation study, our chosen price vector may have significant estimation effects (e.g., potential anchoring bias). Recognizing the limitations in our practical policy choices in this case, we leave the issue of optimal

(1998) used 12 different prices in her examination of municipal solid waste programs. Englin and Cameron (1996) (angling trips in Nevada) and Egan and Herriges (2004) (water recreation) both asked respondents to provide the number of trips they would take to a recreation site at three different travel cost levels. Initial inspections of the data revealed that that the range and number of prices performed well in differentiating purchase observations. The $50 price was sufficiently large to ensure that most individuals would not purchase any tickets. A $25 ticket price was not included in the 2004 scenario that excluded the resident permit quota.[15] For the 2003 MBR base rules scenario there is one RP and five SP prices; for the 2004 MBR rules scenario with the quota there is one RP and six SP prices; and, for the 2004 MBR rules scenario without the quota there are six SP prices.[16] When combined, respondents provided ticket purchase observations for 19 prices across all three scenarios (two RP and 17 SP prices). Unfortunately, the fixed RP price of $25 restricts the number of avenues that can be taken to address the consistency of preferences across the two data sets. As one example, we cannot use interactions between an RP indicator and vector of RP prices to test for differences between the slopes of RP and SP demands.

Respondents were asked questions about their perceived probability of winning a permit under the RP purchases, site and hunt attributes that attracted them to the program, other elk hunting options they pursued, and socio-demographics. To identify donation motives participants were asked to indicate "yes" or "no" if they viewed a portion of their purchase as a charitable contribution to the VCNP.[17] Given the dichotomous nature of this question we cannot identify any reasons behind the individual's answer, which might vary from supporting elk habitat improvements specifically to the charter forest concept more generally.[18] Survey participants were asked to provide their home zip code, which was used to tabulate approximate travel distances from the respondent's home to the VCNP using PCMiler®. Travel costs were calculated, using an updated mileage cost of $0.35, following Chakraborty and Keith (2000).

The analysis is based on 709 complete surveys. Variable definitions and summary statistics are presented in Table 3. The overall mean ticket purchase for the sample was 3.91. Roughly 10% of the ticket observations are at the revealed price of $25. The proportions of the price observations under the policy scenario variables QUOTA (2004 scenario with permit quota) and NOQUOTA (2004 scenario without permit quota) variables are 0.36 and 0.31 and differ because there is not a RP observation in the 2004 hypothetical scenario. New Mexico residents comprise 31% of the sample. This is roughly the same proportion (32%) of residents that participated in the 2003 MBR. The difference in the proportions of the resident interaction terms NMRESQUO (New Mexico resident interaction with 2004 quota scenario) and NMRESNQ (New Mexico resident interaction with 2004 no quota scenario) can also be attributed to the lack of an RP observation in the NOQUOTA scenario.

Weapon-type dummies indicate if an individual purchased tickets for that weapon type for any of the SP and RP prices. Rifle hunts are used as the basis of comparison for the weapon-type dummy variables. Close to half of the sample purchased

price design in SP studies of raffle ticket demand to future research.

[15] To reduce the potential for respondent confusion with regards to their observed purchases a $25 price was not included in the hypothetical 2004 MBR rules scenario.

[16] Due to an error, the $10 SP price was not included in the 2003 baseline MBR scenario. The observations at the $10 price for the 2004 MBR scenarios were dropped and an alternate set of demand equations were estimated, which did not substantially alter results presented here.

[17] The exact wording of the question; "Did you view any part of your ticket purchase as being a charitable donation to the VCNP?"

[18] As suggested by an anonymous reviewer, individuals may be willing to donate for a number of reasons, including buying tickets to support the existence of the forest or buying tickets to support the charter forest concept independently of the particular forest.

