Publication Effects in the Recreation Use Value Literature:

A Preliminary Investigation

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ABSTRACT

This paper provides an overview of an extensive recreation use values database that was developed to investigate the presence of and effects of publication selection bias in this literature. The recreation use values literature has a long history of value transfer applications, which may be affected by publication selection bias. The database consists of 325 studies providing 2,594 estimates of value for over 26 recreation activities for the US and Canada. Preliminary analyses show that document type (journal, agency report, consulting report, dissertation, etc.) result in statistically different mean values. Similarly, motivations or the primary contribution of documents show that documents introducing efficiency in design or estimator provided statistically lower estimates of value than documents that present tests of biases or whose primary purpose is to present a new estimate of value.

Keywords: Nonmarket Valuation, Publication Selection Bias, Recreation Use Values

JEL Codes: Q26; Q51; C80

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INTRODUCTION

Studies that estimate parameters of interest add data points to a stock of knowledge. As a stock of knowledge grows, other applications of the information may become available. Value transfers (a.k.a., benefit transfers) use an existing stock of knowledge to inform management and planning decisions. Value transfer is the application of values and other information from a 'study' site where data are collected to a 'policy' site with little or no data, where information is largely derived from the literature (Rosenberger and Loomis, 2000a). However, is a literature an unbiased representation of a stock of knowledge? The validity of value transfers is constrained by the statistical properties and quality of the underlying body of literature (Loomis and Rosenberger, 2006; Rosenberger and Stanley, 2006). If selection effects are present, then information derived from these literatures may be biased. Identifying potential sources for and measuring the effects of publication selection should enable us to mitigate or control for these effects when applying all or part of a literature in a value transfer setting.

Publication selection bias arises when a literature is not an unbiased sample of empirical evidence. Card and Kreuger (1995, p.239) identified three potential sources of publication selection in economics—(1) reviewers and editors may be predisposed to accept papers consistent with the conventional view; (2) researchers may use the presence of conventionally expected results as a model selection test; and (3) everyone may possess a predisposition to treat 'statistically significant' results more favorably. Smith and Pattanayak (2002, p.273) identify another plausible sources of publication selection bias—(4) most journals in the environmental economics field are not interested in new estimates of benefits for their own sake. These journals may be predisposed to select manuscripts based on methodological innovations and contributions. When a literature is evaluated for publication selection bias, it is often found

(Rosenberger and Stanley, 2006). For example, van Kooten et al. (2004) found peer-reviewed studies reported higher carbon sequestration cost estimates than non-peer-reviewed studies. Their results may be interpreted in opposite ways—the peer-review process is working by validating the design, analysis and interpretation of studies' manuscripts surviving this process, or due to selection effects as noted above, valid studies that use standard, accepted methods are not entering the peer-reviewed, published literature domain.

This paper has two purposes. Its primary purpose is to provide a detailed overview of the development of a database of empirical estimates of recreation use values. This database is part of a larger project (Rosenberger and Stanley, 2005) that will evaluate publication selection bias in the recreation values literature and methods for mitigating these effects when using this literature for value transfers. The next section provides a history of the recreation use values database. Development of the database is provided next along with summary statistics that describe it. An overview of publication selection bias is provided and some preliminary results are presented. Future analyses are detailed in the conclusions of this paper.

A BRIEF HISTORY OF THE RECREATION USE VALUES DATABASE[1]

The first published review of the recreation use values literature was conducted by Sorg and Loomis (1984). Their review covered outdoor recreation and forest amenity use value estimation from the mid-1960s to 1982. The second review, conducted by Walsh, Johnson and McKean (1988, 1989, 1992) covered outdoor recreation use value studies from 1968 to 1988, building on the first review, but focusing primarily on the 1983 to 1988 literature. Concurrently,

[1] Past and present sponsors of the database include US Environmental Protection Agency; USDA Forest Service; USDI National Park Service; USDI Bureau of Reclamation; and USDI Fish and Wildlife Service

Smith (1988) [see also Smith and Kaoru 1989] was conducting a review of the literature focusing on travel cost model estimates of recreation benefits.

