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Contingent Budget Preference Experiment

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Abstract

An economic literature concerns instruments to improve the preference elicitation methods for the reform-based governmental programs. We construct an instrument for the budget allocation method using a Cobb-Douglas functional form. We apply the instrument to the survey data which is collected for Swedish Recreational Fishing Industry to elicit the preferences for governmental management actions. We analyze the elasticity or weights in the instrument by the binary logit and censored regression models and by comparing the significant estimates by the gross and net effects we get results which increase credence to the instrument we apply.

Introduction

A lot of research has been done on revealing public's preferences for different policy programs which are offered by government simultaneously. This paper aggregates important issues about revealing such contingent budget choices of public by enriching instrument or choice technique for decision makers who face known fixed budgets. Our approach for the choice instrument to elicit public preferences is through the budget allocation format. People are asked to allocate an extra budget increment across the governmental policy programs that define their preferences for the policy programs. Here we aggregate the preferences into a utility function to maximize an efficiency gained by the governmental policy programs. We do an analysis through the elasticity in the utility function where the elasticity defines the mean allocations for the programs, thus the preferences for the desired programs. To test the significant effects of the explanatory variables on the elasticity we refer to the binary logit model. Moreover, we use the censored regression model to interpret the net effects of the explanatory variables on the mean allocations. That decision makers determine the preferred budget shares for programs or elasticity in the utility function, which elicit the public's trade-offs among various programs simultaneously. The idea here is taken from Blomquist (2004) which is about the governmental budget management and public budgeting. He defines the trade-offs between the public policy programs by comparing mean allocations for the programs. In the paper we suggest an instrument aiming to elicit the preferences which reflect the trade-offs between the policy programs. We use a secondary data from the Swedish Recreational Fishing Industry which is collected for revealing the preferences of the companies all around Sweden for governmental management actions.

We write the paper to show the possibility of application of the utility maximization issue to get a choice instrument to elicit public's preferences for governmental budget. We suggest sound economic theoretical basis for the analysis of Contingent Budget Preferences' data and suggest appropriate models for an analysis. Using the alternative choice instruments lead to a more efficient budget management for the public policy programs that helps to define the right priorities for an economic development of a country.

1. Summary of the literature on Contingent Budget Preference (CBP) Elicitation

Public values of public programs are often considered a necessary step for governmental decision making. Beckett and King (2002) recommended including citizens when the issues are understandable and when the citizens' participation can be effective. Franklin and Carberry-George (1996) analyze government budgetary processes in Texas and find that most governments use decision making frameworks including public values which maximize satisfaction in the community. Many methodologies are used to elicit the preferences of citizens to value the public goods offered by the government. Surveys in Contingent Valuation (CV) are done by Mitchell and Carsson (1989) to learn the public's willingness to pay (WTP) for various public goods. Structured value referendum method used by McDaniels (1996) to make choice among alternative public programs offered by government.

The researches on elicitation of individuals' preferences for public expenditures are done mostly by use of two ways of preference elicitation: *revealed preferences and stated preference* (Francken, 1985). Revealed preferences refer to actual preferences (choices) of individuals for the services or goods. More, revealed preferences investigate the behavior of individuals according to actual use of the services or goods and preferences are reflected by what is done. (for instance, if an individual buys a service or not) Beside this, in some researches people's preferences for public expenditures are learnt by their political views (Lewis and Jackson, 1985). Instead, stated preferences can be obtained by directly asking individuals' evaluations of supply of public services. Peoples are asked to tell their evaluation or price for the services or are asked whether amounts for the services should be increased, decreased or remain the same. A disadvantage of the stated preferences is the absence of restriction on scarce budget.

Eliciting the Public Budgetary Preferences: CV approach

Contingent Valuation (CV) methodology provides useful insight for designers of surveys to reveal budgetary preferences. CV studies attempt to reveal public monetary valuations of specific non-traded goods to support decisions of managers. It is a methodology for requesting statements about willingness to pay (WTP) for public goods. The CV helps to create survey instruments generating valid and reliable measures of public's demand for non-marketable goods. The contributions for elicitation of budgetary preferences include: asking individuals to divide a

budget pie, emphasizing tradeoffs and constraints, making surveys and testing the effects of fiscal information in a questionnaire. But what makes CV studies undesirable for elicitation of budgetary preferences is that it focuses on a single, quite narrowly defined assortment of public goods rather than the multiple, the broader categories of goods found in budgetary surveys. While stating the WTP for any budget category, individual will not take all other categories into account which makes it undesirable to use if there is a budget constraint considered for all public programs. More, the CV is criticized for its attempt to value items characterized by "passive use", that is, by no direct and physical impact on the individual. Since individuals may not have well-defined fiscal preferences, their evaluation of public goods which are not familiar to them, makes invalid and unreliable measures for the public goods. So called *strategic bias (free riding)* occurs is an individual believes payment of their WTP will be collected from others. That the bias occurs since the WTP for private goods often exceeds the WTP for public goods (Lindberg, 2003). Another important issue in CV is a strategic behavior of people; "will respondents answer honestly?" to value public goods (Mitchell and Carsson, 1989). Thus, since the goods are being valued in CV studies are not commonly sold on market respondents can be uncertain about their true valuation which results with the *hypothetical bias.* Mitchell and Carsson call to be cautious about an overestimation or underestimation by individuals, since individuals may respond strategically if his/her evaluation has an impact on his/her material status. There are other issues in CV, such as visceral states and moods make biases in response of individuals to value public goods which prove the CV method less applicable to budgetary preference elicitation (Loewenstein, 2000).