TABLE 3

VARIABLE DEFINITIONS AND DESCRIPTIVE STATISTICS OF MBR SURVEY DATA

Variable	Definition	Mean	S.D.
TICKET	Ticket purchase at each RP and SP price (count)	3.910	8.493
REVEALED	Indicator of actual ticket purchase (REVEALED = 1 if yes, 0 otherwise)	0.105	0.3069
QUOTA	Indicator variable for 2004 rules scenario with quota (QUOTA = 1 if yes, 0 otherwise)	0.368	0.482
NOQUOTA	Indicator variable for 2004 rules scenario without quota (NOQUOTA = 1 if yes, 0 otherwise)	0.316	0.465
NMRES	New Mexico resident indicator variable (NMRES = 1 if yes, 0 otherwise)	0.312	0.463
NMRESNQ	Interaction term between New Mexico resident indicator variable and 2004 no quota rules scenario (NMRESNQ = 1 if yes, 0 otherwise)	0.098	0.298
NMRESQUO	Interaction term between New Mexico resident indicator variable and 2004 rules scenario with quota (NMRESQUO = 1 if yes, 0 otherwise)	0.115	0.319
MUZZLE	Indicator of ticket purchase made for muzzleloader hunt (MUZZLE = 1 if yes, 0 otherwise)	0.484	0.501
ARCHERY	Indicator of ticket purchase made for Archery hunt (ARCHERY = 1 if yes, 0 otherwise)	0.475	0.499
HOUSE	Number of persons living in household	2.853	1.268
AGE	Respondents age in years	48.904	9.527
EDU	Years of Education (1-20)	15.907	2.363
INC	Midpoint of household income category scaled by $1,000	106.30	
SUCCESS	Indicator variable if hunt success attribute selected (SUCCESS = 1 if yes, 0 otherwise)	0.646	0.478
QUALITY	Indicator variable if game quality attribute selected (QUALITY = 1 if yes, 0 otherwise)	0.915	0.278
PRIVACY	Indicator variable if privacy attribute selected (PRIVACY = 1 if yes, 0 otherwise)	0.670	0.470
BUDDY	Indicator variable if option to bring a companion attribute selected (BUDDY = 1 if yes, 0 otherwise)	0.195	0.396
GUIDE	Indicator variable if availability of optional guide services attribute selected (GUIDE = 1 if yes, 0 otherwise)	0.113	0.316
EXPER	Indicator variable if having past experience on VCNP attributed selected (EXPER = 1 if yes, 0 otherwise)	0.051	0.219
DONATION	Indicator variable if viewed purchase as donation to the VCNP (DONATION = 1 if yes, 0 otherwise)	0.504	0.500
SCENERY	Indicator variable if landscape/scenery attribute selected (SCENERY = 1 if yes, 0 otherwise)	0.329	0.470
NMPUB	Indicator variable if NM public hunts pursued (NMPUB = 1 if yes, 0 otherwise)	0.598	0.490
NMPRI	Indicator variable if NM private hunts pursued (NMPRI = 1 if yes, 0 otherwise)	0.120	0.325
SPUB	Indicator variable if out of state public hunts pursued (SPUB = 1 if yes, 0 otherwise)	0.530	0.499
SPRI	Indicator variable if out of state private hunts pursued (SPRI = 1 if yes, 0 otherwise)	0.123	0.328
TC	Travel cost in $ (divided by 10), calculated following Chakraborty and Keith (2000), where: TC = 0.35*distance + 1/50)*(1/3)*(INC/2080)*distance, and distance is the mileage between the respondent's zipcode and the VCNP	118.054	103.174
Number of respondents		709	
Number of observations		13,471	

tickets for the primitive weapons ARCHERY and MUZZLE. The mean household size (HOUSE) of the sample is 2.85. The mean age (AGE) is 48.90 years. The mean level of educational attainment (EDU) is 15.91 years. Scaled household income (INC) is approximately $106.50. Roughly 65% of the respondents indicated that the likelihood of hunt success (SUCCESS) was one of the attributes that attracted them to the program. Herd quality (QUALITY) was also a very important attribute that attracted respondents to the MBR as approximately 92% of the sample selected this attribute. The mean value for PRIVACY is 0.67. There is also evidence of a possible donation motive as the mean proportion of the variable DONATION is 0.51.

The initial analysis of the MBR made by Little, Berrens, and Champ (2005) drew on zip code level socio-demographic census data. As a check to see if the survey respondents are statistically similar to the aggregate socio-demographics of the ticket order data set analyzed by Little, Berrens, and Champ (2005) a set of cross-comparison *t*-tests on the means of select variables were conducted. Respondent socio-demographic characteristics were aggregated to zip code level census data in order to provide a basis of comparison between all of the 2003 MBR participants and the survey respondents. The results of these tests are presented in Table 4. Of the four variables analyzed, small statistically significant differences were found (0.05 level) with respect to the percentage with a high school diploma and the average household income. Aggregated data of this type is frequently subject to measurement error (Moeltner 2003). The findings of small, statistically significant differences do not necessarily imply that the survey sample is not representative.