A third literature review was conducted by MacNair (1993) and covered the period 1968 to 1993. This review formally coded information on attributes of the studies beginning with the Walsh et al. database and expanding on it through new literature searches. A fourth review of this literature was conducted by Loomis, Rosenberger and Shrestha (1999) [see also Rosenberger and Loomis 2000a, 2000b, 2001; Shrestha and Loomis 2001, 2003] using an expanded coding protocol worksheet and focusing most intently on the period 1988 to 1998, excluding sport fishing studies. The MacNair database (which carried forward the Walsh et al. database) was then merged with this fourth iteration of the database. Concurrently with this fourth literature review was a review of sport fishing studies using a similar coding protocol worksheet (Boyle et al., 1998). A fifth review of the literature was conducted by Kaval and Loomis (2003) [see also Loomis 2005], updating the previous version of the database to 2003 and focusing on under-represented recreation activities.

The current effort is the sixth comprehensive review of the recreation use values literature. This review not only updates the database with newly emerged documents through 2006, but also searched for any heretofore missed documents. A comprehensive review and recoding of all documents was necessary to meet the objectives of this project, but also to correct for prior inconsistencies in screening and coding of documents. For example, Walsh et al. chose to only record one estimate per resource per document[2], which they called 'author preferred'. Conversely, Rosenberger et al. chose to code all estimates provided in each study. Also, Rosenberger et al. did not duplicate search efforts of Boyle et al., choosing to not enter any new

[2] See Stanley (2001) and Rosenberger and Loomis (2000a, 2003) for details on conducting literature searches, coding protocol, etc.

sportfishing values since the MacNair database. Given each subsequent version of the database expanded on but did not revise the coding of documents already in the database, inconsistencies were propagated. In addition, none of the prior iterations of the database coded estimated parameters, their standard errors and price elasticities that are necessary for the publication selection bias testing of the current project.[3] Therefore, all past documents have been re-coded using a standardized and expanded coding protocol worksheet. Additional documents were added including eligible sport fishing documents, previously overlooked documents, and documents released between 2003 and 2006. This latest version is the most comprehensive and consistently coded database to date of recreation use values for the US and Canada.

THE RECREATION USE VALUES DATABASE

An extended bibliography of recreation use value studies was developed by merging the bibliographies of each database identified above along with candidate documents uncovered in a new search of electronic databases. Unfortunately, physical copies of the documents were not inherited along with earlier versions of the database. Fortunately, several collections of recreation use value literature were intact and graciously provided to us.[4] The remaining missing documents were obtained through private collections and interlibrary loans.

New documents were identified through searches of electronic databases (EVRI, EconLit, Argicola, AgEconSearch) and formal requests for documents and/or references distributed via

[3] An exception is the Smith (1988) project; however this was parallel to, but not part of, the recreation use values database.

[4] We thank the generosity of Kerry Smith for donating his collection of documents from his database (Smith, 1988) and Ross Arnold for providing a copy of documents gathered by the USDA Forest Service in support of their RPA values. Without these two individuals, there would definitely be more holes in the early decades of our database. Not only did we obtain a hardcopy of all but one document referenced in the Kaval and Loomis bibliography/database, but we were able to add several more documents to the database that represent the early years of valuation.

postal mail, e-mail, or listserve. The formal requests were sent to all graduate degree granting economics departments in the US (n=176) and Canada (n=28); US state natural resource agencies (n=178); Canadian provincial natural resource agencies (n=36); and to listserves including W1133, RESECON, HDWILD, SERR, SPRE and CALS.

Each document was screened for inclusion in the database using the following criteria—(1) written documentation must be available; (2) estimate of use value must be provided; (3) use values must be for outdoor recreation related activities; (4) these use value estimates must be measures of access value (all-or-nothing, not marginal values); and (5) studies must evaluate recreation resources in Canada or the United States. Once a document passed the screening phase, it could be entered into the database based on the coding protocol template. This template consists of 13 sections that record various fields of information, including information on the study source; publication details; study location; recreation activity; site characteristics; site type; survey and sample characteristics; valuation method; stated preference characteristics; revealed preference characteristics; benefit measure and characteristics; subjective evaluations; and regression parameters. Another section was added for standardizing the benefit estimates based on units and time. In sum, there are 139 data fields.

The database currently contains 329 documents that jointly provide 2,705 estimates of recreation use values. The studies were documented from 1958 to 2006 based on data collected from 1956 to 2004. Figure 1 shows the distribution of the number of studies and estimates over time. As the theoretical foundations and state-of-the-art for nonmarket valuation improved, more scientists were drawn into the field. Since 1983, averages of about 12 documents per year are released. The significant spikes in the number of estimates per year coincide with the release of benefit estimates from the US Fish and Wildlife Service's National Survey of Hunting, Fishing

and Wildlife-Associated Recreation, which provides roughly one estimate per activity per state in the US. Other national-scope studies contribute a large number of estimates.

