ANALYSIS TO ASSIST WITH PRICING THE NEW RECREATION PASS

Task #3: Economic Analyses

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1. INTRODUCTION

Here we describe the economic theory and econometric analyses used to help select a price for the new recreation pass (NRP). The following excerpt from the request for proposals (RFP) defines our objective:

> The primary purpose of the [NRP] is to provide convenient access, at a fair price, to federal recreation sites that charge fees….The price selected needs to make sense in economic terms and be defensible and understandable to decision makers and the public. In order to be defensible, the particular price selected will need to be backed up by a set of analyses. The price of the [NRP] should at least allow the government to break even in the sense that, *on average*, the sale of an [NRP] does not result in a revenue loss relative to the revenue that would be received absent the ability to purchase an annual pass. The expected price should also take into account individuals' willingness to pay for the convenience of using a pass as well as any altruistic motives they may have.

To accomplish this goal, we undertake a state-of-the-art contingent valuation analysis of the NRP. An innovative experimental design allows us to contrast the hypothetical purchasing decisions of survey respondents with the actual purchasing decisions of households. As a result, we are less open to a major criticism of contingent valuation analysis—hypothetical bias. Hypothetical bias exists when people overstate their actual willingness to pay (WTP) in a survey. In the present analysis, we account for hypothetical decision-making because we are able to *calibrate* our new price estimates to actual, incentive-compatible purchasing decisions of households. The empirical basis for our analysis is a nationwide telephone survey conducted in the spring of 2006 as part of a larger project that also included focus groups and benchmark comparisons to state park passes. We begin with a discussion of relevant theoretical issues, followed by some methodological concerns.

2. ECONOMIC THEORY

We develop a simple economic model that we use with standard non-market valuation methods to determine a recommended price for the NRP. The chosen price for the NRP will impact the utility that households derive from recreating on federal lands, as well as visitation patterns and agency revenues. These effects should be weighed against any increase in costs (e.g., visitor congestion, air and water pollution, damage to trails and roads, etc.) associated with the chosen price for the NRP. The current analysis, however, focuses exclusively on the benefit side of NRP pricing. A formal analysis of NRP pricing that would incorporate the social costs of increased visitation is beyond the scope of this project.

2.1 Economic Framework for NRP Pricing

Our economic analysis begins with a standard assumption that households choose their expected number of annual trips to federal recreation sites by solving a utility maximization problem involving the current fee and pass structure for federal recreation sites, expected travel costs, and their budget constraint. We do not attempt to model this recreation-demand problem formally; see Phaneuf and Smith (2003) for a review of the recreation-demand literature. Instead, we assume that by stating their WTP for the NRP, households are revealing their optimal choice for expected number of visits to federal recreation sites (details on this assumption below). This greatly simplifies our analysis by allowing us to avoid specifying a full-scale, site-specific model of recreation demand. At the same time our approach offers the flexibility to investigate how various prices for the NRP will influence household purchases of the NRP, the resulting pass revenues and total (pass plus gate) revenues.

The value of the NRP is derived from both use and non-use sources. The NRP is an instrument that provides access to recreation at federal sites, without paying daily entrance or usage fees. We refer to this as *use value*, which can in turn be separated into *convenience* and *economic value*. Convenience refers to the reduced transaction costs associated with using the NRP rather than having to make separate payments for each entrance fee (although some may find an offsetting inconvenience in having to remember to bring the pass for each visit). Economic value refers to the expected cost in entrance fees, given the number of planned visits to recreation sites and the current entrance fee structure. The NRP may also provide agents with a sense of satisfaction in helping to fund the creation and maintenance of federal recreation sites that may be used by others. We refer to this non-use value as *stewardship value*.

In deciding whether to purchase the NRP, households weigh the benefits and costs. The benefits include convenience, economic value, and possible stewardship motives, while the relevant cost is the price of the pass. The household's decision is simple:

NRP Benefits (Convenience, Economic and Stewardship Value) > NRP Price $\Rightarrow$ *Purchase NRP*

NRP Benefits (Convenience, Economic and Stewardship Value) < NRP Price $\Rightarrow$ *Do Not Purchase NRP.*

The policymaker's decision, on the other hand, is to choose the price of the NRP so as to maintain revenue neutrality, as described in the RFP for the project.

2.2 Hypothetical Bias

In generating the appropriate price elasticity and welfare measures, we use traditional contingent valuation methods (e.g., Mitchell and Carson, 1989). A fundamental concern of any contingent valuation study is *hypothetical bias*. Respondents have a well-established empirical tendency to state willingness to pay values that are significantly greater than those revealed in real-market interactions (Diamond and Hausman, 1994; Harrison and Rutström, 2006). While different methods have been proposed to obtain more accurate WTP values from non-market valuation surveys (Boyle, 2003), our study has a built-in mechanism to calibrate hypothetical WTP values with real choices. We take advantage of the fact that the NRP is very similar to the existing Golden Eagle Passport (GEP), which is currently being sold in the marketplace.

Our survey design (described in more detail below) uses revealed-preference data from the GEP market to estimate the degree of awareness and hypothetical bias within our survey sample. We use these estimated calibration factors to adjust WTP values from the survey so they are consistent with the actual choices of consumers. The details of this calibration exercise are shown in Appendix A.

2.3 Calculating Gate Revenues

Initially, we assume that households are motivated to purchase the NRP based solely on its economic value. In other words, they purchase the NRP pass if it reduces the total planned entrance expenses for visitation to federal recreation sites. They do not place any value on convenience or stewardship. Under this assumption, it is straightforward to use our estimated WTP values to project gate revenues associated with various NRP fee levels. Later, we examine the impact of relaxing this assumption.[1]

Consider the case in which a household's maximum WTP for the NRP is greater than the price of the NRP. In this case, the household purchases the pass and contributes nothing to gate revenues. Conversely, if the household's maximum WTP is less than the cost of the NRP, the household will not purchase the pass. If the household's WTP for the NRP is driven by economics, the most they would be willing to pay for the pass would be the exact amount they expect to spend at the gate. This produces a straightforward method for calculating total gate revenues (equation 1, below).

[1] Initially, we also assume that entrance fees remain fixed at current levels. This assumption is not central to the analysis, as we will illustrate by considering, for example, a 10% increase in gate fees over three years.

$$\text{Total Gate Revenues} = \sum_{\text{WTP<NPR Price}} \text{WTP}_i \,. \tag{1}$$

In other words, total gate revenue is estimated by summing up maximum WTP estimates for all households with WTP less than the NRP price. This method for estimating total gate revenues assumes that (i) households do not systematically over- (or under-) estimate the number of trips to federal recreation sites, and (ii) they do not purchase the pass for convenience or stewardship purposes. In Section 6, we relax the assumptions of unbiased forecasts of future trips and also allow for convenience or stewardship purchasers.

2.4 Revenue Neutrality

Marketing of the NRP will impact overall revenues of the various federal land management agencies. Our analyses for pricing the NRP incorporate the constraint that total revenues across all these agencies will not be less than total revenues in the absence of a pass program. The availability of the NRP, however, could also redistribute revenues in a manner that causes the associated revenues of some agencies to increase and others to decrease. It is outside the scope of this project to assess the impact of pricing on the distribution of revenues, or to determine the economically efficient manner in which to reallocate the revenues among the federal agencies.

The existing GEP shares many of the same attributes as the NRP, and is priced at $65. The existing National Parks Pass (NPP) also shares some features with the NRP, and sells for $50. In determining a revenue-neutral price for the NRP, we consider a range of prices both below and above these current levels. Studies such as Navrud *et al*. (1994) claim that many protected areas are incorrectly priced; fees are set arbitrarily without considering the nature of supply and demand for the protected areas. The benchmarking portion of the present project also established that the pricing of passes for state parks (and for Parks Canada) varies widely and unsystematically. Consequently, we consider some of the pros and cons of various prices for the NRP and discuss a menu of options. We reiterate that without reliable data on marginal and average social costs of visitation to federal recreation sites, we are only presenting the benefit side of the analysis. Efficient pricing requires that both benefits and costs be considered and involves a careful balance between economic, social, and ecological objectives. Our focus, however, is limited to revenue neutrality.

Setting a lower price for the NRP will encourage more purchases of the NRP and greater visitation of federal recreation sites, holding all else equal. Whether this increases the revenues generated by the NRP depends on the *price elasticity of demand*. Our measure of the price elasticity of demand is given by

$$\text{Price Elasticity of Demand} = \frac{\text{Change in \# of NRP Purchased}}{\text{Change in NRP Price}} \times \frac{\text{NRP Price}}{\text{\# of NRP Purchased}}. \quad (2)$$

We estimate this elasticity at various prices using our non-market valuation survey design. A lower price for the NRP, however, is also likely to reduce on-site or gate revenues. Revenue neutrality requires that the difference between total agency revenues with and without the NRP program is approximately zero. (We also note that lower prices may help meet educational goals of the NRP program.)

In contrast, setting a higher price for the NRP will tend to discourage NRP purchases. The higher price, however, may increase NRP revenues if the price elasticity of demand is not too high. Gate revenues are also likely to increase if the NRP is set at a higher price, but total visitation may decrease. This effect on visitation may be inconsistent with educational goals of the program, though it may help reduce other social marginal costs and could improve the quality of the visitation experience (e.g., less crowding).

Using our theoretical and econometric model, along with the non-market valuation survey, we will present revenue schedules that consider both the direct revenue from the NRP and the impact on gate revenues. These revenues in turn reflect expected visitation patterns based on the demand for purchasing the NRP at various prices, as estimated from our survey.

3. CONTINGENT VALUATION SURVEY

3.1 Background of Contingent Valuation

How do people value environmental protection? This question has captivated economists for decades. Driven by academic curiosity, Presidential Executive Orders, and court cases over natural resource damage assessment, the United States has witnessed a push to measure values so society can add non-market considerations onto the benefit-cost balance sheets that help shape government policymaking and legal decisions. The same is also true of many other nations, e.g., Sweden, United Kingdom. It might not be an overstatement to say that probably as much collective energy has been spent on defining, estimating, and debating non-market valuation as any other topic in environmental economics. In particular, people have pondered how best to determine non-market valuation with opinion surveys.

We now briefly discuss the contingent valuation (CV) method, one of the most commonly used approaches to estimating economic values for non-market environmental goods like recreation on federal lands.[2] The CV method can be grouped under a broader category of valuation methods called *stated preference* approaches, a category that also includes choice experiments and contingent ranking.

These methods have the common feature that they are all based on surveys in which the public is directly questioned about its willingness to pay (WTP) for certain hypothetical changes in access to natural resource use or environmental quality, or about choices between different "packages" of environmental quality and the price of each package. The contingent valuation method is the most common of these approaches in practice (see e.g., Bateman and Willis, 1999). The CV method originated in the 1960s, it developed rapidly between in the 70s and 80s, and it began to mature in the 1990s. By 2000, Carson et al. had identified over 1,600 CV-style studies, and its use continues to grow worldwide. CV has been sanctioned for use in government decision-making in the U.S. (for example, by the Fish and Wildlife Service), and in environmental damage claims through the courts. In Europe, its use is also spreading, and many government agencies in, for example, the UK, Denmark, Sweden, and Norway have commissioned its use. CV studies are also growing rapidly in developing countries, as part of the assessment of externally-funded environmental projects.

The method is straightforward, in theory. Since the absence of market prices for environmental goods is due to the absence of a market, CV asks people how they would behave *if* such a market existed. For example, a CV survey question could ask:

> "Suppose the best way to improve public access to public land was if all residents agreed to pay a surcharge on their local council tax. What is the maximum you would be willing to pay, per household per year, to improve access?"

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[2] The CV method is typically used to estimate economic values for public goods that are provided in fixed quantity. In this study, however, we are applying the CV method to a private good – the NRP. Unlike other private goods, where the quantity consumed is variable, households are only able to purchase a fixed quantity of the pass (i.e., they can either purchase the NRP or not). The fixed nature of the NRP removes an additional layer of complexity typically present when using the CV methodology to value private goods.

Respondents should be a random sample of the relevant population, which might in different settings comprise the general public, local residents, or visitors to a recreation area. The key point about CV is that respondents are asked what they would be WTP for a hypothetical increase or decrease in access or environmental quality.