Another set of mean comparison *t*-tests were conducted to identify potential differences between the portion of the sample that was contacted through e-mail and the portion of the sample contacted through standard mail. These tests compared the means of the socio-demographic data collected through the survey. Statistically significant differences were found (0.05 level) for age and income. The sub-sample contacted by e-mail was older (mean age = 48) than the respondents contacted by standard mail (mean age = 50). The mean household income was higher for respondents contacted by e-mail ($108,600) compared to those contacted by standard mail ($98,140). Following Nestor (1998) a probit regression with the dependent variable taking a value of one if the respondent submitted a paper (i.e., standard mail) version, and zero otherwise was estimated using the socio-demographic characteristics and the New Mexico residency (NMRES) indicator variable. The inverse mills ratio was calculated and included in subsequent estimations. Although the probit regression showed statistically significant differences in the income and travel cost variables, the inclusion of the inverse mills ratio in the panel regres-

TABLE 4

MEANS AND T-TEST RESULTS COMPARING SURVEY SAMPLE AND TICKET ORDER DATA

Variable	Ticket Order Data	Survey Sample Data	Test Result*
Average household income, for the census tract	57.50	61.00	Significant
Average number of persons in the household with at least high school education, for the census tract	0.83	0.85	Significant
Average household size, for the census tract	2.679	2.673	Insignificant
Number of observations	3,475	709	

* Significant at the 0.05 level.

sions was not statistically significant and was dropped from the analysis.

IV. ECONOMETRIC MODELING AND ANALYSIS

The demand for tickets, q, is assumed to be a function of ticket price, (p), hunt attributes (a), hunt type (w), alternative elk hunts pursued (s), add on costs (l), quota policy scenario (r), socio-demographics (z), and donation value (c):

$$q = f(p,\mathbf{a},\mathbf{w},\mathbf{s},l,\mathbf{r},\mathbf{z},c). \quad [1]$$

Ticket price (p) is treated as continuous and is given by the variable PRICE. Hunt attributes (**a**) have been shown in the literature to be significant descriptors of hunt permit value (Boxall 1995; Scrogin, Berrens, and Bohara 2000). The specific hunt attribute (**a**) indicator variables used in the estimation are SUCCESS, QUALITY, PRIVACY, SCENERY, GUIDE, BUDDY, and EXPER. The dummy variables ARCHERY and MUZZLE are used to control for hunt type, (**w**), with indicators for the standard rifle hunt as the baseline of analysis. Indicator variables are also used to control for the alternative elk hunting opportunities (**s**) pursued by the respondent. These variables are NMPUB (New Mexico public elk hunts), NMPRI (New Mexico private elk hunts), SPUB (out-of-state public elk hunts), and SPRI (out-of-state private elk hunts). Add on costs, (l), are given by the travel cost variable, TC. The indicator variables QUOTA and NOQUOTA are used to control for the alternative policy scenarios (**r**), presented to respondents. The 2003 MBR scenario without the quota provides the baseline.

The specific socio-demographic variables, (**z**), used in the analysis include the continuous variables for age (AGE), number of persons living in the household (HOUSE), years of education (EDU), income (INC) and New Mexico residency (NMRES). Respondents were grouped into eight income categories; the midpoint of each category is used in the analysis and household income (INC) is treated as a continuous variable.[19] The dummy variable NMRES is an indicator of New Mexico residency. Licensing costs are different for New Mexico and out-of-state residents. While these fees are an add-on cost, they were not included in the estimation because of their strong correlation with the residency indicator variable, NMRES.

A number of studies of raffle and lottery participation have incorporated a donation component of individual value (Walker 1998; Cohen 2001; Duncan 2002). While the monetary value of the donation component (c) is unobserved there is information on this motive in the DONATION indicator variable, which is used in the estimated models. This variable does not allow us to attribute the donation to any specific purpose. An indicator variable REVEALED was also included to control for potential difference between RP and SP ticket demand. Again, the lack of price variability in the RP observations restricted us from estimating separate demand equations for both the SP and RP data.

There are two remaining determinants of raffle ticket demand that are unobserved. The individual hunt value is heterogeneous across participants, and, due to uncertainty only partially revealed through the ticket purchase. Likewise, the respondent's subjective assessment of winning (subjective win probability) is also treated as a heterogeneous unobserved characteristic in the estimated model. The unobserved effects and heterogeneous individual characteristics can be controlled within a panel analysis framework.

Unobserved heterogeneity (individual hunt value and subjective win probability) is accounted for differently in fixed effects (FE) and random effects (RE) panel estimation. In FE estimation, unobserved individual heterogeneity is captured within a panel-specific constant and the effect is modeled as a parametric shift of the reg-

[19] Alternative models were run using dummy variables to control for different income categories. Signs and significance of the coefficients were not substantially different than presented here.

ression (Greene 2003).[20] Variables that do not vary within the panel (individual) are absorbed in the intercept. RE estimation treats the unobserved heterogeneity as a unit (panel) specific random disturbance term that is assumed to be uncorrelated (orthogonal) with the observed explanatory characteristics (Greene 2003).

In standard regression individual (or unit) specific unobserved characteristics is not accounted for in the estimation and may influence the results in a manner consistent with omitted variable bias (Hsiao 2003).