Figure 2 shows the distribution of number of studies and estimates by document type. Documents were classified into one of nine types—(1) journal article; (2) book or book chapter; (3) agency or university report; (4) consulting report; (5) Master's thesis; (6) PhD dissertation; (7) working paper; (8) proceedings paper; or (9) web or internet report. Journals and agency/university reports are the primary sources of information in the database. While journal articles have the highest number of studies, agency/university reports provide the greatest number of estimates.

Figure 3 shows that the vast majority (96%) of the studies were conducted in the US. Studies that applied revealed preference methods (RP) such as the zonal travel cost, individual travel cost, hedonic travel cost or random utility models account for over two-thirds (71%) of the studies. However, studies applying stated preference methods (SP) such as contingent valuation and choice experiments account for nearly half of the estimates in the database. A few of the stated preference studies are national in scope and add an atypical number of estimates to the database. Figure 4 shows an equal number of estimates derived from zonal travel cost models (TCM), individual travel cost models and open-ended contingent valuation models (CVM). Underlying trends include the use of zonal TCM and open-ended CVM in the early years of nonmarket valuation. Advances in theory and state-of-the-art led to the adoption of individual TCMs and dichotomous choice CVMs as standard applications in the later years of nonmarket valuation. Random utility model TCMs and choice experiments are seeing an increase in application to recreation use valuation, but primarily for measuring marginal values of site characteristics changes.

Figure 5 shows the distribution of estimates of consumer surplus per person per day (adjusted to 2006 dollars). There are 2,705 estimates provided, ranging from about $0.50 to $2,754. Estimates that are in the upper tail of this distribution are derived from bad models as identified by the authors of the documents' the authors of the documents included them for illustrative purposes only. Of the 36 estimates >$500, 60% are identified as being based on bad models. We therefore trim the database of all estimates reported as being derived from bad models (n=96), and estimates >$500 (n=16), for a total reduction of the database by 112 estimates (i.e., we removed about 4% of the database). Figure 6 shows the distribution of the trimmed-database, which consists of 2,594 estimates ranging from $0.50 to $486 in consumer surplus per person per day (in 2006 dollars).

Table 1 provides average welfare measures by activity by US Census region and Canada ('National' refers to studies that were national in scope and is not the US average value). Twenty-seven types of recreation activities are identified. Some of the activities can be further segregated, such as big game hunting by species or fishing by species. The names of the activities are straightforward and need no further defining except for General Recreation and Other Recreation. A study that evaluates a site with multiple recreation activities and does not segregate the data is coded as General Recreation; i.e., the underlying sample participates in several activities with no single activity being dominant. Other Recreation includes all recreation activity types that do not fall into the previous 26 types. For example, little studied activities include mountain running, visiting historic sites, visiting arboretums, horseback riding, etc.

The average value for the entire trimmed-database is $53[5] per person per day (in 2006 dollars) and is derived from 325 studies cumulatively providing 2,594 estimates of value. The last row of Table 1 provides an average estimate aggregated across activities for various regions, while the last column provides an average estimate aggregated across regions for each activity. The West region was the most studied with 165 documents reporting 1,048 estimates, which is twice as large a sample size as any other region. The West region also had the highest per person per day welfare measure at $60.74 (in 2006 dollars), with the South region very similar at $60.54 per person per day (in 2006 dollars). The lowest valued and least studied regions include the Midwest and Canada.

The most studied recreation activity is freshwater fishing (101 documents providing 752 estimates). Big game hunting is the second most studied activity with 53 documents providing 459 estimates. Wildlife viewing is the third most studied activity with 32 documents providing 324 estimates. Note that the importance of these three activities is also reflected in the US Fish and Wildlife Service's National Survey of Fishing, Hunting and Wildlife-Associated Recreation, which contributes a substantial number of these estimates to the database. Honorable mentions for most studied activities include hiking and non-motorized boating (such as whitewater rafting, canoeing and floating). Recreation activities that return the most consumer surplus to participants includes mountain biking ($159 per person per day); saltwater fishing ($106 per person per day); non-motorized boating ($98 per person per day); big game hunting ($64 per person per day); and hiking ($61 per person per day)—all estimates adjusted to 2006 dollars.