Budget Allocation Format

It is true that previous research on the CV has contributed more to elicit the preferences by asking individuals WTP to various public goods. However, problems like potential hypothetical and strategic biases, when people state that they will pay more than they actually can limits its usefulness as mentioned above. To avoid this problem for the preference elicitation, it is reasonable to use *budget allocation format* which is developed by Blomquist (2004) in the literature. Unlike the CV, in budget allocation format each individual faces the same budget constraint, not in his/her own personal budget constraint but without tie to private consumption. In budget allocation studies, people are asked to allocate a fixed increment over various

governmental programs funded by the budget. Regarding this study each individual allocates the public budget across budget categories in order to maximize the utility. The utility maximizing solution for respondents with respect to government services implies that respondents will allocate the budget increment so that the marginal utility per SEK allocated is equal. This assumption indicates that respondents optimally allocate SEK according to their own preferences but do not require that the total budget be allocated efficiently according to the preferences of the median voter (Blomquist, 2004).The individual will allocate the budget increment such that

$$\frac{\partial U}{\partial a_i} = \frac{\partial U}{\partial a_j}, \quad i \neq j$$

where U is the utility and a_i is the allocation corresponds to a service for a budget category i. Then the marginal utility for a particular budget category could be disaggregated into

$$\frac{\partial U}{\partial a_i} = \frac{\partial U}{\partial X_i} \frac{\partial X_i}{\partial a_i}$$

where $\frac{\partial U}{\partial X_i}$ is the marginal utility of government services and $\frac{\partial X_i}{\partial a_i}$ is the productivity of the government or the ability of the government to convert SEK into government services. A respondent who believes a program has already accomplished its goal will have a smaller marginal utility for a new unit of that service than he or she would have for a program that he or she believes is not currently funded satisfactorily or has not accomplished its goal (Blomquist, 2004). Thus, a smaller increment should be allocated to the policy programs which have accomplished their goals and more should be allocated to the policy programs in need of improvement.

The contingent choice technique by Blomquist (2004) leads individual respondents to reveal their marginal willingness to tradeoff additions to one program for additions to another, competing public program, given the specified budget. The marginal willingness to tradeoff (MWTTO) value between any two budget categories, i and j, is the ratio of contingent choice increments to the two categories:

$$MWTTO = \frac{a_i}{a_j}$$

where a_i and a_j are allocation shares to the budget categories i and j. For example, if allocation to category i is 18 (million SEK) and to the allocation j is 12 (million SEK), then the MWTTO value of i to j is 1.5 (Blomquist, 2003).

2. Model for CBP and Data

The Model

In order to arrive at an optimal budget allocation, the allocations have to be aggregated into a utility function. To do this, weights have to be attached to each budget category X_i $(i = 1,.,n)$. We refer to Hardy, Littlewood and Polya (1952) who assume a collection of numbers $\{X_1, X_2, \dots, X_n\}$ such that $X_i \geq 0$ for all i. They define a *generalized weighted mean* of order ρ, $M_\rho(.)$ with non-negative weights $\alpha = (a_1, a_2, \dots, a_i, \dots, a_n)$

$$M_\rho(X_1, X_2, \dots, X_n) = (\sum_{i=1}^{n} a_i X_i^\rho)^{\frac{1}{\rho}} \quad \text{for } \rho > 0.$$

where $\sum_{i=1}^{n} a_i = 1$. For our case, collections of numbers $\{X_1, X_2, \dots, X_n\}$ above correspond to allocations for budget categories.

It is proved that for the case of $\rho = 0$ (which means a geometric weighted mean)

$$\lim_{\rho \to 0} (\sum_{i=1}^{n} a_i X_i^\rho)^{\frac{1}{\rho}} = \prod_{i=1}^{n} X_i^{a_i}$$

Under a this limiting case, the generalized weighed mean form takes the Cobb-Douglas form where the sum of weights is $\sum_{i=1}^{n} a_i = 1$.

Based on the idea above, for the case of the utility functional form of the Cobb-Douglas type the weighted geometric average seems to be a more practical way of establishing the utility function for aggregated allocations. The maximization problem is

$$\text{maximize} \quad U = \prod_{i=1}^{n} X_i^{a_i}$$

subject to

$$\sum_{i=1}^{n} X_i = B$$

where X_i's are allocated amount for public policy program i, a_i's are weights or budget shares which sum to one, that $\sum_{i=1}^{n} a_i = 1$. B is the extra budget increment, that the total additional

dollars to be allocated across budget categories or policy programs.