The RP and SP raffle ticket purchases are recorded as counts of non-negative integers, which calls for the use of a count based distribution such as the Poisson or Negative Binomial (Cameron and Trivedi 1986; Englin and Cameron 1996; Greene 2003). Cursory inspection of the RP and SP ticket data revealed that the conditional variance exceeded the conditional means at each price level, which suggests that the negative binomial distribution may be more suitable. The RP and SP data were pooled and estimated using both Poisson and Negative Binomial distributions.

Following Hausman, Hall, and Griliches (1984), the application of the negative binomial distribution in the panel framework is possible through the use of a likelihood function that is conditioned on individual heterogeneity rather than group means. Unlike standard fixed effects panel models, the conditional likelihood used in the negative binomial framework allows for the inclusion of variables that do not vary within the panel. The likelihood function developed by Hausman, Hall, and Griliches (1984) is presented in equation [2]:

$$L = \left(\prod_t \frac{\Gamma(\lambda_{it} + q_{it})}{\Gamma(\lambda_{it})\Gamma(q_{it} + 1)}\right)\left(\frac{\Gamma(\sum_t \lambda_{it})\Gamma(\sum_t q_{it} + 1)}{\Gamma(\sum_t \lambda_{it} + \sum_t q_{it})}\right) \quad [2]$$

In general, λ_{it} is defined as $exp(\mathbf{X\beta})$ where $\mathbf{X}$ is a matrix of explanatory variables and $\boldsymbol{\beta}$ is the vector of coefficients and Γ is the gamma function.

We specified and estimated a linear demand function ($\mathbf{X\beta}$) as follows:

$$\begin{aligned} q_{it} &= f(p_{it}, \mathbf{a}_{it}, \mathbf{w}_{it}, \mathbf{s}_{it}, l_{it}, r_{it}, \mathbf{z}_{it}, c_{it}) + do_{it}\beta + u_{it} \\ &= \alpha_i + p_{it}\beta_1 + \mathbf{a}_{it}\boldsymbol{\beta}_2 + \mathbf{w}_{it}\boldsymbol{\beta}_3 + \mathbf{s}_{it}\boldsymbol{\beta}_4 + l_{it}\beta_5 \\ &\quad + r_{it}\beta_6 + \mathbf{z}_{it}\boldsymbol{\beta}_7 + c_{it}\beta_8 + do_{it}\beta_9 + u_{it}, \end{aligned} \quad [3]$$

where, q_{it}, is the number of tickets purchased by individual i at price t. The effects of unobserved characteristics are captured in the unit (panel) specific constant term (α_i). Finally, u_{it} is the random error term. The indicator variable REVEALED is included in equation [3] to control for observed behavior (do).

Results from a likelihood ratio test for overdispersion in the data (χ^2–statistic = 40,177.781) supported the use of the negative binomial distribution. To test for unobserved heterogeneity, negative binomial RE and FE models were estimated and compared against the estimates obtained from the standard negative binomial regression using a likelihood ratio test. Test results identified the presence of individual heterogeneity (χ^2-statistic =, 7,085.79), and thus support the use of the panel estimators. Finally, the Hausman (1978) test was used to select between the random and fixed effects models (Green 2003). The test (χ^2-statistic = 292.83) indicated that the FE specification is preferred.[21]

Fixed effects negative binomial estimates for each MBR ticket demand equation are presented in Table 5. Specifically, equation [3] was estimated using different vectors of independent variables. Models 1 and 3 present "full" specifications that include all the variables in the general specification

[20] By capturing unobserved heterogeneity in a panel specific constant, the estimated coefficients of the fixed-effects model apply only to the units present within the sample (Hsiao 2003), and cannot be used to make reliable inferences about the general population.

[21] Total observations is thus, $i*t$. Here, t, is equal to 19, with two RP prices and 17 SP prices. The number of useable surveys, 709, provides i, so that $i*t$ equals 13,471 total observations. The reported test statistics are based on estimations of Model 3. The tests we report were carried out for each model. Test results were consistent with those reported and are available by request.