There are several main design features of a CV questionnaire:

- People should be given a reason for why they are being asked to pay for something that they currently do not see themselves as paying for.

- A bid vehicle should be *credible*. The bid vehicle is the means by which respondents pay in the hypothetical market. Bid vehicles must be credible in the sense that respondents feel that they could be applied in practice. For example, if the value of a large wilderness area with many access points were being studied, specifying an entrance fee as a bid vehicle would not be credible if people thought it would be impossible to enforce, or if it would be too unpopular politically to imagine it being introduced.

- The CV payment question should be asked in a way that minimizes incentives for respondents to behave strategically, for example by free-riding (under-bidding) or by stating an amount in excess of their true WTP.

- Respondents should be given adequate, unbiased information on the good and its hypothetical market, to let them make an informed judgment.

- A decision has to be made on how to ask the WTP question. This can be done using an open-ended format ("what is the most you would be WTP?") or a dichotomous-choice format. In the latter format, people are asked to say whether they would pay a specific amount, known as the *bid price*. This bid price is then varied across people, which yields yes/no responses to different amounts. Average WTP for the sample can then be inferred statistically from the data.

- "Protest bids" should be identified. When respondents are asked how much they would be WTP, a fraction will give a zero response. For some people, this is because they do not value the good; for others, a zero bid might be because they are *protesting* about being asked the question in this way, or because the hypothetical market is not credible. Protest bidders are often separated out before analysis progresses.

Given all these issues, CV studies usually start by undertaking focus group sessions, in which different scenarios, bid vehicles, information sets and question formats are tested before the full surveying begins. For the present project, a total of seven focus groups were conducted at various sites from coast to coast. After focus groups, the next step is to conduct a survey, whether by mail, through face-to-face interviews, or (as in the present study) by telephone. Once a sufficient sample has been collected, mean WTP is calculated from the sample, using the individual responses (accounting for protest bidders). This sample mean can be aggregated into a population mean. A final stage is to undertake a "bid curve" analysis, where WTP responses are statistically related, generally using some form of regression analysis, to variables thought likely to influence it.

The primary advantages of CV methods include (i) their flexible application to a wide range of non-market situations and (ii) their ability to take into account both use and non-use values. Two main disadvantages of most CV studies are (i) hypothetical bias—people frequently promise to do more than they do in reality, and (ii) scoping issues—people's stated values are insensitive to the amount of the environmental good being provided (e.g., pay $40 for better access to public lands regardless if 10,000 acres or 10,000,000 acres). In the present study, the scope of the NRP is well defined and fixed (one year's access to all federal recreational lands that charge a fee), and hypothetical bias is explicitly addressed.

Hence for present purposes the advantages of the CV approach greatly outweigh its disadvantages, especially by comparison to other methods that might be considered. For example, any attempt to estimate a demand curve from existing data on park visitation or pass sales (either nationally or at the state level) would be severely hampered not only by limitations in the data available, but also by the lack of sufficient variation in price to estimate the complete demand curve. Similarly, a choice experiment (systematically varying both pass attributes and price) would be too complex and confusing for a telephone survey, as would any approach that required detailed recall of travel costs for multiple recent trips to federal lands. The short time frame for data collection (given the statutory mandate to have a new pass in place by 2007) dictated a telephone survey rather than a mail questionnaire or in-person interviewing, and the need for statistically representative sampling ruled out use of an internet survey. In light of these constraints, CV was the preferred method. While the CV method is not perfect, it provides a widely used and well-understood approach to the pricing question. And as noted, in this application we are able to make statistical calibrations to minimize the impact of its chief drawback, hypothetical bias.

3.2 Dichotomous-Choice Formats and Bid Design

Contingent valuation surveys usually ask people to state their values for a good in one of two ways: an *open-ended question* or a *dichotomous-choice question*. An open-ended question asks people to state a willingness to pay amount (How much are you willing to pay per year for good X: $____). The dichotomous-choice (or closed-ended) question, by contrast, asks people to answer "yes or no" to a stated price (Would you be willing to pay $125 per year for good X?). Today, the dichotomous-choice format is perhaps the most common mechanism used in CV work. An advantage of this ''take-it-or-leave-it'' format is that it mimics the decision-making task that people face in everyday market transactions. Common sense suggests that a dichotomous-choice question is easier to answer because people do it all the time.

A drawback of the dichotomous-choice method is that a person's response does not precisely quantify his or her actual willingness-to-pay. The basic take-or-leave-it question—called the single-bounded dichotomous choice—provides only one bit of information about each person's willingness to pay. A "yes" means, in theory, that the person's willingness to pay exceeds or equals the stated price, say $125; a "no" means the willingness to pay was less than that price. But a "yes" does not reveal just how much more than that a person would be willing pay. The researcher can statistically compensate for this lack of information from any one person by selecting a range of prices and asking a large number of people. The researcher increases the information signal by surveying many people. Large survey sample sizes are required to characterize a population's willingness to pay, the downside being that the research might run up against the project's budget constraint. In effect, the full CV study could become too expensive.

In response, researchers have proposed the idea of *follow-up* questions to improve the statistical efficiency of dichotomous-choice surveys. Now a person is asked a sequence of prices so as to narrow down the range of his or her potential willingness to pay. For example, if a respondent said *yes* to paying $125 for the good, a follow-up question could ask whether he or she would pay $245. If he now said *no*, his willingness to pay would be bounded between $125 and $245. A similar procedure would occur if he said *no* to $125, except that the price would now be lower, say $65. If he said *yes* to $65, we know his willingness to pay is bounded between $65 and $125.

There are alternative formats for the follow-up question (see Herriges and Shogren, 1996). The most common is the *double-bounded dichotomous choice* (DBDC) method, which we illustrated above. This is the format used in the present study. The DBDC method asks a person if his or her willingness to pay exceeds or equals a price, say b_M. If the response to b_M is *yes*, the follow-up question asks if his willingness to pay is above a second and higher bid value, say $b_H > b_M$. If the response to b_M is *no*, the follow-up question asks if his value exceeds a lower bid value, say $b_L < b_M$. The sequence of answers puts the person's value into one of four regions: $R_1 = [0, b_L)$, $R_2 = [b_L, b_M)$, $R_3 = [b_M, b_H)$, or $R4 = [b_H, Y)$, where Y denotes the person's income.

Hanemann et al. (1991) demonstrate that, because of the additional information provided by the follow-up question, the DBDC format is asymptotically more efficient than the single-bounded alternative. Combs et al. (1993) use a different sequence of follow-up questions to achieve the same efficiency gains. In their *one-way up* format, the first question asks the person if his or her willingness to pay exceeds the lowest bid value, B_L. If the respondent answers *no*, no further questions are asked. If the answer is *yes*, he or she is asked if the WTP exceeds the second bid value, B_M. Again, a *no* response stops the questioning, while a *yes* response leads to a third and final question—whether the WTP exceeds the highest bid value, B_H. This one-way format yields the same categorization of a person's value as the double-bounded approach, placing it into one of the same four regions defined. Only the sequence of questioning has changed. Either way, such follow-up questions can enhance the efficiency of dichotomous-choice surveys. But other studies have also found that they yield WTP estimates that are substantially different from estimates implied by the first question responses alone (Cummings et al., 1995; Cummings et al., 1997; Carson et al., 2000).

3.3 Survey Design

Our goal with the valuation survey was to link the NRP valuation exercise to real choices and real outside options; respondents answered the new valuation question after thinking about the status quo and their familiarity with the National Parks Pass (NPP) and Golden Eagle Passport (GEP). Our intent was to keep the survey realistic, simple, and quick while still generating reasonable value estimates. When possible, we followed general guidelines established by recent research in this area and by the NOAA panel (Arrow *et al.*, 1993) on non-market valuation methods. Given time constraints and the scale of the project, however, the NOAA panel's recommended face-to-face survey was not feasible. Instead, we conducted a nationwide telephone survey between February and April of 2006, using the facilities for computer-aided telephone interviewing of the Wyoming Survey & Analysis Center at the University of Wyoming. The survey methods were reviewed and approved by the U.S. Office of Management and Budget.

The survey sample consisted of two independent strata. The first stratum was sampled using a national Random Digit Dialing (RDD) draw of households with landline telephones. To enhance the precision of estimates from this part of the sample, it was pre-stratified by the 9 major geographic divisions defined by the U.S. Bureau of the Census, and post-stratified to reflect Census Bureau distributions by geographic division, household income, Hispanic origin, and racial identification. By design, this sample of 1799 responding RDD households represents all 110 million households in the U.S., except for about 30,000 that fall into the second stratum. The second stratum was randomly sampled from a population list of telephone numbers for households known to the National Parks Foundation (NPF) to have purchased a National Parks Pass between April 2004 and March 2005 (i.e, from one to two years prior to the survey). This sample was also pre-stratified by geographic division, and the 1974 responding NPF households were post-stratified to reflect the geographic distribution of the NPF population list. Thus the total sample size across both strata was 3773.

With total NPP sales of approximately half a million passes sold per year, the NPF population list of only 30,629 households covers only a small subset of NPP purchasers; obviously, it covers an even smaller fraction of all U.S. households. The NPF population, and therefore the NPF sample drawn from that population, mainly represents households that purchased the pass on-line. The NPF sampling frame omits the much larger number of households that purchased the NPP in-person at a park, except for those that chose to provide their phone numbers by mailing a reply card to NPF, requesting a park "owner's manual," or sending the NPF a donation. It also omits the roughly 50,000 annual purchasers of the GEP.

Thus, results from the NPF sample are of interest in that they reflect a small but noteworthy group of supporters of the national parks, while the RDD sample comes as close as our methodological and budget constraints allow to being representative of the full spectrum of the population of U.S. households. We focus most of our attention in the analysis to follow on the results from the RDD sample, because it tells us more about the entire potential market for the NRP than does the NPF sample.

Both samples were screened, through questions early in the survey, to eliminate from our analysis those households where anyone qualified for a Golden Age or Golden Access Passport. These lifetime passes, available only to senior citizens and the disabled, effectively remove a household from the market for an annual GEP, NPP, or NRP. Households that had not visited any federal recreation lands in the past two years were also screened out of the analysis, on the assumption that they would not be part of the relevant market either. After screening, the RDD sample provided 529 cases for analysis and the NPF sample provided 1491 cases. We analyze these two strata separately, since if they were combined and properly weighted to reflect their relative population sizes, the combined results would be virtually indistinguishable from an analysis of the RDD sample alone. Further details regarding survey design, sampling, and weighting can be found in the full survey report.

In general, the survey questionnaire can be broken into four stages:

1) *Awareness of GEP/NPP*: The interview began with an introduction, some screening questions, and a short series of items about the household's recent recreational experiences on federal lands. The interviewer then asked whether the person was aware of the GEP/NPP. This question grounded the person in the real outside option that currently exists that is closest to the NRP we are trying to value. If YES, the person moved to Stage 2 (described below). If NO, the person moved to Stage 3.

2) *Status Quo*: The interviewer then asked whether the household has purchased a GEP or NPP. If YES or NO, the person moved to Stage 3.

3) *Purchase of the NRP*: After the interviewer provided a short description of the NRP (which has approximately the same attributes as the GEP), we asked if the household would be willing to buy—binary choice, YES or NO—the NRP at a randomly selected bid value. For some respondents, the random bid value was the current GEP price. For these cases, the question allows us to compare hypothetical purchasing decisions to the real purchasing decisions in Stage 2. If YES or NO, the experiment continues to stage 4.

4) *Follow-up Valuation Question*: We can more precisely pinpoint the valuation distribution if we have the interviewer ask a follow-up valuation question. If a YES in Stage 3, we increase the price and ask YES or NO again; if a NO in Stage 3, we lower the price and ask again.

4. ECONOMETRIC MODEL

Our econometric model estimates WTP for the NRP, which in turn can be used to forecast NRP and gate revenue at various NRP fee levels. We use an interval regression model that follows directly from the double-bounded dichotomous-choice (DBDC) survey design described above (Hanneman et al., 1991; Herriges and Shogren, 1996).