The solution to the maximization problem can be obtained using a Lagrange equation. In the data presented below, the total additional allocated amount is 100 million SEK. The formulated Lagrange equation will be as follows:

$$\mathcal{L} = \prod_{i=1}^{n} X_i^{a_i} - \lambda(\sum_{i=1}^{n} X_i - 100)$$

where λ is a Lagrange multiplier, the rate at which the optimal value of objective function *U* changes with respect to changes in the constraint 100. That is:

$$\frac{d\,U^*(100)}{d(100)} = \lambda(100)$$

This equation can be written in another way for making calculation easier as:

$$\mathcal{L} = X_j^{a_j} \prod_{i \neq j}^{n} X_i^{a_i} - \lambda(\sum_{i=1}^{n} X_i - 100)$$

where X_j is taken out of the product. By taking a derivation of the Lagrange equation with respect to X_j:

$$\frac{\partial \mathcal{L}}{\partial X_j} = a_j X_j^{a_j - 1} \prod_{i \neq j}^{n} X_i^{a_i} - \lambda$$

$$= \frac{a_j}{X_j}(\prod_{i=1}^{n} X_i^{a_i}) - \lambda$$

and making this differentiation equal to zero, yields the first order condition

$$\frac{a_j}{X_j}(\prod_{i=1}^{n} X_i^{a_i}) = \lambda$$

To simplify the calculation a substitution is made. $\prod_{i=1}^{n} X_i^{a_i}$ is substituted with U. And the expression gets the following form:

$$a_j U = \lambda X_j$$

Summing the left and right hand side expressions yields:

$$\left(\sum_j a_j\right) U = \lambda B$$

where $B = \sum_{i=1}^{n} X_j$ is obtained from the first order condition of the derivative w.r.t. λ. To get rid of λ let's say;

$$\lambda = \left(\left(\sum_{i=1}^{n} a_j\right) U \,/ B\right)$$

Thus

$$a_j/\left(\sum_j a_j\right) = X_j/B$$

$$X_j = \left(a_j/\left(\sum_j a_j\right)\right) B \quad \text{or} \quad X_j = a_j\, B$$

So, we get an explicit result of how X_j is dependent on weights, a_j's.

The result "$X_j = a_j B$"-can also be obtained in the Marshallian Demand function. The number of items bought is identical to public goods since every item represents the budget share if the price is set to one. Taking first order derivatives implies the marginal utilities which have to be equal to each other for an efficient allocation.

Moreover, we can check the matrix of second order derivatives is negative semi-definite at the optimal point, that is, the Hessian matrix of Lagrangian ($D^2\mathcal{L}(\lambda^*, X_i^*, X_j^*)$) satisfies the second-order conditions, which verify results to be optimal (see Varian, 1999).

There is another issue, how the explicit result for X_j would be if the initial amount of money allocated to the j^{th} budget category, let's say W_j is given. Then the utility function would take the form:

$$U = \prod_{i=1}^{n}(W_i + X_i)^{a_i}$$

by doing the utility maximization subject to

$$\sum_{i=1}^{n} X_i = B$$

we get the Lagrange equation:

$$\mathcal{L} = \sum_i \alpha_i \log (W_i + X_i) - \lambda(\sum_{i=1}^{n} X_i - B)$$

Taking the derivative with respect to X_i and λ:

$$\frac{\partial \mathcal{L}}{\partial X_i} = \frac{\alpha_i}{(W_i + X_i)} - \lambda \quad \text{and} \quad \frac{\partial \mathcal{L}}{\partial \lambda} = \sum_{i=1}^{n} X_i - B$$

making these differentiations equal to zero, the results is:

$$\frac{\alpha_i}{(W_i + X_i)} = \lambda \quad \text{and} \quad \sum_{i=1}^{n} X_i = B$$

As $\alpha_i = \lambda W_i + \lambda X_i$, then $\sum_i a_i = \lambda\,(\sum_i W_i + B)$. By making these expression equal to each other we get rid of λ in the following form:

$$\frac{\alpha_i}{\sum_i a_i} = \frac{(W_i + X_i)}{(\sum_i W_i + B)}$$

Thus,

$$X_i = \left(\frac{\alpha_i}{\sum_i a_i} - \frac{W_i}{(\sum_i W_i + B)}\right)(\sum_i W_i + B)$$

So, we get the explicit result for X_i if W_i, when the initial amount of money allocated is given.

Data

Survey responses

The survey was held by the Swedish Environmental Protection Agency and Swedish Board of Fisheries aiming to develop the recreational fishing industry in Sweden (2006). Questionnaires as in the **Table 1** were sent to 725 companies all around Sweden asking to allocate extra increment among the most preferred fishing programs. 598 companies filled the questionnaire about the allocation of extra incremental funds among 9 program areas. More, only 94% of those companies gave information regarding their firm-related characteristics, which play an important role to elicit preferences for the above mentioned mean allocations. For our data, these characteristics are "Company turnover" (in millions of SEK) and other characteristics which are in the form of dummy variables, such as the "Company head being male instead of female", the "Firm situated in the northern Norrland" instead of elsewhere, the "Firm situated in the South of Sweden" instead of elsewhere, the "Firm situated in the West Coast of Sweden" instead of elsewhere, "Firm offering food and lodging" instead of contrary, "Firm offering guide and boat services" instead of contrary , "Firms with sea fishing services instead of non-sea fishing services", "Serves connected to river fishing services instead of other fishing services". There is also a "Design weight" in the data which is a sampling design, equal to$1/p$, where p is a probability of a unit being selected to the sample.

The summary statistics for the firm-related characteristics is given in the **Table 2**. As it is shown in the table, the companies which heads are males account for 85% (0.85) of all companies, where the value is 15% for the companies with female heads. The firms' total mean turnover is 1.886 million SEK. Other firm related locational and service variables, such as the firms situated in the Northern Norrland (47%), the firms situated in the South Sweden (38%), the firms situated in the West Sweden (16%), the firms offering food and lodging (47%), the firms offering guide

and boat services (31%), the firms offering sea fishing services (15%), the firms with serves connected to river fishing (29%) are displayed in the table above.