TABLE 5

FIXED EFFECTS MODELS OF MBR TICKET DEMAND

Variable	Model 1	Model 2	Model 3	Model 4
PRICE	−0.046***	−0.046***	−0.046***	−0.046***
	(0.001)	(0.001)	(0.001)	(0.001)
REVEALED	—	—	−0.373***	−0.371***
			(0.028)	(0.028)
QUOTA	−0.789***	−0.809***	−0.794***	−0.814***
	(0.025)	(0.025)	(0.024)	(0.025)
NOQUOTA	0.241***	0.228***	0.185***	0.171***
	(0.020)	(0.020)	(0.020)	(0.020)
NMRESNQ	−0.674***	−0.689***	−0.675***	−0.690***
	(0.039)	(0.040)	(0.039)	(0.039)
NMRESQUO	0.633	0.650***	0.628***	0.646***
	(0.039)	(0.040)	(0.039)	(0.039)
NMRES	−0.420***	−0.107	−0.415***	−0.078
	(0.095)	(0.083)	(0.097)	(0.085)
ARCHERY	−0.738***	−0.699***	−0.748***	−0.707***
	(0.063)	(0.060)	(0.064)	(0.062)
MUZZLE	−0.837***	−0.782***	−0.820***	−0.766***
	(0.060)	(0.024)	(0.061)	(0.058)
HOUSE	−0.083***	−0.107	−0.091***	−0.114***
	(0.025)	(0.024)	(0.025)	(0.024)
AGE	−0.006*	−0.009**	−0.006*	−0.009**
	(0.004)	(0.003)	(0.004)	(0.003)
EDU	0.093***	0.085***	0.100***	0.091***
	(0.013)	(0.013)	(0.013)	(0.013)
INC	−0.001	−0.0002	−0.001	−0.0003
	(0.0006)	(0.001)	(0.0007)	(0.001)
SUCCESS	0.338***	—	0.346***	—
	(0.062)		(0.063)	
QUALITY	0.063	—	0.047	—
	(0.102)		(0.104)	
PRIVACY	0.015	—	0.005	—
	(0.068)		(0.070)	
BUDDY	−0.505***	—	−0.525***	—
	(0.073)		(0.074)	
GUIDE	−0.180**	—	−0.183*	—
	(0.083)		(0.085)	
EXPER	−0.341***	—	−0.364***	—
	(0.104)		(0.106)	
DONATION	0.113*	0.110*	0.115*	0.110*
	(0.059)	(0.056)	(0.061)	(0.057)
SCENERY	0.615***	—	0.649***	—
	(0.070)		(0.072)	
NMPUB	0.443***	—	0.449***	—
	(0.063)		(0.065)	
NMPRI	−0.093	—	−0.094	—
	(0.085)		(0.087)	
SPUB	−0.041	—	−0.056	—
	(0.064)		(0.065)	
SPRI	−0.153*	—	−0.148*	—
	(0.081)		(0.083)	
TC	−0.002***	−0.002***	−0.002***	−0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	2.120	2.76	2.181	2.803
	(0.305)	(0.275)	(0.311)	(0.280)
Number of observations *(i*t)*	13,471	13,471	13,471	13,471
i	709	709	709	709
χ^2	7,593.99***	7,207.87***	8,013.25	7,611.00***
lnL	−22,962.631	−23,078.78	−22,874.50	−22,992.605

Notes: Standard errors in parentheses. χ^2 test statistic for overall model significance.
* Significant at 0.10 level; ** significant at 0.05 level; *** significant at 0.01 level.

in equation [1] and differ only in the absence or presence of the REVEALED (*do*) dummy variable, respectively. Models 2 and 4 present "reduced" specifications that exclude the hunt attribute variables (**a**) and the alternative elk hunting opportunities (**s**), and differ in the absence or presence of the REVEALED dummy variable, respectively.

Across all specifications in Table 5 the estimated coefficient on PRICE is of the expected sign (negative) and significant (0.01 levels). Price elasticity of demand is calculated as $E_{p,q} = \beta_1 P^*$, where P^* is the price, β_1 is the coefficient on PRICE (Griffiths, Hill, and Judge 1993). The revenue-maximizing price was found using a point elasticity of -1 (i.e., unitary elasticity) and then solving for price. Thus, -1 was set equal to $-0.046*P$ and then solved for P, which produced a solution of \$21.74. Using the Delta Method, a non-linear Wald test was used to identify whether the revenue-maximizing price was significantly less than the current ticket price. The χ^2-statistic of 107.65 is significant at the 0.01 level suggesting the revenue-maximizing price is significantly lower than the current \$25 price.

In models 3 and 4, the coefficient on the variable REVEALED is estimated to be negative and significant (0.01 level), which indicates that there is an upward bias in the contingent purchases.[22] The coefficients on QUOTA and NOQUOTA are interpreted as shifts in MBR ticket demand relative to the 2003 MBR rules base policy scenario. The negative and significant (0.01 level) coefficient on the QUOTA variable indicates that MBR ticket demand decreased relative to the 2003 base MBR policy scenario without the quota. Once again it is important to note that, in addition to the resident permit quota, more permits were allocated through the 2004 MBR. Even in the presence of an increased number of permits, ticket demand is estimated to decrease under the 2004 QUOTA scenario. The coefficient on NOQUOTA is of the opposite sign (positive) and significant (0.01 level) in each model which suggest that without the quota ticket demand would have increased between the 2003 and 2004 seasons.