Start by writing the empirical model in terms of a household's maximum willingness to pay (WTP) for the NRP, which is derived from the utility received from visiting federal recreation sites. The model is

$$WTP_i = \exp(X_i'\beta + \varepsilon_i), \tag{3}$$

where WTP_i is unobserved willingness to pay for the NRP; X_i is a vector of explanatory variables; β is a vector of coefficients; ε_i is a mean-zero normal error term with variance σ^2; and $i = 1,..,N$ is the sample size. The exponential functional form guarantees that predicted WTP will not be negative. Given expression (3), the probability of purchasing the pass can be represented as

$$P_i = \Pr(y_i = 1) = \Pr(WTP_i \geq \ln(\$b_i)) = \Phi(\frac{1}{\sigma}(X_i'\beta - \ln(\$b_i))), \tag{4}$$

where y_i is a binary variable defined above and b_i is the proposed price of the NRP. The initial bids are chosen at random from the following bid vector:

$$b = (\$25, 45, 65, 85, 105, 125, 145, 165). \tag{5}$$

We selected the range of bids based on the focus groups and on the benchmarking analysis of other recreation pass programs.

As described at the end of Section 3.3, we then ask a follow-up bid which is randomly selected from either b^H = (b+$20, 2*b-$5) if the respondent accepts the bid or b^L = (b-$20, 0.5*(b+$5)) if the respondent declines. If a respondent says "no" to both bids, we ask a follow-up question with a bid equal to *zero*. The relevant probabilities of purchasing a pass within each range of prices are

$$P_{i1} = \Pr(-\infty < WTP_i < 0) = \Phi(\frac{1}{\sigma}(X_i'\beta)) \quad (6.1)$$

$$P_{i2} = \Pr(0 < WTP_i < b_i^L) = \Phi(\frac{1}{\sigma}(X_i'\beta - \ln(b_i^L))) - P_{1i} \quad (6.2)$$

$$P_{i3} = \Pr(b_i^L < WTP_i < b_i) = \Phi(\frac{1}{\sigma}(X_i'\beta - \ln(b_i))) - \Phi(\frac{1}{\sigma}(X_i'\beta - \ln(b_i^L))) \quad (6.3)$$

$$P_{i4} = \Pr(b_i < WTP_i < b_i^H) = \Phi(\frac{1}{\sigma}(X_i'\beta - \ln(b_i^H))) - \Phi(\frac{1}{\sigma}(X_i'\beta - \ln(b_i))) \quad (6.4)$$

$$P_{i5} = 1 - (P_{i1} + P_{i2} + P_{i3} + P_{i4}). \quad (6.5)$$

The log likelihood function is then given by

$$\ln L(\beta,\sigma) = \sum_{i=1}^{N}\sum_{j=1}^{5} w_{ij} \ln P_{ij}(\beta,\sigma), \quad (7)$$

where w_{ij} is a binary variable equal to one if household *i* chooses category *j*. We then choose β and σ to maximize the likelihood function. With estimates of β and σ in hand, we form WTP estimates for every household in the sample. From the household WTP estimates, we generate predictions for the relevant revenue functions, as defined below.

5. ECONOMETRIC RESULTS

We now present the empirical estimates of household WTP, demand elasticities and revenue functions. We present two types of estimates: unconditional and conditional. The *unconditional* estimates do not rely on any economic or econometric model.[3] Thus, they directly reflect households' "yes" or "no" responses to the various bids presented in the CV analysis. These are unrestricted Turnbull distribution-free estimators (see Haab and McConnell, 2002). The *conditional* estimates are based on the parametric models and methods outlined in Section 4.

All elasticity and revenue figures presented, unless otherwise stated, are calibrated for hypothetical and other biases and omit as protest bidders all households that said they would not accept the NRP even if it were free. As is shown in A, the biases in the RDD sample are much larger than those in the NPF sample.

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[3] The sole exception is the model-derived adjustment for hypothetical bias, as outlined in Appendix A.

This result is to be expected and confirms previous research that experience helps mitigate valuation biases (List and Gallet, 2001; Murphy et al., 2005; List, 2001). See Appendix A for additional details on the calibration for awareness bias, hypothetical bias, and external bias.

5.1 Unconditional Estimates

We present three revenue functions – NRP, gate and forgone revenues. *NRP revenue* is defined as the revenue generated directly from the sales of the NRP and does not consider gate revenues. *Gate revenue* is the revenue generated from on-site entrance fees at federal recreation sites. *Forgone revenue* is defined as total (NRP and gate) revenues without the pass program in place, less total revenues with the pass program. If forgone revenues are positive, the NRP program is *revenue losing*. If forgone revenues are zero, the NRP program is *revenue neutral*. If forgone revenues are negative, the NRP program is *revenue generating*. These three revenue functions are calculated as follows:

- NRP Revenue. NRP revenue is calculated by multiplying the NRP price (P_{NRP}) times the number of households in the sample with WTP greater than the NRP price (N_{YES}). Gate revenue is then scaled up to the relevant population (all households, or NPF households)[4].

  $$\text{NRP Revenue} = (\text{Population Scaling Factor}) \times (P_{NRP}) \times (N_{YES}). \quad (8)$$

- Gate Revenue. Gate revenue is calculated using the formula in (1), that is, by summing up WTP for all households in the sample that have WTP less than the NRP price. Again, these revenues are scaled up to the relevant population figures.

  $$\text{Gate Revenue} = (\text{Population Scaling Factor}) \times \sum_{\text{WTP<NPR Price}} \text{WTP}_i \quad (9)$$

- Forgone Revenue. Forgone revenue is calculated by summing up household WTP for every household in the sample (i.e., total gate revenue in the absence of a pass program), scaling this value up to the population, and then subtracting NRP plus gate revenue (as defined above).

[4] The population scaling factors for the RDD and NPF samples are 57,108 and 15.47, respectively. In other words, each household in the RDD (NPF) sample represents 57,108 (15.47) households in the corresponding population.

$$\text{NRP Revenue} = (\text{Population Scaling Factor}) \times \sum \text{WTP}_i - (\text{NRP} + \text{Gate Revenue}) \qquad (10)$$

5.1.1 NRP Revenue Functions

Because the unconditional estimates are based directly on the "yes" and "no" responses to discrete bids, the underlying NRP revenue functions are discontinuous and resemble step functions.[5] In Figures 1 and 2, we present the unconditional revenue functions for the RDD and NPF samples. The details, as well as predicted number of passholders, are presented in Table 2, omitting bid values at the extremes (bids less than $45 or greater than $125) for the sake of simplicity.

The NRP revenue functions reach maximums at approximately $35 and $45 for the RDD and NPF samples. For the RDD sample, NRP revenues fall rapidly between $50 and $60 and then level off between $60 and $160, after which pass revenues again begin to fall more rapidly. In the NPF sample, the decline in pass revenues after the peak is steady out to $250. The degree of sensitivity of NRP revenues to NRP price reflects the elasticity of the underlying demand curve for the NRP.

5.1.2 Revenues and the Price Elasticity of Demand

NRP revenues are systematically related to the *price elasticity of demand*. The price elasticity of demand for the NRP is defined in equation (2) as the percentage change in households that purchase the NRP for a given percentage change in the NRP price. On the upward-sloping portion of the NRP revenue function, the demand function is generally inelastic—people are relatively unresponsive to an increase in NRP price (i.e., the price elasticity of demand is less than one in absolute value). This implies, for example, that a 10% increase in the NRP price results in less than a 10% reduction in the quantity purchased. Here overall pass revenues increase as price goes up—the additional revenues gained from people continuing to purchase the pass exceed the lost pass revenue from those who cease to purchase the pass.

[5] In order to calculate the unconditional revenue functions we assume that the household's true WTP is at the midpoint of the chosen bid interval. Households that answer "Yes" to both bids are assigned a WTP equal to $10 plus the high bid. Households that answer "No" to both bids, but "Yes" when asked if they would accept the new pass for free, are assigned a WTP equal to half the lower bid. Those that reject both bids, and also say they would not accept the pass for free (67 households in the RDD sample and 30 in the NPF sample), are treated as protest bidders and are omitted from the analysis.

Conversely, on the downward-sloping portion of the NRP revenue function, the demand curve is generally elastic—people are relatively responsive to an increase in NRP price (i.e., the price elasticity of demand is greater than one in absolute value). This implies that a 10% increase in the NRP price results in more than a 10% reduction in the quantity purchased. Now overall pass revenues decrease, as the additional revenue gained from people continuing to purchase a higher priced pass does not cover the lost revenue from those who stop purchasing the pass. For linear demand curves, peak revenues occur when these two effects are balanced and demand is said to be unitary elastic (i.e., the price elasticity of demand is equal to negative one).

Table 1 shows the unconditional price elasticity of demand for various NRP prices corresponding to the RDD and NPF demand curves in Figure 3, as well as the percentage of households that will purchase the NRP. Although the demand curves in Figure 3 are not entirely linear, the peak NRP revenues in Figures 1 and 2 are consistent with the elasticities in Table 1 – the peaks correspond to the range where elasticities first change from inelastic to elastic. Also notice in Table 1 and Figure 3 that the region where the RDD demand curve flattens out, and the elasticities become smaller, corresponds to the area of gradual decline in the NRP revenue function.[6]

5.1.3 Gate Revenue Function

Gate revenues are shown in the second panels of Figures 1 and 2. As discussed in Section 2.2, we project the level of gate revenues based on households' maximum WTP for the NRP (i.e., the most households should be willing to pay for the NRP is the amount they expect to spend at the gate). For completeness, the RDD gate revenue function begins where the price of the NRP is zero. Gate revenues at that point could only be generated from households that are unaware of the pass program.[7] As the NRP price goes up, gate revenues increase as households with a maximum WTP less than the pass price choose instead to

[6] The price elasticities in Table 1 are not restricted to be monotonically increasing with price. Consequently, it is possible that the demand curve may exhibit an upward slope for some price intervals. This is a small-sample problem that would disappear if the sample size increased. Although not implemented here, we note that Haab and McConnell (2002) outline a procedure to 'smooth' the demand curve so the elasticities would monotonically increase with price.

[7] Projected gate revenues are based on the assumption that the fraction of unaware households in the population does not vary with the NRP price. We recognize that this assumption is questionable at low NRP prices (i.e., word is likely to spread fast if the NRP price is set at or near zero). However, these low prices are also likely to be outside the practical range for public policy, and hence little or no attention need be given to the extremes of any of the revenue functions.

pay the gate fees. Gate revenues flatten out at their maximum level once the NRP price reaches about $200 and there are few NRP purchasers remaining.

5.1.4 Forgone Revenue Function

The third panels of Figures 1 and 2 show the forgone revenue functions. Forgone revenues are positive (revenue losing) and decreasing with NRP price. As the NRP price increases, forgone revenues approach "revenue neutrality" (i.e., zero) near a price of about $175 for both samples. If policymakers are mainly concerned with revenue neutrality, the results from Figure 1 and Table 2 suggest that in the general population the price may need to be set at $125 or higher to avoid sacrificing substantial revenues. We note that, based on the benchmarking part of this project, $125 is equal to the current cost of an annual pass for California's state parks, and considerably less than the price of an annual pass for Parks Canada.

Note too that, whatever base price is chosen, it could be adjusted to account in advance for likely future increases in gate fees. Plausibly, the NRP might see cost of living adjustments no more than once very three years, whereas gate fees might be increased more often. Assuming that over a three-year period gate fees increase by 10%, then the selected NRP price would need to include a 10% premium at the outset to ensure that it will still satisfy the revenue neutrality constraint by the end of the three years. Other premiums might also be warranted. For example, if third-party vendors of the NRP are allowed to keep a percentage of the sales price as a reward for their efforts in marketing the pass, then the price will need to be set high enough to insure that the net pass price, after subtracting vendor commissions (and any other distribution costs), equals the desired revenue-neutral price.

The *unconditional* numbers presented above do not control for any household characteristics or make any parametric assumptions regarding the distribution of error terms. In the next section, we turn our attention to the model-based *conditional* WTP and revenue results.

5.2 Conditional Estimation

5.2.1 Baseline DBDC Model

The results from the double-bounded discrete choice (DBDC) model are presented in Table 5. Protest households (i.e., those that refuse the pass for free) are excluded from the analysis. As compared to the rest of the sample, protest households (N=67 for RDD; N=30 for NPF) tend to be older, less educated, lower income, less likely to be white, and more likely to reside in the northeast (PA, NY and NJ) and great plains (IA, KS, MN, MO, ND, NE and SD) states. The model is estimated allowing for heteroscedasticity associated with the size of the initial bid. In this section we summarize the general results from the model, before turning specifically to the estimated revenue functions in the next section. Throughout, we exclude households that refuse the pass for free as this is consistent with the original screening decision to exclude households that have not visited any federal lands recently and therefore are unlikely to participate in the market for the NRP.