Table 1. ***Questionnaire***

Choices for Governmental Fishery Management Budget

Please check the policy programs below. If you were making the choices for the Fishery Management Programs introduced by government and ***extra* 100 million SEK** were available to be added to the existing budgets, ***how much of the* 100 million SEK *would you put in each of the following program areas?*** The sum should be 100.

_____Allocate more salmon to the sport-fishing

_____ Allocate more cod to the sport fishing

_____ Increased fishing-superintendence

_____ Planting of fish

_____ Buy out small scale hydropower plants and Increased min-flow and by-pass for fish at hydropower use

_____ Restoration of biotopes

_____ Actions to increase recreational fishing

_____ Supporting fishing industry and domestic fishing

_____ Supporting companies and marketing

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100 Total **<<Please check to see that your total is equal to 100>>**

Table 2. Summary statistics for the firm-related characteristics

Firm Related Characteristics	*Obs.*	*Mean*	*Min.*	*Max.*
Company Head Being Male	562	0.85	0	1
Company Turnover (million SEK)	562	1.886	1.21	2.66
Firm situated in Northern Norrland	562	0.47	0	1
Firm situated in West Coast Sweden	562	0.16	0	1
Firm situated in the South of Sweden	562	0.38	0	1
Firm Offering Food and Lodging	562	0.47	0	1
Firm Offering Guide and Boat service	562	0.31	0	1
Firm offering Sea Fishing Services	562	0.15	0	1
Firm with Serves connected to River Fishing	562	0.29	0	1

Estimated MWTTO values

The average (mean) allocations to each of the 9 budget categories are found in the **Table 3**. A t-test of significance was used to determine whether or not each category was ranked significantly lower than the category just above it. The t-test rejects a null hypothesis of identical means which support the idea that means are significantly different. They are shown by the empty spaces between two adjacent categories on rank in the Table. As we see from the table (buying out) "Small scale hydropower plants and increased min-flow and by-pass for fish at hydropower" (21.48), "Restoration of biotopes" (20.98) and "Planting of fish" (19.39) categories are valued highly. Firms' preference for "Supporting fishing industry and domestic fishing" category is the lowest one, (0.95). For those categories ranked below the "Actions to increase recreational fishing" (12.82), firms allocated less than the amount that would be budgeted if the budget had been equally divided among the 9 categories. We may check the mean allocations for each budget category in the table below.

Coefficient of Variation (C.O.V)

The average allocations for the budget categories are the measure of firms' preferences concerning expanding each program area relative to the other program areas, given the current level of funding. The coefficient of variation for each budget category is a measure of differentiation of interests among the firms on a particular budget category. So, *the lower the value of the C.O.V.,the greater the agreement about the relative value of a program* (Blomquist, 2004). The table above provides a list of C.O.V.s for all of the 9 categories. Greater agreement is

apparent for the largest allocation, *buying out* "*Small scale hydropower and increased min-flow and by-pass for fish at* hydropower" (1.24) compared to the smallest allocation, "*Supporting fishing industry and domestic fishing"* (8.47). Greater agreement exists among the top three program areas, (1.24), (1.12) and (1.22) relatively for 1st, 2nd and 3rd program areas which have the bigger allocations than the rest program areas.

Table 3

Fishery Management Programs	Mean Allocation	Standard Deviation	C.O.V
Small scale hydropower plants and Increased min-flow and by-pass for fish at hydropower	21.48	26.55	1.24
Restoration of biotopes	20.98	23.68	1.12
Planting of fish	19.39	23.83	1.22
Actions to increase recreational fishing	12.82	21.42	1.67
Allocate more salmon to the sport-fishing	9.87	18.90	1.91
Increased fishing-superintendence	7.94	14.04	1.77
Allocate more cod to the sport fishing	3.45	9.25	2.68
Supporting companies and marketing	3.12	13.12	4.20
Supporting fishing industry and domestic fishing	0.95	8.05	8.47

Notes: 1. The empty spaces between rows separate mean allocations, which are significantly different from each other. The t-test conducted for equality between each category and the next higher category 2. All categories above the single line receive more than the average allocation (11.11 SEK Millions) for all categories. All categories below the single line receive less than the average allocation 3. Coefficient of allocation = Standard Deviation/ Mean. Total allocation = 100 Million SEK 4. All the categories involve the minimum (zero) and the maximum (100) allocations by companies/firms 5.N=598

Simple Test of Random Values.

An indication of successful elicitation of the firms' preferences for the changes in the provision of publicly provided goods given a fixed budget is that they are not random. We test the average (mean) observed allocations against the allocations that might be expected to occur in random choice. For this, the distribution of average observed allocations was tested to see whether it is significantly different than the normal distribution. A significant difference provides additional assurance that the survey is measuring relative preferences for the various budget categories. The Shapiro-Wilk test, the test which detects and measures departure from normality, was used on STATA. The tests reject the hypothesis of normality when the p-value is less than or equal to

0.05. After the test, the distribution found to be significantly different from normal distribution at a 0.95 level. This is an indication that the firms are not only ranking the categories, but also do consider the strengths of their preferences.