The coefficient on NMRES is negative and significant in models 1 and 3 (0.01 level). The coefficient on NMRES is negative but insignificant in FE models 2 and 4. Although the significance of the estimates is inconsistent, New Mexico residents purchased fewer tickets than non-residents, overall. Identifying a single reason why residents are purchasing fewer tickets is difficult. It might be speculated that residents are more familiar with the entire array of elk hunting opportunities in the state, including the state lottery that historically favors residents through a quota restriction on non-resident permits allocated. Such familiarity might also suggest that New Mexico residents have more good substitutes available and in relatively close proximity, and do not attribute any special significance to the VCNP hunt and, consequently, do not purchase as many tickets. The interaction terms NMRESQUOTA and NMRESNQ help identify the direction of resident specific quota effects. The coefficient on NMRES-

[22] Again, the lack of variability in the RP price (\$25) limits the options available for testing the consistency of RP and SP ticket demand. It remains important to explore the matter, and to that end we estimated another set of demand equations drawing on the specifications of Models 1 and 2 and using only the SP data. The estimates were used to obtain a vector of ticket demand predictions at a price of \$25 both with and without the quota. For example, drawing on Model 1, the mean predicted ticket purchase obtained from the estimation using SP data only (with the quota), was 5.59 with a variance of 35.52. By way of comparison, the mean ticket purchase of the 2003 RP data (without the quota) was 3.14 with a variance of 21.81. The mean predicted ticket purchase obtained from the estimation using SP data only (with the quota), was 3.12 with a variance of 29.70. The mean ticket purchase of the 2004 RP data (with the quota) was 1.16 with a variance of 8.70. As a check, we tested the ratio of the variance of the SP-only predictions to the variance of the RP data (with and without the quota) to identify if the value was significantly different from one (χ^2-distributed). Test results confirmed (0.01 level) that the variance of the predicted tickets using the SP data was, in each instance, larger than the variance of the RP data. Results available by request.

QUOTA is positive and significant (0.01 level) while the coefficient on NMRESNQ is negative and significant (0.01 level) across all models and specifications. Such findings might be attributable to residents recognizing that the permit quota shifts the final permit allocation in their favor (by restricting available slots to nonresidents), and in relative terms this causes an increase in resident ticket demand.[23] Again, we cannot make inferences about any new entry, which might be prompted by the quota, and, thus, we only note that the policy has a positive influence on resident ticket demand.

The coefficients on both ARCHERY and MUZZLE are negative and significant (0.01 level) in all models implying that the demand for tickets for archery and muzzleloader hunts is comparatively less than that for the standard rifle hunts. Interestingly, however, close to half of all permits allocated through the MBR are for archery and muzzleloader hunts. The findings suggest that the VCT may be able to generate additional revenue by reducing the number of permits allocated to hunts with lower ticket demand.

Many of the socio-demographic variables are significant across each model and specification. Both the number of individuals living in the household (HOUSE) and age are estimated to be negative and significant (0.01 level) in each model. The coefficient on household income is negative but insignificant in each model, which suggests that MBR tickets are viewed as a neutral good. Income has been found to be a statistically insignificant determinant of hunting demand in a number of studies (e.g., Balkan and Kahn 1988; Sarkar and Surry 1998; Sun, Van Kooten, and Voss 2005).

Individuals who had indicated that the likelihood of hunt success (SUCCESS) and landscape and scenery (SCENERY) attracted them to the program purchased more tickets. While those participants who indicated that the option of bringing a friend (BUDDY) and guide services (GUIDE) purchased fewer tickets. Finally, those who had indicated that a previous experience at the VCNP (EXPER) attracted them to the program also purchased fewer tickets.[24]

The type of alternative elk hunts pursued by MBR participants also influences the ticket purchase decision. In each model, the coefficient on the indicator variable for participation in other New Mexico public hunts is positive and significant (0.01 level). Participation in out of state public hunts appears to be a substitute for the MBR as the coefficient on the SPRI variable is negative and significant (0.05 level) in each model. Travel cost (TC) has a small negative impact on ticket demand (0.01 level).