[5] This estimate and all others reported in this paper should be approached with caution. We have not corrected for intra-study correlation effects for studies reporting more than one estimate, nor corrected for possible publication selection effects.

PRELIMINARY EVIDENCE OF PUBLICATION SELECTION BIAS

As noted previously, publication selection can bias a literature as a source of empirical evidence. If these potential sources of publication bias are working in the same direction, an empirical literature can become quite skewed. For example, price elasticities of water demand are exaggerated by nearly four-fold (Stanley, 2005). Meta-regression analysis, or the analysis of analyses, may be the only defensible method to detect and correct for publication selection and other biases (Rosenberger and Stanley, 2006; Stanley, 2005, in press).

Some simple publication selection test results are provided below to describe potential sources of bias. Additional, more powerful tests are warranted given the low power and preliminary nature of this analysis. Therefore, we will not draw any definitive conclusions based on these simple tests. Figure 7 displays the mean value and 95% confidence intervals by document type. Table 3 provides the t-statistics and their p-values based on two sample t-tests assuming unequal variances that test H_0: $u_i = u_j$, where u is the mean and $i \neq j$. While 'journal' or 'peer-review' may not be indicators of sources of publication selection, they have been found to have an effect in other nonmarket valuation literatures (Rosenberger and Stanley, 2006). In this case, journals, agency/university reports, PhD dissertations, working papers and proceedings papers did not provide statistically different mean values of consumer surplus from each other, but did provide mean values statistically different from books/book chapters (+), consulting reports (-), and Master's theses (+). Mean values provided by consulting reports differed significantly from all other document types.

Publication selection may have more to do with the motives of a document. For example, certain journals are most interested in theoretical contributions or other innovations that advance the state-of-the-science. Therefore, a better classification may be the primary contribution of

each study. Figure 8 displays the mean value and 95% confidence interval for estimates classified as efficiency, bias testing, and new values. Efficiency refers to papers that either introduces new, more efficient estimators or survey designs/data collection. Bias testing refers to studies that test the validity/reliability of methods, such as various specifications and treatments of the data (e.g., protest respondents). New values are studies that have as their primary purpose the introduction of a new estimate of value. Table 4 provides two sample t-tests assuming unequal variances, and show that all three contribution motivations statistically differ at the 0.10 level or better. Efficiency contributing studies resulted in lower consumer surplus values per person per day than either bias testing or new values contributing studies, which did not differ from each other. However, if efficiency and bias testing studies are pooled, their mean estimate of value does not statistically differ from the mean of new value studies.

There are many confounding factors and dimensions that can either masquerade as or mask publication selection effects. For example, Figure 7 shows consulting reports provide higher values than other document types, on average. But if consulting reports are highly correlated with saltwater fishing studies, then the higher values are expected. Table 2 provides the results from a preliminary meta-regression model. The dependent variable in the meta-regression model is the reported welfare measures (adjusted for units and time), while the independent variables control for various factors such as valuation method, resource type, survey mode, region and activity. That is, the meta-regression model:

$$(1) \qquad y_i = \beta_0 + \beta_k' x_i + \varepsilon_i ,$$

where y is consumer surplus/person/day, β's are parameters to be estimated, the x's are variables describing various factors, and ε is the classical error term with mean zero and variance σ^2_ε.

Only the variables of primary interest are reported in Table 2 along with summary statistics for the regression model. The semi-log (logged dependent variable) fit the data best based on goodness-of-fit parameters. The adjusted-R^2 is 0.344. The F-test is significant at the 0.01 level. The N is 2,594 and number of parameters estimated (k) is 58, leaving 2,536 degrees of freedom (df). All document types with the exception of books/book chapters are statistically different than zero, meaning they are statistically different from the omitted category of Master's thesis and from each other. Primary contribution effects only show that efficiency contributions differ from zero and from the omitted category of new values. Bias testing and new values are not distinguishable from each other.

CONCLUSIONS

This paper reports on the initial stages of a project to investigate the presence of publication selection bias in the recreation use values literature for the US and Canada and its effect on value transfers using this literature. A comprehensive study and consistent coding scheme were conducted, resulting in a database of 325 studies providing 2,594 estimates of value (after trimming inappropriate values and uncharacteristically large estimates). Results from simple tests of mean differences among classifications of the data by document type and primary contribution show that these sources/motivations provide statistically different estimates of mean values in many cases.