3. Model Specification and Estimation

In the previous section, the utility maximization estimate resulted as $X_j = \alpha_j B$ where allocation (X_j) to budget category "j" was defined by the weight, α_j. We analyze the effects of Z_j explanatory variables on these weights. It takes the simple linear form:

$$\boldsymbol{\alpha_j = Z'\beta_j + \varepsilon_j}$$

where $\boldsymbol{\alpha_j}$ is the weight for budget category "j" and as it is known from the simple linear regression $\boldsymbol{\beta_j}$'s explains the expected change in α_j if the $\boldsymbol{Z}$'s increase by one unit. In the data we see that the companies do not allocate money to unattractive budget categories and sometimes allocate the maximal amount to only one category. It is possible to derive model to estimate $\boldsymbol{\beta_j}$ parameters by maximum likelihood estimation, however we use the following simplified analysis of the data. We analyze the data in two steps. Firstly we refer to the choice models for determining or testing the significant explanatory variables. In the second step we use the censored regression model to find both the significant estimators and analyze the net and gross effects regarding the data. We refer to the choice models by using the latent variable approach for binary logit models. We define an indicator variable for α_j, for instance $\boldsymbol{y_j}$ as follows:

$$\boldsymbol{y_j} = \begin{cases} 1 & if\ \ money\ is\ allocated\ (\boldsymbol{\alpha_j} > 0) \\ 0 & if\ no\ money\ is\ allocated\ (\boldsymbol{\alpha_j} \leq 0) \end{cases}$$

The probability of non-zero money allocation j by company i is defined as:

$$\boldsymbol{p_j} = Pr(\boldsymbol{y_j} = 1) = Pr(\boldsymbol{\alpha_j} > 0) = \Pr(\boldsymbol{Z'\beta_j + \varepsilon_j} > 0) = \Pr(-\boldsymbol{\varepsilon_j} < \boldsymbol{Z'\beta_j}) = F(\boldsymbol{Z'\beta_j})$$

where $F(.)$ is the cumulative distribution function (CDF) under symmetric distribution of $\boldsymbol{\varepsilon_j}$.(Cameron and Trivedi, 2005) It is convenient to use the logit model rather than the probit model because of its closed form:

$$\boldsymbol{p_j} = \Pr(y_j = 1|\boldsymbol{Z}) = \frac{\exp(\beta_1+\beta_2 Z_j)}{1+\exp(\beta_1+\beta_2 Z_j)}$$

The log likelihood for the binary logit model is:

$$\ell(\boldsymbol{\beta}) = \sum_{i=1}^{N}\left[\boldsymbol{y_j}\log \boldsymbol{p_j} + (1-\boldsymbol{y_j})\log(1-\boldsymbol{p_j})\right]$$

The maximum of $\mathcal{L}$ is solved by differentiating it with respect each of β_j coefficients and equating each partial derivative to zero to seek estimates $\hat{\beta}_1, \hat{\beta}_2, \ldots, \hat{\beta}_j$ (Akiva and Lerman 1985).

In the logit model the estimated probabilities of coefficients indicate the effects of the relative explanatory factors to increase the likelihood of an event occur or money is allocated. **Table 4** shows the estimated coefficients of the firm related characteristics on allocations. The explanatory factors "Design weight" and "Company Turnover" are excluded from the table since no coefficients of these factors have been observed as significant parameter to affect the allocations. The most significant variables to explain contributions across all the fishery management programs are the "Firms offering sea fishing services" and the "Firms offering guide and boat services". Their estimated coefficients take higher values compared to other factors, which show their effects increase the likelihood that more increment will be allocated to the fishery management programs.

Since some companies allocate zero amount or maximal amount to one budget category alternative regression model, censored regression is applied to estimate coefficients by left or right censoring. For our case censoring at zero, namely Tobit regression or "Tobin's Probit" is more relevant. The model is expressed in terms of the latent variable approach again, by defining the indicator variable:

$$\boldsymbol{y_j} = \begin{cases} \boldsymbol{\alpha_j} & if \quad \boldsymbol{\alpha_j} > 0 \\ 0 & if \quad \boldsymbol{\alpha_j} \leq 0 \end{cases}$$

where $\boldsymbol{y_j}$ contains either zeros for the companies which allocate money to the budget categories or a positive amount for those which allocate money. The model combines aspects of the binomial probit to the distinction of $\boldsymbol{y_j} = 0$ versus $\boldsymbol{y_j} > 0$ and the regression model for positive allocations. (Christopher, 2006) Fitting the data to the tobit estimation method we use the

maximum likelihood to combine the probit and regression components of the likelihood function. We explain the likelihood of the given company "i" as:

$$\ell_i(\boldsymbol{\beta}, \sigma_\varepsilon) = \mathrm{I}(\boldsymbol{y_j} = 0) \log \{1 - F(\boldsymbol{Z'\beta_j}/\sigma_\varepsilon)\} + \mathrm{I}(\boldsymbol{y_j} > 0)\{logf(\boldsymbol{y_j} - \boldsymbol{Z'\beta_j}/\sigma_\varepsilon) - - 1/2 \log({\sigma_\varepsilon}^2/\varepsilon)\}$$