In all four models, the coefficient on the DONATION variable is positive and sig-

[23] While not explicitly modeled in our ticket demand equation, the relationship between the level of ticket purchases and expected return can be important in small lotteries. The quota changes the relative share of permits allocated to residents and non-residents and, presumably, the expectations of winning. In our survey, the issue is whether the subjective probability of winning was significantly altered under different scenarios. We are limited in what can be said about such changes because we did not directly elicit subjective win probabilities at every price under each scenario; nor did we elicit information on risk attitudes. To accurately gauge respondent's subjective win probabilities with respect to both revealed and stated preference ticket purchase would have required asking a large number (19) of follow-up questions, and pre-tests showed that these were relatively difficult questions to answer. Given our focus on ticket demand, this would have significantly increased the complexity of the survey and, potentially, confused participants. At a more limited level, for the baseline RP data, we did ask respondents what their subjective probability of winning was when they made their purchase. This was intended as a check on identifying individuals who over-estimated their win probability. Thus, this RP perceived odds of winning was classified into three categories, less then 1%, between 1% and 5%, and greater than 5%. Models were estimated using dummy variables based on these categories, and showed that individuals who stated a probability of higher than 5% purchased fewer tickets than those in the other categories (0.01 level). While interesting, this is limited to the RP data, and doesn't allow us to identify differences across scenarios, and doesn't affect other key findings. Results available by request.

[24] The significant and negative coefficient estimate on EXPER may suggest that more informed hunters value VCNP hunting less those who had no previous experience on the preserve, or alternatively may indicate a preference for variety or novelty.

TABLE 6

PREDICTED INDIVIDUAL TICKET DEMAND UNDER ALTERNATIVE POLICY SCENARIOS

	Quota		No Quota	
Price ($)	Tickets	Interval (LL; UL)	Tickets	Interval (LL; UL)
10	3.59	(3.31; 3.91)	8.33	(7.70; 9.02)
25	1.79	(1.56; 1.83)	4.16	(3.88; 4.50)
50	0.57	(0.53; 0.62)	1.32	(1.22; 1.43)
	Quota Donation		Quota No Donation	
Price ($)	Tickets	Interval (LL; UL)	Tickets	Interval (LL; UL)
10	3.80	(3.44; 4.22)	3.39	(3.06; 3.77)
25	1.90	(1.73; 2.11)	1.70	(1.54; 1.88)
50	0.60	(0.55; 0.67)	0.54	(0.49; 0.60)
	No Quota Donation		No Quota No Donation	
Price ($)	Tickets	Interval (LL; UL)	Tickets	Interval (LL; UL)
10	8.82	(7.80; 9.73)	7.86	(7.12; 8.69)
25	4.42	(4.02; 4.86)	3.93	(3.58; 4.34)
50	1.40	(1.27; 1.55)	1.25	(1.13; 1.38)

nificant (0.10 level). Individuals who indicated that they viewed a portion of their purchase as a charitable contribution to the VCNP purchased more tickets than those that did not. Without being able to identify more specific reasons for the contribution, the presence of this apparent donation motive is consistent with theoretical arguments made by Cohen (2001) and Duncan (2002) concerning raffle mechanisms.[25]

In summary, the findings present a number of important implications. First, the quota is estimated to have a significant negative impact on total ticket demand. While the quota does not restrict the total number of available permits, it does alter the relative permit shares available in favor of New Mexico residents and against non-residents. In relative terms, the quota is estimated to have a positive affect on resident ticket demand. Second, participants who viewed a portion of their purchase as a charitable contribution are estimated to purchase more tickets.

Using the results from model 3, ticket demand predictions at the $10, $25, and $50 prices were generated both with and without the quota. Mean ticket predictions are presented in Table 6. The first set of predictions isolates the effect that the resident quota has on individual ticket demand and revenues. For these predictions the QUOTA and NOQUOTA variables are either evaluated at a value of one or zero. The remaining variables are evaluated at their sample means. To highlight donation effects, another set of predictions, were calculated where the coefficients on the QUOTA, NOQUOTA, and DONATION variables were evaluated at one or zero, were calculated; the remaining variables were evaluated at their sample means.

At the $25 price, predicted individual ticket demand and revenues are all markedly lower under the quota. Evaluating the donation coefficient at its mean, predicted individual ticket demand under the quota and is 1.79 tickets with associated revenues per person of $44.70. Without the quota (NOQUOTA is evaluated at one), predicted individual ticket demand is 4.16 and associated revenues per person are $104.05.

Isolating DONATION effects, both with and without the quota, is comparable to separating the individual ticket demands

[25] Inspections of the data revealed that the relative proportions of the DONATION variable as indicated by residents and non-residents are 0.496 and 0.507, respectively. Given the comparable means we chose not expand the analysis toward resident-specific donation affects.

of the average respondents who did and did not indicate a willingness to donate. Using Model 3 estimation results and a $25 price, predicted individual ticket demand when DONATION and QUOTA are both evaluated at a value of one is 1.90 tickets. When QUOTA is evaluated at one and DONATION is evaluated at zero, predicted individual ticket demand is 1.70. The difference in predicted revenues for those who indicated a willingness to donate versus those who did not is approximately $5. By way of comparison, predicted individual ticket demand when NOQUOTA and DONATION are evaluated at one increases significantly. When DONATION is evaluated at one the predicted individual ticket demand is 4.42 versus 3.93 when DONATION is evaluated at zero. The difference in predicted revenues is $11.75.