First, we discuss the estimated relationship between WTP and the explanatory variables.[8] The results vary across the samples, but a few patterns do emerge. We find that WTP is higher for households where the responding adult …

- reports being more likely to purchase if all the revenues were used for service and facilities at federal recreation sites (RDD and NPF samples).
- is a woman (NPF sample).
- holds a professional degree (NPF sample)
- is Hispanic (RDD sample)

Those who are not willing to pay as much ….

- are infrequent visitors to federal recreation sites (NPF and RDD samples)
- have low income (NPF sample)[9]
- are African American (RDD sample)
- reside in the west north central (WI, OH, MI, IN, IL) region (RDD sample).

Second, we turn to the heteroscedasticity results. Heteroscedasticity – a violation of the classical assumption that the error variance is constant across observations – is a common feature in household

[8] Although not explicitly modeled here, a potential source of explanatory power is the distance to all nearby federal recreation sites. Measurement of this variable is difficult for various reasons: (i) many federal recreation sites have multiple points of entry (e.g., national forests), (ii) the definition of 'nearby' is arbitrary, (iii) not all recreation sites are equally attractive recreation areas, etc. For these reasons, we do not include this spatial variable in our empirical analysis but leave it as a possible avenue for future research.

[9] We investigated models with a larger number of income categories (as opposed to just low income (<$50K) and high income (>$50K)), but found all the coefficients were statistically insignificant.

survey data. In the case of the DBDC model, we have built-in heteroscedasticity because the survey design generates bid intervals of varying length. There is naturally more uncertainty in the true WTP values for households receiving wider bid intervals. We use the initial bid to proxy for interval width, since the bid design automatically tends to create larger bid intervals when the initial bid is higher (see Section 4 above). In the NPF sample, we find the likelihood ratio statistic testing for the existence of heteroscedasticity is large and leads us to reject the null of homoscedastic errors. The RDD sample does not exhibit significant heteroscedasticity.

Third, we present calibrated mean and median WTP figures at the bottom of Table 5. The calibrated mean and median WTP values for the RDD sample are approximately $30 and $24, indicating a WTP distribution that is slightly skewed toward higher WTP values. The calibrated mean and median WTP values for the NPF sample are substantially higher at approximately $73.[10] The entire WTP distributions for the RDD and NPF samples can be found in Figure 5.

We emphasize that the mean (or median) WTP values do not imply revenue neutrality. Revenue neutrality requires that revenues with the pass program be no less than revenues without a pass program. As previously discussed, choosing this revenue-neutral price depends on the elasticity of demand and the revenue functions, not on mean or median WTP. Setting the NRP price equal to median WTP, for example, would likely result in substantial revenue losses because half the population would have a higher WTP than the pass price. The high WTP for the pass indicates that this group expects relatively high gate expenses but will instead purchase the pass and save money. This would generate a revenue loss for federal agencies.

Revenue issues aside, mean or median WTP does not necessarily indicate a "fair" price, either. A low-priced pass mainly benefits those who visit federal lands more often, by allowing them to enjoy a lower effective cost per visit. In that sense, a pass subsidizes those who, because of geography, live closest to federal lands. It also subsidizes those who, because of economic circumstances, can best afford to travel to federal lands. It is far from self-evident that either kind of subsidy should be regarded as "fair."

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[10] We also estimated a single-bounded dichotomous-choice (SBDC) WTP model. (The results are not shown here but are available upon request from the authors.) The predicted NPF WTP distributions and coefficient estimates from the SBDC model are very similar to the results from the DBDC model. For the RDD sample, the calibrated mean and median WTP from the SBDC model are approximately $7 lower than from the DBDC model, but the coefficient estimates are qualitatively similar.

Fourth, we discuss how well the model fits the data. Unlike standard linear models where R^2 is the conventional goodness-of-fit measure, discrete-choice models do not have a single agreed upon measure. Two common measures are (1) the pseudo-R^2 and (2) a frequency table of correct predictions (Greene 2003, pp. 683-685). The pseudo-R^2 is reported in Table 5 and the table of correct predictions is shown in Table 6. The pseudo-R^2 is about 0.06 for the RDD sample and about 0.02 for the NPF sample. Although this measure is theoretically bounded between zero and one, intermediate values do not have the convenient interpretation of being the percentage of variation in the dependent variable explained by variation in the right-hand-side variables. Nevertheless, these pseudo-R^2 values are small numbers and in comparison with other dichotomous-choice models they indicate at best a modest fit.

Table 6 summarizes the number of correct predictions within the four WTP intervals. Overall, the model for the RDD and NPF samples correctly predicts over half of the households (54% and 56% correct). Similar to the pseudo-R^2 measure, this indicates that the model produces a modest fit. In the RDD sample, the model does a much better job of predicting WTP for households on the low end than on the high end of the WTP distribution. As a result of the poorer fit at the high end, the predicted elasticities tend to be larger at higher prices (i.e., the model tends to incorrectly predict that the survey respondents will not purchase the pass at high prices). Hence, the corresponding revenue functions show a sharper decline than the unconditional revenue estimates (e.g., compare the price elasticities in Tables 1 and 7 in the price range between $65 and $105). In the NPF sample, prediction is also above average at the low end, but is best at the high end of WTP.

Taken together, these various indications of the questionable fit of the econometric model incline us to give more credence to the unconditional results than to the more elaborate, but probably less robust, findings from the multivariate model. Nevertheless, we next summarize the model-based revenue results.

5.2.2 NRP, Gate and Forgone Revenue Functions

The estimated NRP, gate and forgone revenue functions from the econometric model (i.e., conditional results) are presented in Figures 6 and 7.[11] Recall, all these revenue functions are calibrated for awareness, hypothetical and external bias as described in Appendix A. The calibrated NRP revenue

[11] The NRP revenue functions for the RDD sample tend to be steeper on the downside of the curve than the corresponding functions from the unconditional estimates. This is a reflection of the fact that the econometric model and maximum likelihood estimation tend to have more difficulty in accurately predicting the smaller number of households that place themselves at the tails of the WTP distributions. See Greene (2003, page 685).

functions for the RDD and NPF samples are maximized at approximately $25 and $60. These peaks correspond to the point at which the estimated price elasticity of demands turn from inelastic to elastic, as shown in Table 7.

Once again, we focus mainly on the RDD sample that is more representative of the general U.S. population. As in the unconditional results, gate revenues increase with NRP price, and positive gate revenues at a zero price reflect households not aware of the pass. Gate revenues are predicted to level off once the pass price reaches approximately $65 (RDD) to $100 (NPF).

Forgone revenues, as defined in Section 5.1, are positive and reflect the notion that if households value the pass exclusively for its expected savings in entrance and usage fees, then it is a revenue-losing program. Yet, Figure 6 shows that once the price reaches about $65, the vast majority of the general population is predicted to no longer purchase the pass, and the program will approach revenue neutrality. In the NPF population, the conditional estimates indicate that revenue neutrality would require a pass price of nearly $100.

6. ALTERNATIVE ASSUMPTIONS: CONVENIENCE, STEWARDSHIP, AND TRIPS

In all of our results so far, we assume that households are motivated to purchase the NRP based on its *economic value*. That is, people purchase the NRP pass because doing so results in a savings in expected at-the-gate expenses for visiting federal recreation sites. This assumption has some empirical support: 83% of the RDD sample (and more than 90% of the NPF sample) state that "the number of times the household expects to visit federal lands" and "the price of the pass compared to the cost of entrance fees" are important reasons to purchase the pass. But there are other reasons a household may purchase the pass. First, the household may receive *convenience value*, which refers to the reduced transaction costs associated with using the NRP rather than having to make separate payments for each entrance fee. Indeed, a smaller but still substantial fraction of the RDD sample (76%) state that "the convenience of one annual pass" is important. That figure is even higher in the NPF sample (94%). There may also be *stewardship value*, if the household views the NRP as a method for contributing to the maintenance and improvement of federal lands and facilities. And households may systematically *over-estimate* the number of expected trips to federal recreation sites or the associated entry fees. Any of these factors (and perhaps others) might encourage households to purchase the NRP at a greater rate than the basic "economic" assumption would imply. Consequently, our estimates to this point represent a lower bound on the demand for the NRP pass based on economic considerations.

We believe the economic rationale for purchasing the pass is reasonable. However, the modest fit of the multivariate model, and in particular its poor prediction of WTP for households on the upper end of the WTP distribution in the RDD sample, may indicate that non-economic factors also come into play, especially for those with high WTP. The open-ended survey questions reveal that a few households do express stewardship concerns. Furthermore, in the multivariate model the coefficient for ALL REVENUE, which could be considered a weak proxy for stewardship, is a positive and statistically significant predictor of WTP. In addition, the average expected number of trips within the next year (3.58 and 5.98 for RDD and NPF) are slightly higher than the average number of typical trips (3.09 and 5.89), which might indicate some over-estimation of upcoming trips.[12]

To explore these possibilities, we allow 20% and 40% of the WTP for the NRP to be derived from convenience, stewardship concerns, trip over-estimation, and/or other "non-economic" factors. It should be noted that these percentages are strictly illustrative, as we are unable to directly estimate the non-economic component of WTP.

The forgone revenue curves in Figure 8 show that rather than being a *revenue loser*, the NRP program could actually become a *revenue generator* for NRP prices greater than $60 – but only if nearly 40% of the value of the NRP is due to stewardship or other non-economic factors. This seems unlikely given that our survey shows limited evidence of stewardship purchasers and little systematic over-estimation of visitation to federal recreation sites.

7. SUMMARY OF ECONOMIC AND ECONOMETRIC ANALYSIS

- The NRP provides access to federal recreation sites for a year at a one-time fixed price, and also offers a way to make stewardship contributions toward the support of federal lands.

- Our survey results suggest that it is reasonable to treat the decision of whether to purchase the NRP as driven primarily by "economics". That is, households compare the total expected costs

[12] For both samples, the estimated and actual average numbers of trips are not statistically different from one another at a 10% significance level.

from visits to federal recreation sites with the price of the NRP. If total expected costs are greater than the price of the pass, they purchase the pass. Otherwise, they pay the gate fees.

- Selecting an appropriate price for the NRP requires balancing different objectives:
  - Setting a high price for the NRP is more likely to maintain revenue neutrality.
  - Setting a low price for the NRP may sacrifice federal dollars in the form of lost gate revenues but may be desirable to increase visitation to federal recreation sites.

- If desired, whatever base price is selected can be adjusted upward to account in advance for future cost-of-living increases in gate fees, or for the anticipated costs of marketing and distribution.

- Using the econometric analysis and standard contingent valuation methods, we estimate that WTP for the NRP is significantly related to factors such as (i) desire that pass revenues be used for maintenance and service of federal recreation sites; (ii) number of typical visits; (iii) income; (iv) race; (v) gender; and (vi) region.

- Using the raw contingent-valuation data, we estimate that NRP revenues will be maximized in the range of $35 to $45, but such a pass price would result in substantial forgone gate revenues.

- In order to minimize the overall forgone revenues, NRP will need to be set well in excess of the current $65 for the Golden Eagle Passport. Assuming households do not substantially over-estimate the number of trips to federal recreation sites and do not place substantial stewardship value on the pass, a pass price of $100, for example, is predicted to generate revenue losses that are less than 10% of total pass and gate revenues. A pass price of $125 or above should come close to revenue neutrality with gate fees at their current level.

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Table 1. Price Elasticity of Demand and Percent Responding "Yes" (Unconditional Estimates)

RDD Sample (N = 462)			NPF Sample (N = 1461)		
Price	Percent Responding "Yes"	Elasticity	Price	Percent Responding "Yes"	Elasticity
25	4.3%	--	25	63.8%	--
45	3.0%	-1.01	45	56.4%	-0.30
65	1.7%	-2.31	65	43.0%	-1.01
85	1.7%	-0.07	85	32.4%	-1.39
105	1.5%	-0.73	105	24.2%	-1.78
125	0.8%	-5.24	125	16.3%	-3.05
145	1.0%	1.25	145	15.9%	-0.17
165	1.1%	0.45	165	9.7%	-5.27

Notes. Elasticities are defined for $20 intervals and use only the initial bid. Protest households (67 in RDD sample and 30 in NPF sample) have been omitted. The "Percent Responding 'Yes'" figures are calibrated for awareness, hypothetical and external bias using the scale factors from Appendix A.