where $\mathrm{I}(.) = 1$ if its argument is true and is zero otherwise.(Christopher, 2006) "σ_ε" is the standard error of disturbance ε, $F(.)$is the normal CDF and $f(.)$is the normal density function. **Table 5** shows the estimated coefficients by the Tobit Regression Analysis. As shown from the table, the coefficients are quite close to those in the Logit Regression Analysis. More, the significant coefficients coincide with each other in both models. Again, "Firms offering guide and boat services" and "Firms offering sea fishing serves" have significant effects of allocating money to the policy programs. Distinction from the binary logit regression analysis are just about that the "Firms situated in the Northern Norrland" have significant effect of allocating money for buying out small scale hydropower plants and the "Firms with serves connected to the river fishing" have significant effect of allocating money for supporting companies and marketing. The tobit regression coefficient estimates tell us about the net effects of the mean allocations which are compared to the gross effects of the allocations regarding the dummy explanatory variables in the **Table 6**. As shown in the **Table 5**, "Company head being male" instead of female is associated with the net effect of approximate one million SEK (coeff.= -0.788) decrease in allocation to the planting of fish. However, in the **Table 7**, "Company head being male" instead of female causes to 3.4 million SEK decrease in the allocations to the planting of fish in the gross effect. More, "Firms situated in the Northern Norrland" instead of elsewhere, is associated with the net effect of approximate one million SEK (coeff.= 0.731) increase in allocating money for buying out small scale hydropower plants. Again, we see from the **Table 7** that "Firms situated in the Northern Norrland" allocate 6 million more than the firms not situated in the Northern Norrland. Although the amounts differ, there are correlations between the gross and net effects regarding the dummy explanatory variables. The other coefficient estimates and the gross effects are interpreted in the same way using the **Table 7**.

Policy Implications

In the research we get estimates for determining the preferences using the data at hand. The correlations between the gross and net effects supports the reliability of the instrument we use. The significant estimates and the preferences for the specified fishery management actions in Sweden can be explained as follows.

In the analysis we see that “Buying out small-scale hydropower plants and increased min-flow and by pass for fish at hydropower facilities” is mostly preferred by the companies situated in the Northern Norrland (coef.= 0.731) where good coastal fishing condition is limited. Since most fishing days in all around Sweden especially in Northern Norrland are produced in inland waters, often in streams, it is not surprising that 21% of hypothetical funds (21 million SEK) is allocated for “Buying out small-scale hydropower plants and increased min-flow and by pass for fish at hydropower facilities”. Firms offering sea fishing services prefer fewer money to be allocated for “Buying out small-scale hydropower plants and increased min-flow and by pass for fish at hydropower facilities” because of their coastal fishing businesses which do not need such hydropower plants (coef.= -1.269).

Besides, companies offering sea fishing services demands much more money to be allocated for planting of fish where the hypothetical amount of allocation is 19 million SEK. Since, for the companies especially situated in the South Sweden the coastal sea fishing is prevalent, it is reasonable to allocate much funds for the planting of fish to improve the sea fishing (coef.= 0.809). More, firms with services connected to the river fishing demand less money to be allocated for planting of fish (coef.= -0,880) because at least they would prefer to allocate for “Buying out small-scale hydropower plants and increased min-flow and by pass for fish at hydropower facilities”. This may help to improve the quality of their services rather than planting of fish which is good for serves in the sea coasts.

Although the hypothetical value of allocation is one of the highest value for “Restoration of Biotopes” (21 million SEK), there is not any significant estimates to interpret it. We may say that the higher allocation for the “Restoration of Biotopes” is mostly generally preferred since most companies in Sweden support to restore heavily modified waters for better fishing conditions. Firms offering guide and boat services prefer fewer resources to be allocated for the actions to

increase recreational fishing (13 million SEK) compared to the first three policy programs where may be interpreted by this companies as cutting into their business depending on the action. Moreover, the companies which want more money to be allocated to the cods and salmons in the sport fishing are the companies offering guide and boat services and the companies offering sea fishing services. Other significant results can be derived from the estimates in the **Table 7** which seems promising to orient the decision makers to elicit preferences.

Summary and Conclusion

In the thesis we contribute to the growing literature with a choice instrument concerning the contingent budget preferences that helps public decision-makers to reveal the preferences of public and to allocate the limited governmental budget across all the public programs efficiently. For doing so, we aggregate all allocations by the generalized weighted mean assumption together by using the Cobb-Douglas production function. We do a maximization to calculate the marginal utilities of each allocation which should be equal to each other for the optimal efficient budget allocations. This result is applied on a random sample of companies from the different parts of Sweden and collects the information regarding their preferences in amounts, which is limited to 100 million SEK for the governmental fishery management policy programs as mentioned in the questionnaire. Application of the technique leads to a useful information regarding their preferences. The provision of limited budget information to companies makes differences in allocations across all the policy programs. Moreover, most companies allocate zero amounts to the policy programs which they consider to have less marginal utilities or be less effective if an additional increment is going to be allocated to the programs. This proves the validity and the reliability of the data, that the responses are not random. Estimation of the budget allocations by the weights with the firm related variables using binary logit and censored models show the systematic differences in allocations between the firm related dummy variables. These coefficients lead to the meaningful responses if we check them with the corresponding mean allocations by each dummy firm related variable. The correlations between the estimated coefficients and the gross effects increase the credence to our contingent choice instrument, so that the technique elicits preferences deliberately. More, the coefficient estimates are almost similar in both binary logit and censored models, whereby the results of the model estimates give support to each other.

Thus, results from the research suggest a consideration of the choice technique by public decision makers when they meet the kind of contingent budget planning issue. Perhaps, the technique will not elicit preferences of people precisely, but it will help to come up with close results and it suggests at least one simple option to consider when other ways of preference elicitation are more complex.