There are three important points that can be drawn from this analysis. First, the resident permit quota is estimated to reduce individual ticket demand and, hence, revenues. Second, the average respondent who indicated a willingness to donate is predicted to purchase more tickets than the average respondent who did not indicate the same. Recall that Little, Berrens, and Champ (2005) found, assuming a donation value of zero and risk neutrality that the expected participation value of the MBR ranged from −$4 to −$19. The presence of a small positive donation value would help to ameliorate the negative expected participation values seen in that study and would appear to partially, if not fully, explain why individuals are choosing to participate in the MBR. The third impact of the quota is that the policy reduced the predicted revenue differences between the average respondent who indicated a willingness to donate and the average respondent who did not. The predicted revenue difference under the quota was roughly $5 and increased to $11.75 when the quota was removed.

V. DISCUSSION AND CONCLUSIONS

The VCT will continue to be a closely scrutinized experiment in public lands management (GAO 2005). The idea that charter forests can be created from a *tabula rasa* perspective (e.g., see VCT 2004) and somehow dropped whole cloth into the landscape is probably unduly naïve. Successful program implementation, including meeting financial self sufficiency objectives, will require the Trust to actively engage other economic and political agents at a variety of levels (e.g., competition with a wide mix of public, private and tribal entities active in providing big-game hunting, and negotiation over institutional arrangements, etc.). It will also require the Trust to formally develop an economic and social science research program. From an economics research perspective, the focus will not need to be so heavily focused on estimating non-market values (use and nonuse) for these public lands, but rather on estimating demand for raffle tickets or direct fee-based access, associated price elasticity, and revenue generation.

Using data from an online SP-RP survey of individuals who participated in the 2003 MBR, this research investigated raffle ticket demand under alternative pricing scenarios and institutional arrangements. The primary policy question pertained to the New Mexico resident permit quota and its impacts on MBR revenues. However, raffle mechanisms also draw revenue-generating capacity from the willingness of participants to donate to worthwhile causes. A series of predictions were calculated to assess individual MBR ticket demand, donation values, and program revenues both with and without the quota. Fixed effects panel models were used to estimate the demand equations. Four models were estimated; two did not differentiate between RP and SP purchases. The differentiated models used an indicator variable to control for RP observations. Results reveal some interesting insights on which the VCT could draw on for guidance. First, the $25 ticket price appears to fall in the "neighborhood" of the revenue-optimizing price of $21.74. Considering inflation, there does not appear to be a need to change the current ticket price. Second, and most importantly, the estimated models indicate that the resident permit quota has had a detrimental effect on pro-

gram revenues. The mature bull permit raffle remains the critical revenue generator at the site. Prior to 2004 program monies were used to cross-subsidize other recreational pursuits on the preserve. The program also had the added benefit of capturing revenues, with a significant donation component, from individuals who may not access the preserve. Some would argue that the Trust should wait to see if the resolutions reached in the quota-related lawsuits lead to the suspension of the New Mexico resident permit quota. Pursuing policy change through legal channels is costly and time consuming. Such action may not be in the Trust's interest given its essentially probationary status. Alternately, the Trust could negotiate with the state for an exemption from the resident permit quota, as well as a reintroduction of selected permit auctions.

To be clear, the MBR, while the largest, is not the only revenue-generating recreation program on the preserve. The Trust can systematically design and implement pricing and packaging strategies that will maximize the revenue generating potential of programs (hiking, biking, cross-country skiing, wagon tours, etc.) that are not so unencumbered by state regulations on a fugitive resource. It will be incumbent on the Trust to ensure that they do so in a fashion that provides the public with reasonable access opportunities. Combining allocation mechanisms (e.g., lotteries, raffles, and auctions), price discrimination, two-part tariffs, product bundling, and cross-subsidization can all be used to meet both the financial self-sufficiency and access requirements set forth in the VCPA. Implementing adaptive management and developing programs that will achieve these goals requires a substantial amount of economic and socio-demographic information. As the breadth of the VCNP recreation program widens (e.g., recent introduction of a fishing raffle) there will be further opportunities to conduct such analyses. Such steps will also help the Trust to substantively respond to prominent criticisms (GAO 2005) that they have not actively pursued the statutory goal of financial self sufficiency embedded in the charter forest experiment.

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