Table 2a. Predicted Revenue and Number of Pass Holders (RDD Sample – Unconditional Estimates)

Price	Predicted Number of Pass Holders (in thousands)	NRP Revenue (millions of dollars)	Forgone Revenue (millions of dollars)
45	1,086.0	48.3	44.3
55	760.2	41.8	35.1
65	461.5	30.0	29.0
75	448.0	33.6	24.5
85	366.5	31.2	20.5
95	352.9	33.5	18.8
105	312.2	32.8	13.8
115	217.2	25.0	11.3
125	203.6	25.5	9.2

Notes. For simplicity, price points at the extremes of the bid range are excluded. Survey data have been calibrated to reflect $30 million in NRP revenue at $65, based on current annual pass sales. Revenue and pass holder figures are calculated using the midpoint of the WTP interval. Households that state “Yes” to both bids are assigned a WTP equal to $10 plus the highest bid. 67 protest households have been omitted, leaving a sample size of N = 462.

Table 2b. Predicted Revenue and Number of Pass Holders (NPF Sample – Unconditional Estimates)

Price	Predicted Number of Pass Holders	NRP Revenue (millions of dollars)	Forgone Revenue (millions of dollars)
45	27,610	1.24	1.01
55	20,989	1.15	0.77
65	15,385	1.00	0.59
75	12,940	0.97	0.45
85	9,667	0.82	0.34
95	7,335	0.70	0.26
105	4,965	0.52	0.19
115	3,987	0.46	0.15
125	2,972	0.37	0.11

Notes. For simplicity, price points at the extremes of the bid range are excluded. Survey data have been calibrated to reflect $1 million in NRP revenue at $65, based on estimated NPP and GEP sales to former purchasers through NPF. Revenue and pass holder figures are calculated using the midpoint of the WTP interval. Households that state “Yes” to both bids are assigned a WTP equal to $10 plus the highest bid. 30 protest households have been omitted, leaving a sample size of N = 1461.

Table 3. Variable Definitions

Variables	Definitions
Initial Bid	First bid chosen randomly from {$25,$45,$65,$85,$105,$125,$145,$165}
All Revenue	1 if household is more likely to purchase pass if all money was used for services and facilities on federal recreation sites; 0 otherwise
Low Visits	1 if number of visits last year to Federal recreation sites ≤ 3, 0 otherwise
Young	1 if 17 < Age < 30; 0 otherwise
Old	1 if 50 < Age < 60; 0 otherwise
Male	1 if Male; 0 otherwise
BS degree	1 if BS degree or some graduate school; 0 otherwise
Professional degree	1 if Graduate or professional degree; 0 otherwise
Low Income	1 if Household income is less than $50K; 0 otherwise
Hispanic	1 if Hispanic; 0 otherwise
White	1 if White; 0 otherwise
Asian	1 if Asian; 0 otherwise
African American	1 if African American; 0 otherwise
NE	1 if states (CT, MA, ME, NH, RI, VT); NE = 0 otherwise.
ENC	1 if states (PA, NY, NJ); ENC = 0 otherwise.
WNC	1 if states (WI, OH, MI, IN, IL); WNC = 0 otherwise.
GP	1 if states (IA, KS, MN, MO, ND, NE, SD); GP = 0 otherwise.
SE	1 if states (DC, DE, FL, GA, MD, NC, SC, VA, WV); SE = 0 otherwise.
WSC	1 if states (AL, KY, MS, TN); WSC = 0 otherwise.
SW	1 if states (AR, LA, OK, TX); SW = 0 otherwise.
RM	1 if states (AZ, CO, ID, MT, NM, NV, UT, WY); RM = 0 otherwise.
PC	1 if states (AK, CA, HI, OR, WA); PC = 0 otherwise.

Table 4. Descriptive Statistics

Variables	RDD Sample (N = 462)				NPF Sample (N = 1461)			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Initial Bid	93.615	45.187	25	165	96.691	46.702	25	165
All Revenue	0.628	0.484	0	1	0.636	0.481	0	1
Low Visits	0.803	0.398	0	1	0.453	0.498	0	1
Young	0.149	0.357	0	1	0.138	0.345	0	1
Old	0.242	0.429	0	1	0.300	0.458	0	1
Male	0.433	0.496	0	1	0.477	0.500	0	1
BS degree	0.357	0.480	0	1	0.394	0.489	0	1
Professional degree	0.236	0.425	0	1	0.353	0.478	0	1
Low Income	0.321	0.464	0	1	0.255	0.436	0	1
Hispanic	0.056	0.231	0	1	0.027	0.163	0	1
White	0.846	0.361	0	1	0.876	0.329	0	1
Asian	0.011	0.104	0	1	0.026	0.159	0	1
African American	0.024	0.153	0	1	0.003	0.058	0	1
NE	0.048	0.213	0	1	0.079	0.271	0	1
ENC	0.113	0.316	0	1	0.117	0.322	0	1
WNC	0.160	0.367	0	1	0.155	0.362	0	1
GP	0.071	0.258	0	1	0.082	0.275	0	1
SE	0.165	0.371	0	1	0.177	0.382	0	1
WSC	0.065	0.247	0	1	0.025	0.155	0	1
SW	0.067	0.251	0	1	0.071	0.257	0	1
RM	0.097	0.297	0	1	0.109	0.312	0	1

Notes. SD = Standard Deviation

Table 5. DBDC WTP Estimates for the NRP

Explanatory Variables†	RDD Sample		NPF Sample	
	Coefficient	P-Value	Coefficient	P –Value
All Revenue	0.52***	0.00	0.12***	0.00
Low Visits	-0.40***	0.01	-0.11***	0.00
Young	0.12	0.27	-0.09*	0.06
Old	-0.01	0.47	-0.04**	0.04
Male	-0.09	0.24	-0.08**	0.02
BS degree	0.17	0.15	0.05	0.14
Professional degree	0.08	0.33	0.09**	0.04
Low Income	-0.10	0.27	-0.19***	0.00
White	0.06	0.43	-0.02	0.39
Hispanic	0.77**	0.02	0.07	0.31
Asian	0.62	0.12	-0.16	0.12
African American	-0.66*	0.09	0.32	0.14
NE	-0.24	0.22	0.02	0.38
ENC	-0.23	0.17	-0.03	0.34
WNC	-0.40**	0.04	-0.04	0.27
GP	-0.18	0.26	-0.12*	0.09
SE	-0.07	0.38	-0.02	0.34
WSC	-0.40*	0.10	-0.06	0.31
SW	0.02	0.47	0.04	0.30
RM	0.21	0.19	0.05	0.21
Heteroscedasticity (H^d) Results				
Constant	-0.22	0.22	-0.57***	0.00
Initial Bid	0.003	0.19	-0.01***	0.00
H^d Likelihood Ratio	0.76	0.38	14.34***	0.00
Summary Statistics				
Sample Size	462		1461	
Likelihood Ratio	45.97***		65.07***	
Pseudo-R^2	0.056		0.024	
Calibrated Mean WTP	$29.58		$72.80	
Calibrated Median WTP	$24.44		$73.65	

Notes. (***), (**), and (*) refer to statistical significance at the 1, 5 and 10 percent levels. The estimation was carried out using the Constrained Maximum Likelihood (CML 2.0) package in Gauss version 3.5. The nonlinear optimization routine was Newton-Raphson with a convergence criterion of 1×10^{-5} for the gradient of the coefficients. The estimates for "don't know" and "missing" dummy variables are not shown. †Although not explicitly listed as an explanatory variable, we control for BID in creating the probabilities that enter the likelihood function. See Cameron and James [1987] for further details. Protest households are defined as those who refused the NRP for free and are excluded from the analysis.

Table 6a. Correct Predictions using the DBDC Model (RDD Sample)

WTP Interval	Number of Correct Predictions	Number of Responses	Percentage Correct
No Free	--	--	--
"No, No"	161	195	82.6%
"No, Yes"	17	76	22.4%
"Yes, No"	14	47	29.8%
"Yes, Yes"	10	56	17.9%
Totals	202	374	54.0%

Notes. The sample size is N = 374. This excludes the 88 households that answered "Don't Know" to one of the bids.

Table 6b. Correct Predictions using the DBDC Model (NPF Sample)

WTP Interval	Number of Correct Predictions	Number of Responses	Percentage Correct
No Free	--	--	--
"No, No"	195	332	58.7%
"No, Yes"	123	247	49.8%
"Yes, No"	85	247	34.4%
"Yes, Yes"	247	331	74.6%
Totals	650	1157	56.2%

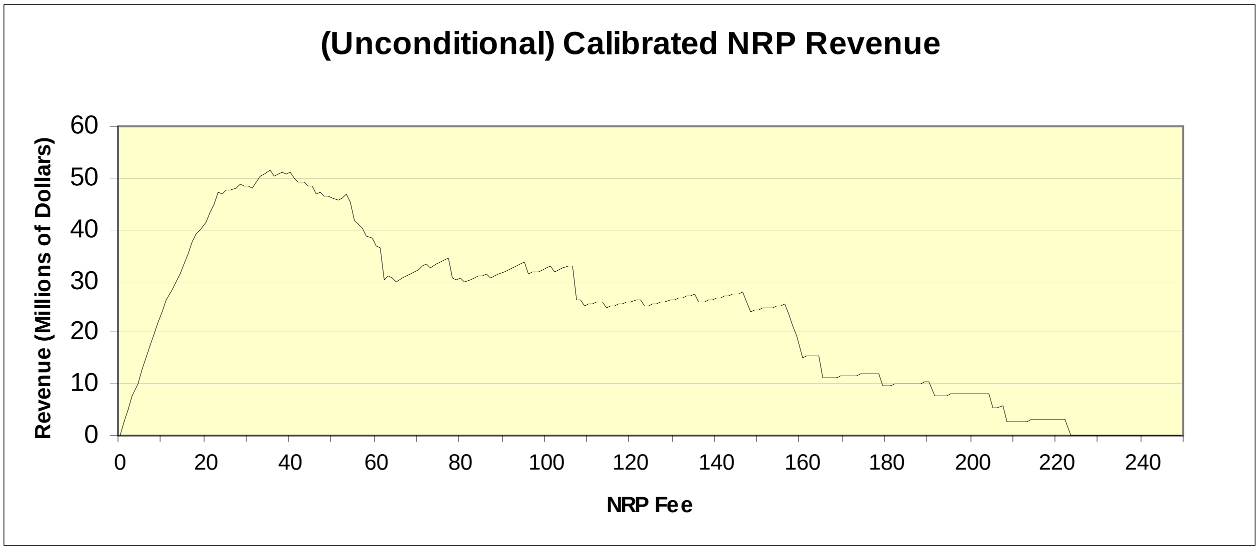
Notes. The sample size is N = 1157. This excludes the 304 households that answered "Don't Know" to one of the bids.