The preliminary analyses presented in this paper do not lead to any definitive conclusions regarding the presence of and effect of publication selection bias in the recreation use values literature. Additional tests of the database, including analyses on subsets of the data, are

warranted. However, should publication selection bias be detected, means for mitigating or controlling for its effects is needed.

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Table 1. Recreation Activity Access Values in Consumer Surplus Per Person Per Activity Day by US Census Regions (2006 dollars).

ACTIVITY	NORTHEAST	MIDWEST	SOUTH	WEST	NATIONAL (in scope)	CANADA	GRAND TOTAL
Backpacking	$7.43 (2:31)[a]	---	$29.16 (1:4)	$36.66 (2:2)	$45.70 (1:1)	---	**$12.26** (6:38)
Beach	48.04 (3:12)	12.03 (2:10)	74.21 (2:26)	53.19 (2:20)	---	---	**54.26** (9:68)
Bicycling, Leisure	---	$33.71 (1:6)	43.34 (4:12)	---	23.48 (1:1)	---	**39.26** (5:19)
Boating, Motorized	97.96 (2:6)	10.37 (2:24)	23.56 (4:13)	27.69 (7:19)	28.82 (1:1)	---	**26.95** (14:63)
Boating, Non-Motorized	34.17 (2:5)	60.46 (3:12)	119.84 (6:27)	108.89 (15:46)	37.79 (1:3)	67.54 (1:3)	**98.51** (27:96)
Camping	23.16 (4:7)	9.06 (2:3)	9.38 (3:10)	19.94 (15:58)	15.35 (1:2)	---	**18.38** (21:80)
Fishing, Freshwater	57.11 (22:125)	34.77 (21:187)	49.40 (24:126)	69.62 (50:279)	61.48 (4:14)	$15.05 (6:21)	**53.81** (101:752)
Fishing, Saltwater	61.34 (6:16)	---	143.01 (7:20)	118.14 (5:25)	70.49 (3:10)	---	**105.63** (21:71)
Hiking	60.95 (2:2)	55.64 (1:1)	100.20 (5:10)	55.49 (23:63)	21.74 (1:1)	---	**61.00** (30:77)
Hunting, Big Game	67.26 (11:57)	51.34 (10:90)	61.15 (9:77)	72.60 (33:171)	124.32 (2:5)	54.71 (7:59)	**64.11** (53:459)
Hunting, Small Game	28.60 (3:9)	44.82 (3:3)	165.04 (1:1)	80.60 (6:28)	68.16 (2:6)	7.89 (2:17)	**52.45** (17:64)
Hunting, Waterfowl	36.30 (5:17)	29.22 (3:26)	56.07 (4:30)	53.46 (8:31)	120.71 (2:7)	15.02 (2:19)	**44.97** (18:130)
Mountain Biking	---	---	52.48 (1:1)	166.22 (6:15)	---	---	**159.11** (7:16)
Off-Highway Vehicles	---	---	27.96 (1:6)	38.66 (2:6)	26.59 (1:1)	---	**32.79** (4:13)
Picnicking	5.33 (2:5)	9.99 (1:1)	40.98 (2:4)	17.53 (3:8)	20.92 (1:1)	---	**19.04** (7:19)
Rock Climbing	55.53 (1:1)	---	163.48 (3:3)	31.86 (1:6)	10.58 (1:4)	---	**55.67** (6:14)
Scuba Diving	---	---	155.98 (1:1)	10.53 (1:2)	---	---	**59.02** (2:3)
Sightseeing	---	28.41 (2:2)	56.99 (4:6)	40.74 (4:12)	21.08 (1:2)	---	**42.26** (7:22)
Skiing, Cross-Country	38.48 (1:2)	---	---	30.43 (1:2)	16.90 (1:1)	---	**30.94** (3:5)
Skiing, Downhill	---	---	---	27.14 (3:7)	26.15 (1:1)	---	**27.02** (4:8)
Snorkeling	---	---	50.06 (2:4)	9.47 (1:2)	---	---	**36.53** (3:6)
Snowmobiling	---	---	---	27.98 (2:4)	---	---	**27.98** (2:4)
Swimming	27.75 (2:2)	18.48 (1:1)	12.65 (2:2)	7.18 (4:8)	26.17 (1:1)	---	**24.14** (8:14)
Waterskiing	---	---	18.80 (1:1)	7.18 (1:1)	47.54 (1:1)	---	**24.51** (3:3)