Table 4. Binary Logit Regression Analysis

	Allocate more Salmon to the sport fishing	*Allocate more Cod to the sport fishing*	*Increased fishing super-intendence*	*Planting of fish*	*Small Scale Hydropower plants and increased min-flow and by-pass for fish at hydropower use*	*Restoration of biotopes*	*Action to increase recreational fishing*	*Supporting fishing industry and domestic fishing*	*Supproting companies and marketing*
Firm Related Characteristics	***Coefficient***	***Coefficient***	***Coefficient***	***Coefficient***	***Coefficient***	***Coefficient***	***Coefficent***	***Coefficient***	***Coefficient***
Company head being Male	0.253 (0.277)	0.106 (0.354)	-0.094 (0.250)	-0.602* (0.272)	0.084 (0.254)	0.213 (0.273)	-0.647* (0.256)	---	-0.280 (0.411)
Firms situated in Northern Norrland	0.232 (0.280	0.121 (0.348)	0.223 (0.259)	0.145 (0.265)	0.486 (0.260)	0.055 (0.278)	-0.102 (0.263)	-0.442 (0.842)	-0.530 (0.458)
Firms situated in West Coast Sweden	-0.266 (0.305)	0.112 (0.348)	-0.728* (0.287)	-0.274 (0.292)	-0.426 (0.289)	-0.234 (0.296)	-0.439 (0.290)	-0.081 (0.961)	0.032 (0.508)
Firms situated in the South of Sweden	0.341 (0.303)	0.346 (0.361)	0.291 (0.282)	0.169 (0.291)	0.771* (0.287)	-0.070 (0.301)	0.231 (0.286)	-0.716 (0.821)	-0.292 (0.492)
Firms Offering Food and Lodging	-0.381 (0.194)	-0.304 (0.243)	0.044 (0.182)	0.320 (0.186)	-0.505* (0.185)	-0.323 (0.194)	0.088 (0.184)	-0.066 (0.628)	0.907* (0.345)
Firm Offering Guide and Boat service*	0.651* (0.218)	0.644* (0.273)	0.433* (0.213)	-0.287 (0.218)	0.171 (0.418)	-0.064 (0.227)	-0.773* (0.221)	0.106 (0.974)	0.598 (0.370)
Firm offering Sea Fishing services*	0.901* (0.276)	1.238* (0.301)	-0.127 (0.270)	0.701* (0.290)	-0.708* (0.274)	0.177 (0.290)	-0.118 (0.280)	1.998 (0.755)	-1.120* (0.590)
Firm with Serves connected to river fishing	0.436* (0.225)	-0.526 (0.308)	-0.238 (0.217)	-0.506* (0.241)	0.355 (0.255)	0.114 (0.234)	0.130 (0.220)	-1.292 (1.118)	-0.625 (0.420)
Constant	-1.219* (0.360)	-1.971 (0.451)	-0.420 (0.329)	0.673* (0.347)	-0.123 (0.331)	1.060 (0.357)	0.338 (0.334)	-3.603* (0.763)	-2.259* (0.558)
Log-likelihood	-345.4	-243.9	-377.1	-364.2	-366.5	-341.0	-366.1	-48.5	-149.9

*N=528. The symbol * designate coefficients' values which are significant at the 0.95 level. The estimates in the brackets show the relative standard errors.*

Table 5. Tobit Regression Analysis

	Allocate more Salmon to the sport fishing	*Allocate more Cod to the sport fishing*	*Increased fishing super-intendence*	*Planting of fish*	*Small Scale Hydropower plants and increased min-flow and by-pass for fish at hydropower use*	*Restoration of biotopes*	*Action to increase recreational fishing*	*Supporting fishing industry and domestic fishing*	*Supproting companies and marketing*
Firm Related Characteristics	***Coefficient.***	***Coefficient***	***Coefficient***	***Coefficient***	***Coefficient.***	***Coefficient***	***C oefficient***	***Coefficient.***	***Coefficient***
Company head being Male	0.702 (0.551)	0.654 (0.801)	-0.205 (0.389)	-0.788* (0.361)	0.113 (0.387)	-0.121 (0.290)	-1.293* (0.430)	39.702 ---	-0.509 (0.497)
Firms situated in Northern Norrland	0.345 (0.508)	0.109 (0.347)	0.531 (0.382)	0.112 (0.351)	0.731* (0.371)	0.153 (0.281)	-0.296 (0.441)	-1.701 ---	-1.405 (0.459)
Firms situated in West Coast Sweden	-0.610 (0.563)	0.112 (0.750)	-1,206* (0.432)	-0.108 (0.409)	-0.504 (0.282)	-0.302 (0.321)	-0.978 (0.499)	1.198 ---	0.211 (1.623)
Firms situated in the South of Sweden	-0.644 (0.559)	0.801 (0.748)	0.911 (0.418)	-0.112 (0.383)	0.976* (0.416)	-0.018 (0.324)	0.985 (0.272)	-3.434 ---	-0.737 (1.694)
Firms Offering Food and Lodging	-0.717 (0.360)	-0.907 (0.521)	0.101 (0.260)	0.443 (0.251)	-0.778* (0.261)	-0.442 (0.203)	0.256 (0.102)	1.492 ---	0.921* (1.098)
Firm Offering Guide and Boat service*	1.504* (0.403)	1.505* (0.589)	0.709* (0.315)	-0.409 (0.303)	0.202 (0.319)	-0.213 (0.249)	-1.339* (0.381)	1.165 ---	2.061 (1.233)
Firm offering Sea Fishing services*	1.127* (0.506)	2.311* (0.681)	-0.293 (0.399)	0.809* (0.305)	-1.269* (0.461)	0.204 (0.301)	-0.171 (0.479)	5.872 ---	-4.276 (1.969)
Firm with Serves connected to river fishing	0.896* (0.419)	-1,119 (0.626)	-0.427 (0.329)	-0.881* (0.303)	0.509 (0.319)	0.136 (0.247)	0.345 (0.371)	-5.233 ---	-2.009* (1.311)
Constant	-2.261* (0.719)	-4.422* (0.484)	-0.351 (0.325)	1.721* (0.349)	0.740 (0.504)	1.899* (0.383)	1.038 (0.562)	-55.510 (0.761)	-8.449* (0.612)
Log-likelihood	-688.5	-406.9	-735.1	-709.8	-929.7	-966.9	-792.8	-69.9	-232.3