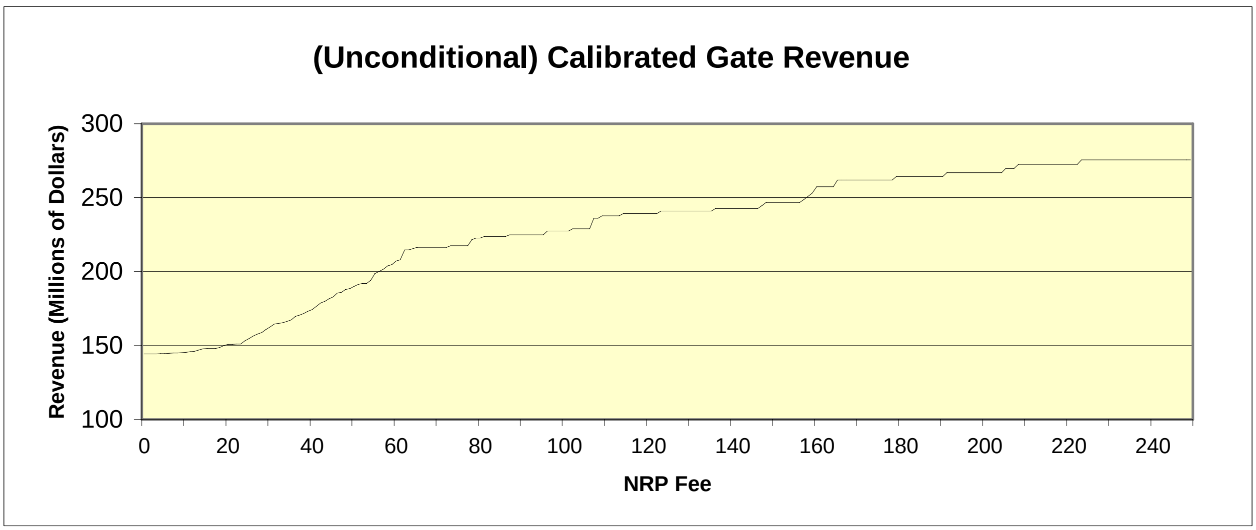
Table 7. Price Elasticities of Demand for the NRP (Conditional Estimates)

Price	RDD Sample	NPF Sample
15	-0.459	0.000
25	-1.216	0.000
35	-1.852	-0.014
45	-2.588	-0.276
55	-2.357	-0.685
65	-1.444	-1.465
75	-3.409	-2.814
85	-4.250	-5.655
95	-1.727	-8.301
105	-2.333	-10.302
115	0.000	-4.600
125	0.000	-25.000

Notes. Elasticities are defined for $5 intervals. Explanatory variables are evaluated at their means.

Figure 1. Unconditional Revenue Functions for RDD Sample





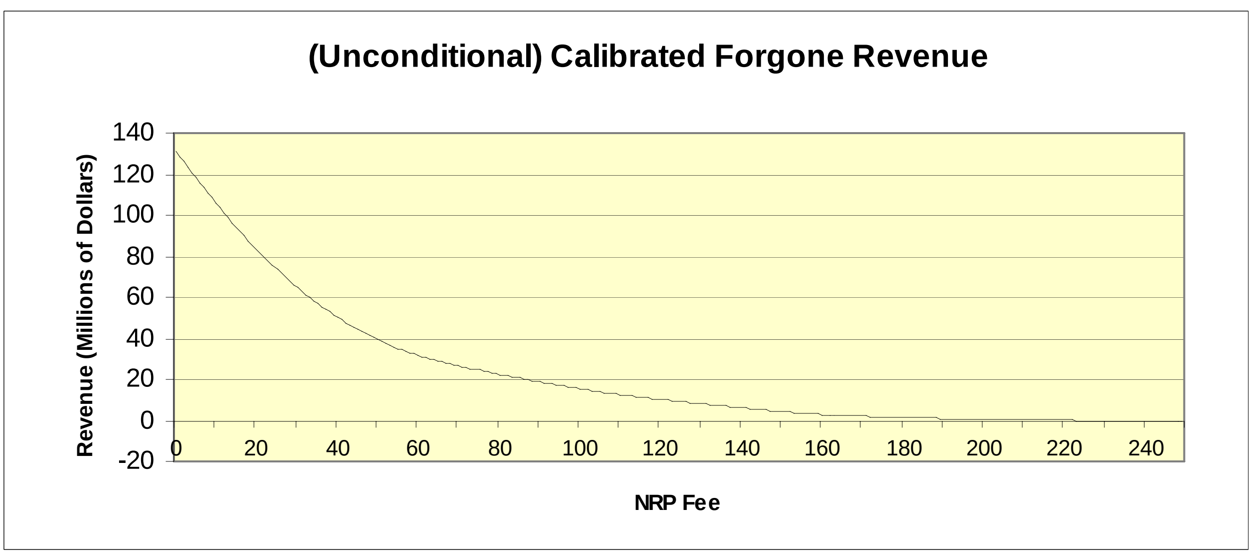


Figure 2. Unconditional Revenue Functions for NPF Sample

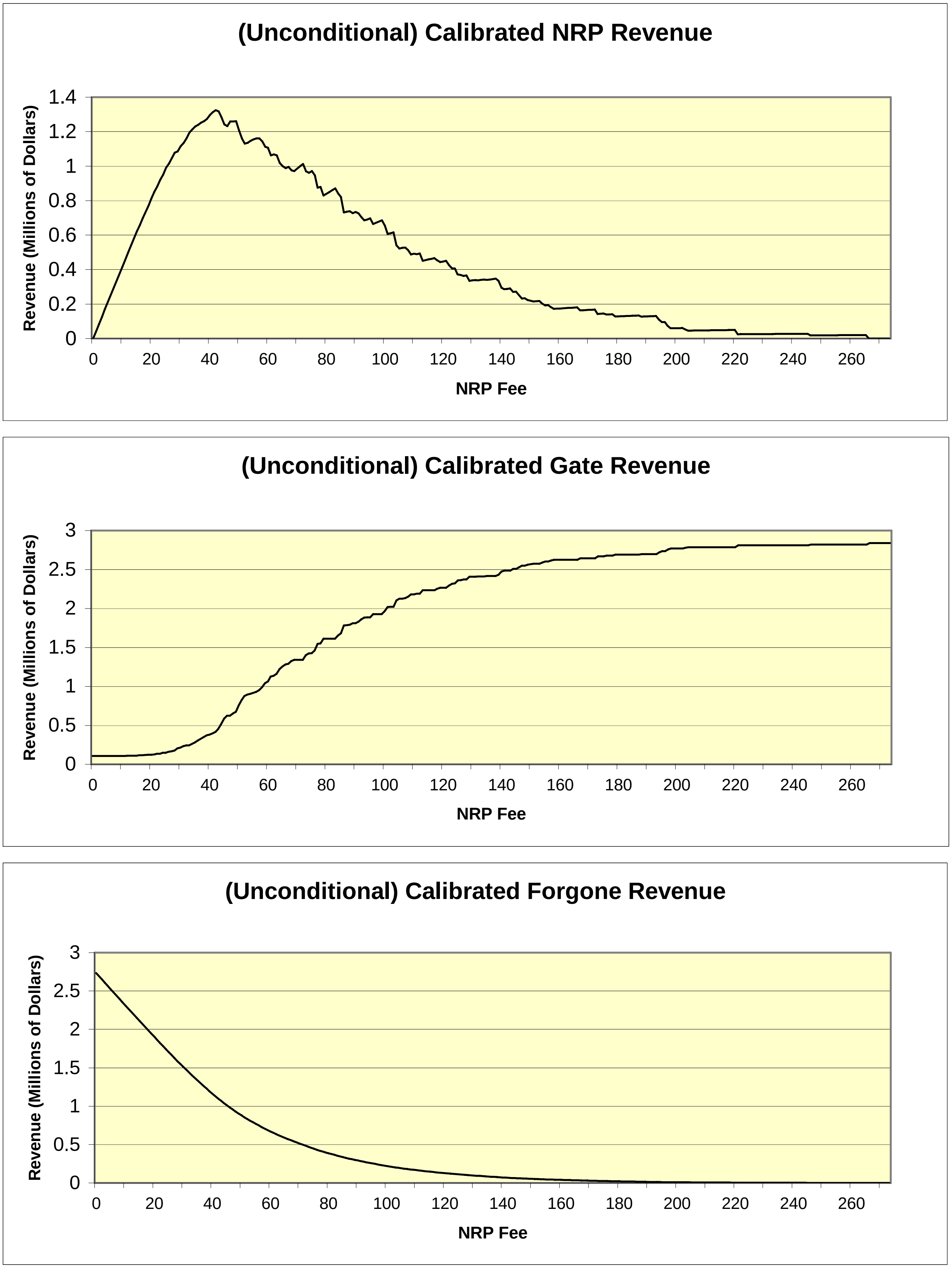


Figure 3a. Unconditional Demand Curve for the NRP (RDD Sample)

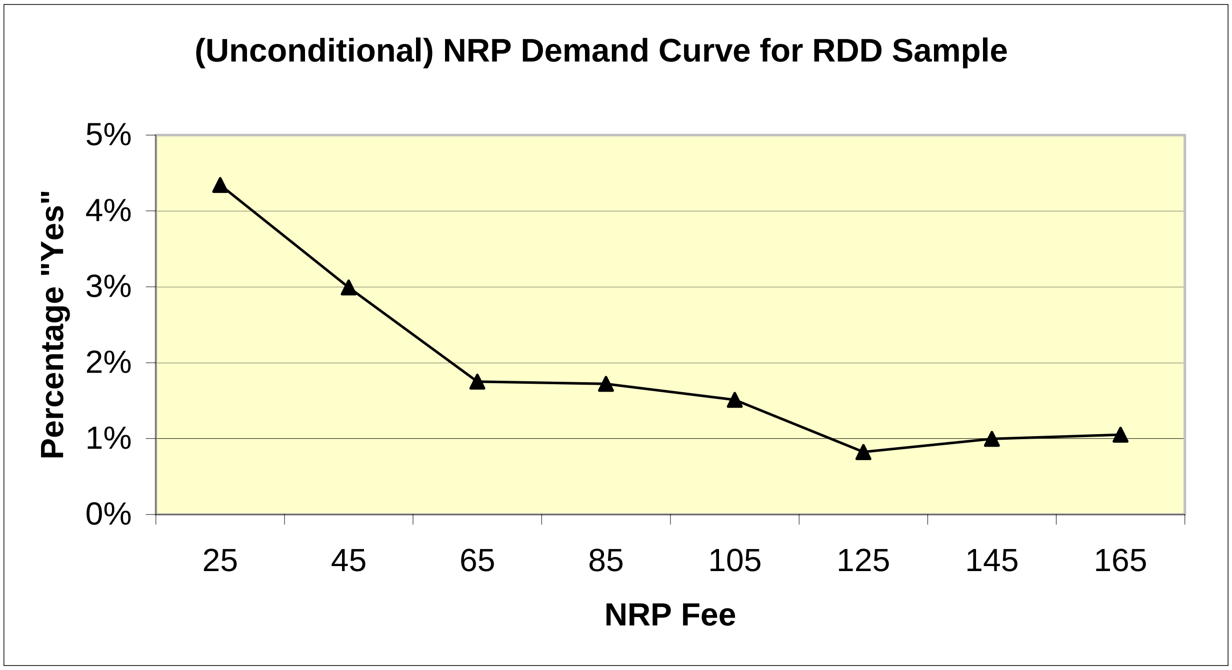
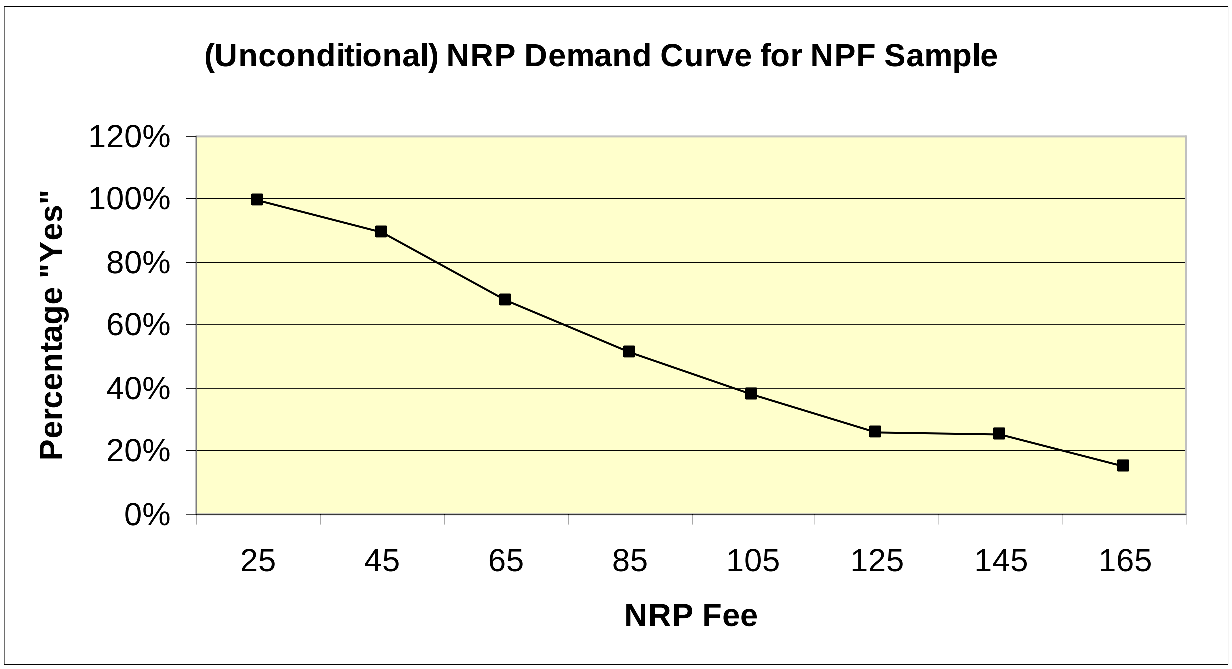


Figure 3b. Unconditional Demand Curve for the NRP (NPF Sample)



Notes. The demand curve only considers responses to the initial bid and is corrected for awareness and hypothetical bias. See Appendix A for further details.

Figure 4a. Predicted (Unconditional) WTP Distributions

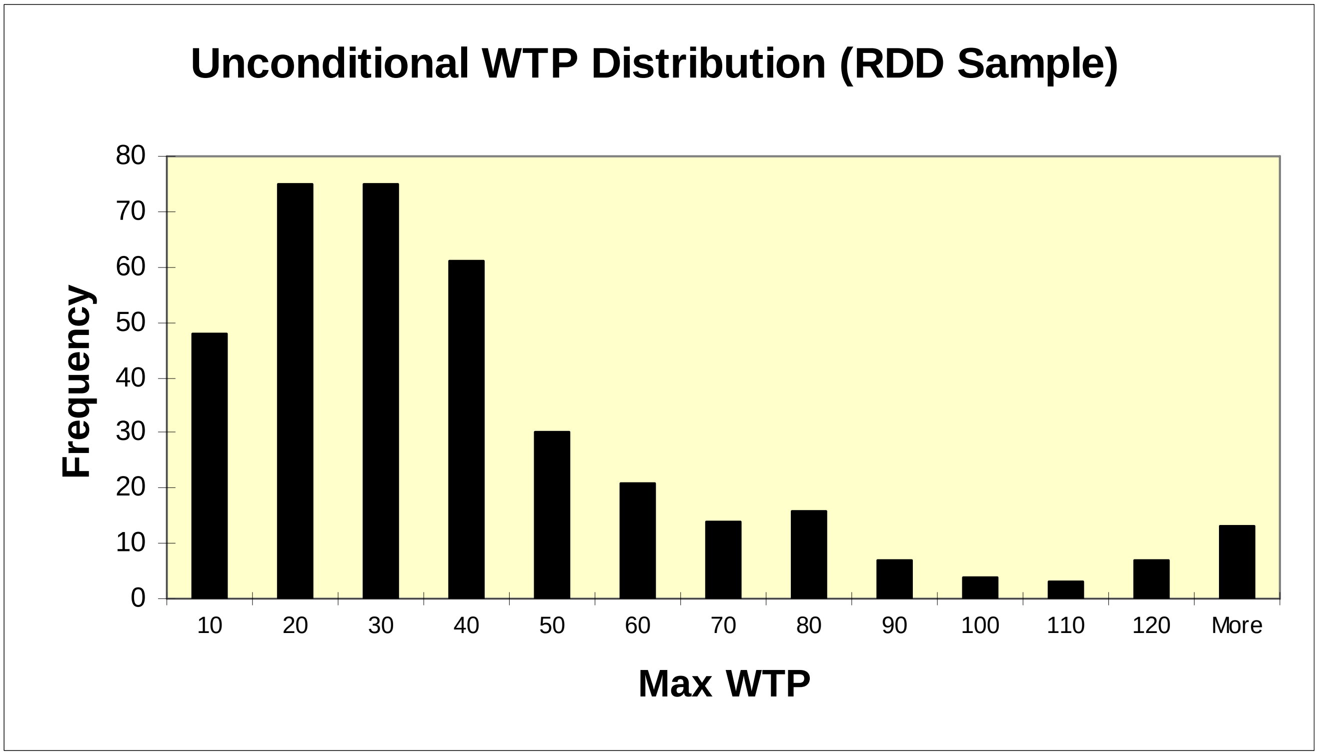
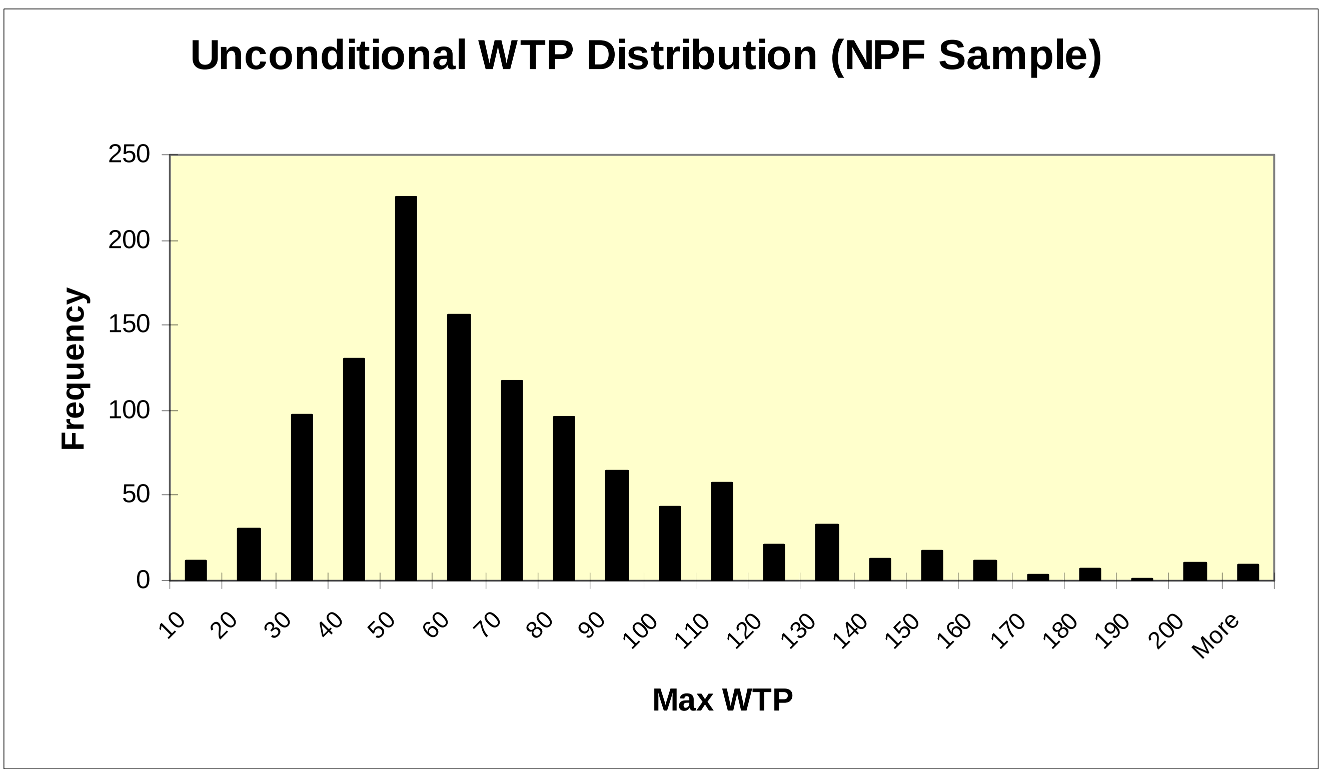


Figure 4b. Predicted (Unconditional) WTP Distributions



Notes. The WTP distributions are calibrated for awareness and internal hypothetical bias. See Appendix A for further details.

Figure 5a. Predicted (Conditional) WTP Distributions

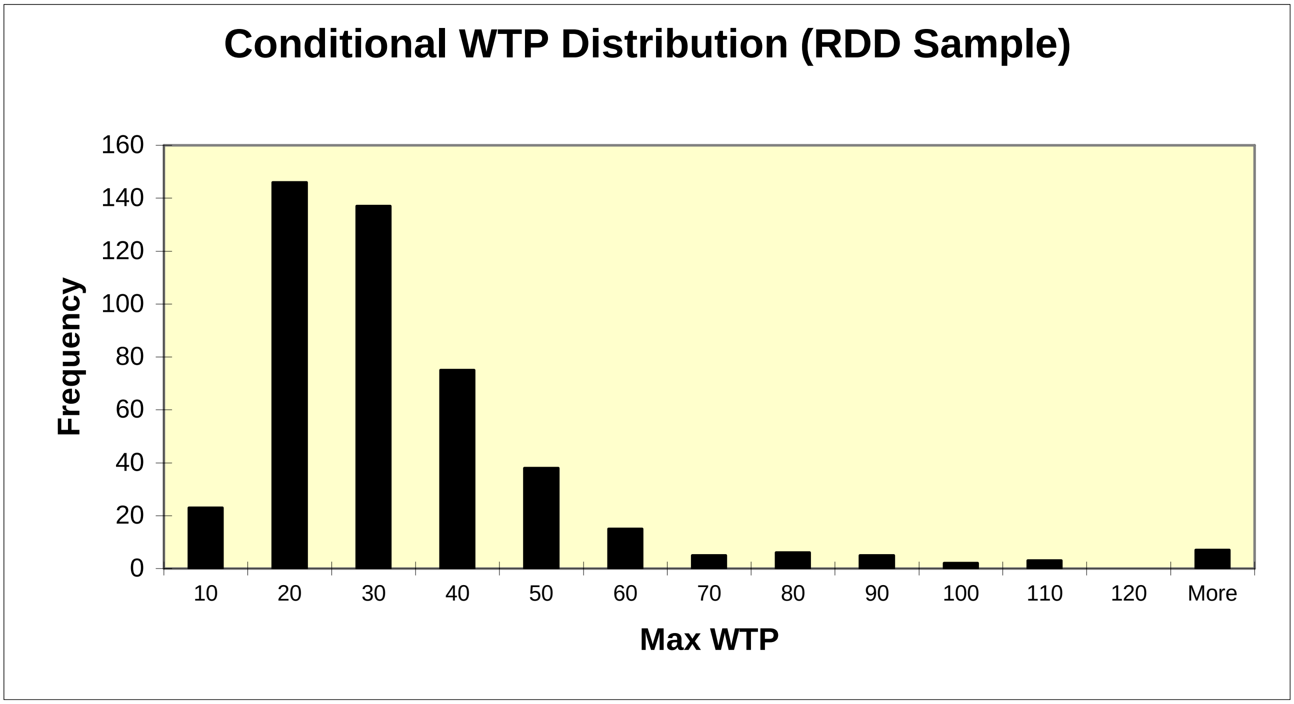
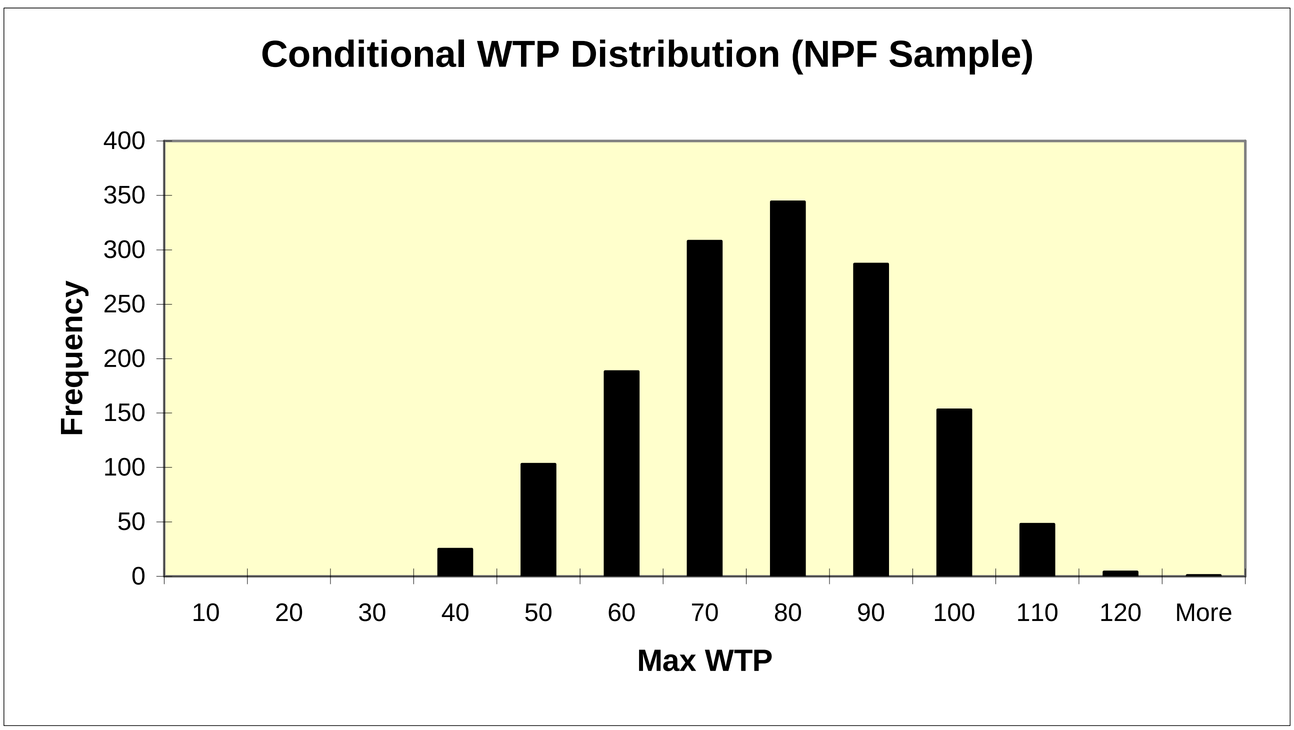