*N=528. The symbol * designate coefficients' values which are significant at the 0.95 level. The estimates in the brackets show the relative standard errors.*

Table 6. ***Mean Allocations for Fishery Management Programs regarding Firm Related Characteristics (SEK Millions)***

Firm Related Characteristics	More Salmon to the Sport Fishing	More Cod to the Sport Fishing	Increased Fishing Superintendence	Planting of Fish	*Small Scale Hydropower plant and increased min-flow and by-pass for fish at hydropower use*	Restorations of Biotopes	Actions to increase Recreational Fishing	Supporting Fishing Industry and Domestic Fishing	Supporting Companies and Marketing
Company Head Being Male	10.4	3.7	7.6	18.8	22.5	21.3	11.8	1.1	2.7
Company Head Being Female	6	1.9	10	22.2	16.4	17.4	20	0	5.9
Firm situated in Northern Norrland	11.9	1.9	8	18	24.9	21.5	10.8	0.6	2.1
Firm **NOT** situated in Northern Norrland	8.1	4.7	7.9	19.5	18.9	20.6	14.6	1.3	4.3
Firm situated in West Coast Sweden	7.7	5.8	5.9	20.3	19.7	21.6	13.1	1.3	4.5
Firm **NOT** situated in West Coast Sweden	10.1	3	8.5	18.3	22	21	12.7	0.9	3
Firm situated in the South of Sweden	7.9	5.2	7.9	18.9	23	20.9	15.1	0.8	3.8
Firm **NOT** situated in the South of Sweden	10.7	2.3	8.2	19.1	19.5	21.4	11	1.2	3
Firm Offering Food and Lodging	9.9	2.9	9.6	20.4	18.6	19.6	13.6	1.5	4.1
Firm **NOT** Offering Food and Lodging	9.6	4.1	6.8	17.6	24.2	22.4	12.3	0.5	2.4
Firm Offering Guide and Boat service	16.6	5.8	9.1	15.5	20.6	19.8	7.8	1.4	3.4
Firm **NOT** Offering Guide and Boat service	6.7	2.5	7.6	20.2	22.2	21.7	15	0.8	3.2
Firm offering Sea Fishing Services	12.2	9.4	8.2	23	13.2	20	9.4	2.1	2.7
Firm **NOT** offering Sea Fishing Services	9.3	2.4	8.1	18.1	23.3	21.2	13.2	0.8	3.5
Firm with Serves connected to River Fishing	16	2	7.8	13	24.7	21.7	12.7	0.3	1.9
Firm **WITHOUT** Serves connected to River Fishing	7.2	4.1	8.2	21	20.6	20.8	12.8	1.3	3.8

Table 7. ***Net effects of allocations regarding the Firm-Related Characteristics on the Fishery Management Programs in SEK Millions***

Firm Related Characteristics	More Salmon to the Sport Fishing	More Cod to the Sport Fishing	Increased Fishing Superintendence	Planting of Fish	*Buying out Small Scale Hydropower plant …*	Restorations of Biotopes	Actions to increase Recreational Fishing	Supporting Fishing Industry and Domestic Fishing	Supporting Companies and Marketing
Company Head Being Male Gross effect (Net Effect)	---	---	---	-3.4 (-0.788)	---	---	-8.2 (-1.293)	---	---
Firm situated in Northern Norrland Gross Effect (Net Effect)	---	---	---	---	6.0 (0.731)	---	---	---	---
Firm situated in West Coast Sweden Gross Effect (Net effect)	---	---	-2.6 (-1.212)	---	---	---	---	---	---
Firm situated in the South of Sweden Gross Effect (Net Effect)	---	---	---	---	3.5 (0.976)	---	---	---	---
Firm Offering Food and Lodging Gross Effect (Net Effect)	---	---	---	---	-5.6 (-0.778)	---	---	---	1.7 (0.9)
Firm Offering Guide and Boat service Gross Effect (Net Effect)	9.9 (1.505)	3.3 (1.504)	1.5 (0.709)	---	---	---	-7.2 (-1.339)	---	---
Firm offering Sea Fishing Services Gross Effect (Net Effect)	2.9 (1.127)	7.0 (2.311)	---	4.9 (0.809)	-10.1 (-1.269)	---	---	---	---
Firm with Serves connected to River Fishing Gross Effect (Net Effect)	8.8 (0.896)	---	---	-8.0 (-0.881)	---	---	---	---	-2.0 (-2.009)

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