Figure 5b. Predicted (Conditional) WTP Distributions



Notes. The WTP distributions are calibrated for awareness and internal hypothetical bias. See Appendix A for further details.

Figure 6. Conditional Revenue Functions for RDD Sample

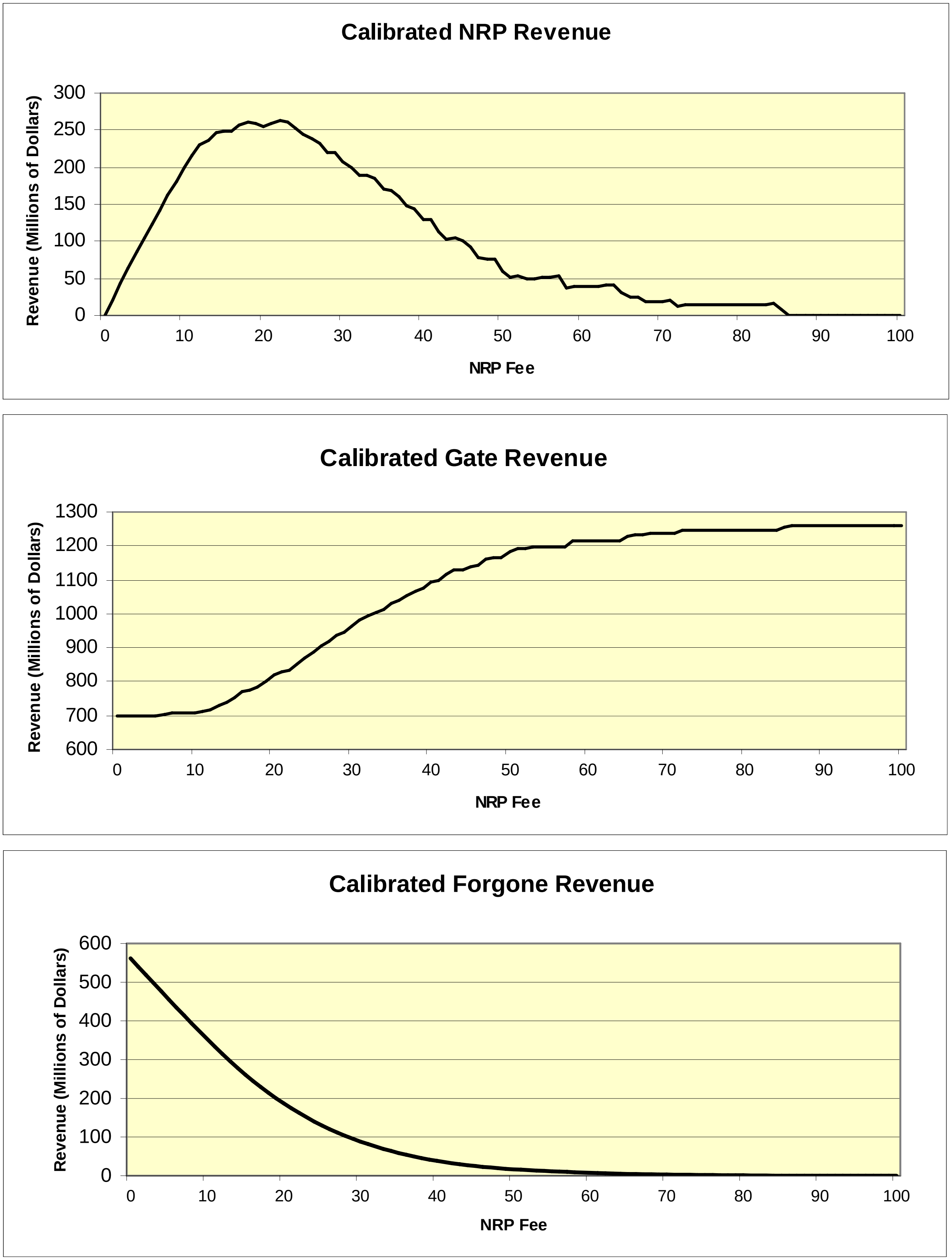
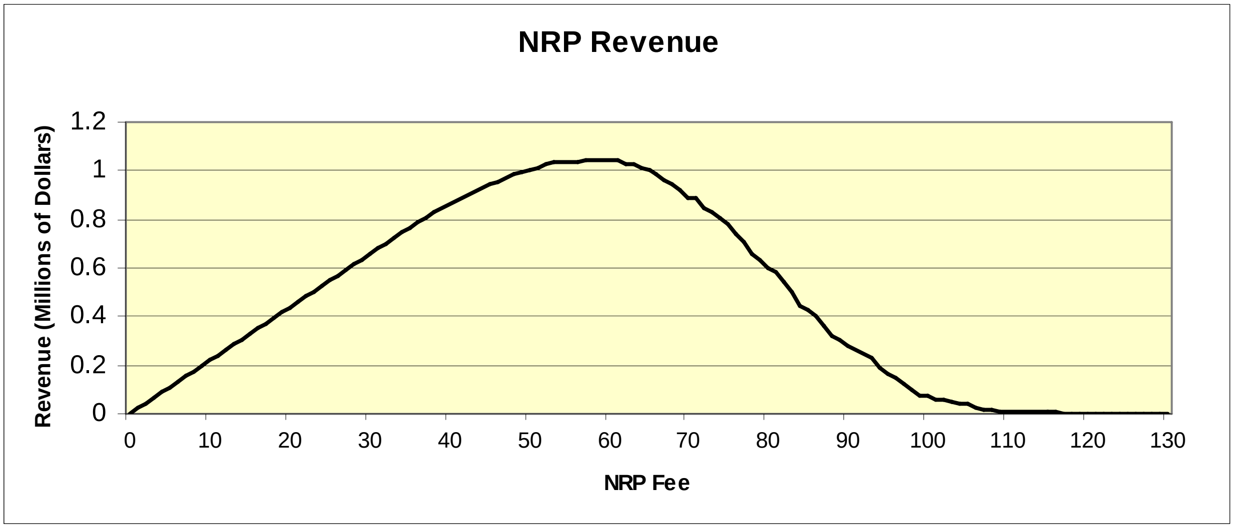
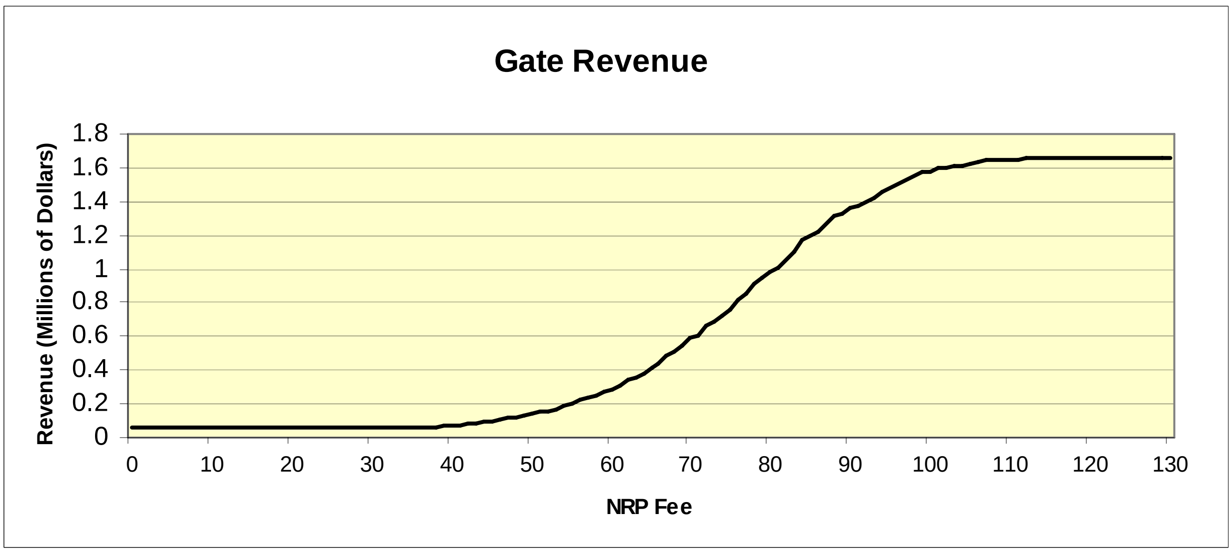


Figure 7. Conditional Revenue Functions for NPF Sample





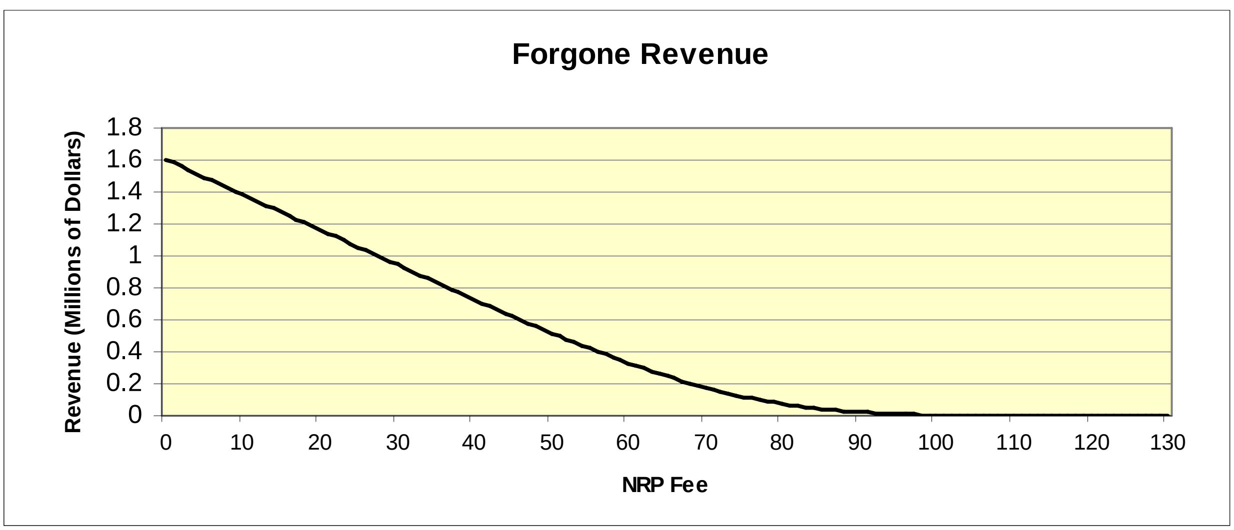


Figure 8. Forgone Revenue for Alternative Stewardship and Trip-Estimation Assumptions (Unconditional Forecasts for RDD Sample)