ACTIVITY	NORTHEAST	MIDWEST	SOUTH	WEST	NATIONAL (in scope)	CANADA	GRAND TOTAL
Wildlife Viewing	49.79 (9:47)	35.94 (6:50)	50.84 (10:80)	58.87 (16:91)	35.23 (3:14)	11.18 (3:42)	**44.83** (32:324)
General Recreation	---	141.92 (4:14)	52.40 (16:36)	29.43 (19:79)	---	7.41 (2:13)	**44.33** (38:142)
Other Recreation	25.22 (2:2)	20.14 (2:5)	24.23 (3:4)	28.09 (8:63)	24.21 (1:10)	---	**26.90** (14:84)
Grand Total	**49.95** (48:346)	**39.92** (43:435)	**60.54** (83:504)	**60.74** (165:1048)	**53.90** (9:87)	**27.20** (15:174)	**53.29** (325:2594)

[a]In parentheses, #Studies:#Estimates.

Table 2. Meta-regression model with document type and primary contribution dummy variables.

VARIABLE	COEFFICIENT	STD. ERROR	T-STATISTIC	P-VALUE	MEAN
Constant	**2.374**	0.306	7.769	0.000	---
⋮[†]	⋮	⋮	⋮	⋮	⋮
DOCUMENT TYPE					
Journal	**0.225**	0.131	1.706	0.086	0.284
Book/Chapter	0.146	0.208	0.704	0.481	0.013
Govt/Univ Report	**0.449**	0.140	3.220	0.001	0.478
Consulting Report	**0.310**	0.158	1.960	0.050	0.052
Dissertation	**0.556**	0.149	3.720	0.000	0.047
Working Paper	**0.401**	0.146	2.753	0.006	0.083
Proceedings Paper	**0.415**	0.176	2.366	0.018	0.023
PRIMARY CONTRIBUTION					
Efficiency	**-0.238**	0.096	-2.467	0.014	0.049
Bias Testing	-0.064	0.059	-1.075	0.282	0.163
SUMMARY STATISTICS					
Adjusted-R^2	0.344	F[57,2536]	24.85	Log-Likelihood	-3259
N	2594	k	58	df	2536

Dependent variable is log($CS/person/day); mean = $3.468.
[†]48 covariate estimates are suppressed. We only highlight document type and primary contribution effects.

Table 3. Document type: Two sample t-tests assuming unequal variances.

	Book/Chapter	Agency/Univ Report	Consulting Report	Master's Thesis	PhD Dissertation	Working Paper	Proceedings Paper
Journal	**5.50 (<0.01)**	1.49 (0.14)	**-5.37 (<0.01)**	**3.48 (<0.01)**	-0.77 (0.44)	-0.30 (0.77)	0.92 (0.36)
Book/Chapter	---	**-5.15 (<0.01)**	**-7.93 (<0.01)**	-1.48 (0.14)	**-4.30 (<0.01)**	**-5.33 (<0.01)**	**-3.73 (<0.01)**
Agency/Univ Report	---	---	**-6.04 (<0.01)**	**2.94 (<0.01)**	-1.45 (0.15)	-1.55 (0.12)	0.11 (0.91)
Consulting Report	---	---	---	**6.81 (<0.01)**	**3.93 (<0.01)**	**5.09 (<0.01)**	**5.43 (<0.01)**
Master's Thesis	---	---	---	---	**-3.00 (<0.01)**	**-3.46 (<0.01)**	**-2.14 (0.03)**
PhD Dissertation	---	---	---	---	---	0.56 (0.57)	1.28 (0.20)
Working Paper	---	---	---	---	---	---	1.07 (0.28)

Estimated t-statistic with p-value in parentheses. Rejection of the null hypothesis $u_i = u_j$ are in **bold.**

Table 4. Primary contribution: Two sample t-tests assuming unequal variances.

	Bias Testing	New Values
Efficiency	**-4.06 (<0.01)**	**-3.61 (<0.01)**
Bias Testing	---	**1.71 (0.08)**

Estimated t-statistic with p-value in parentheses. Rejection of the null hypothesis $u_i = u_j$ are in **bold.**

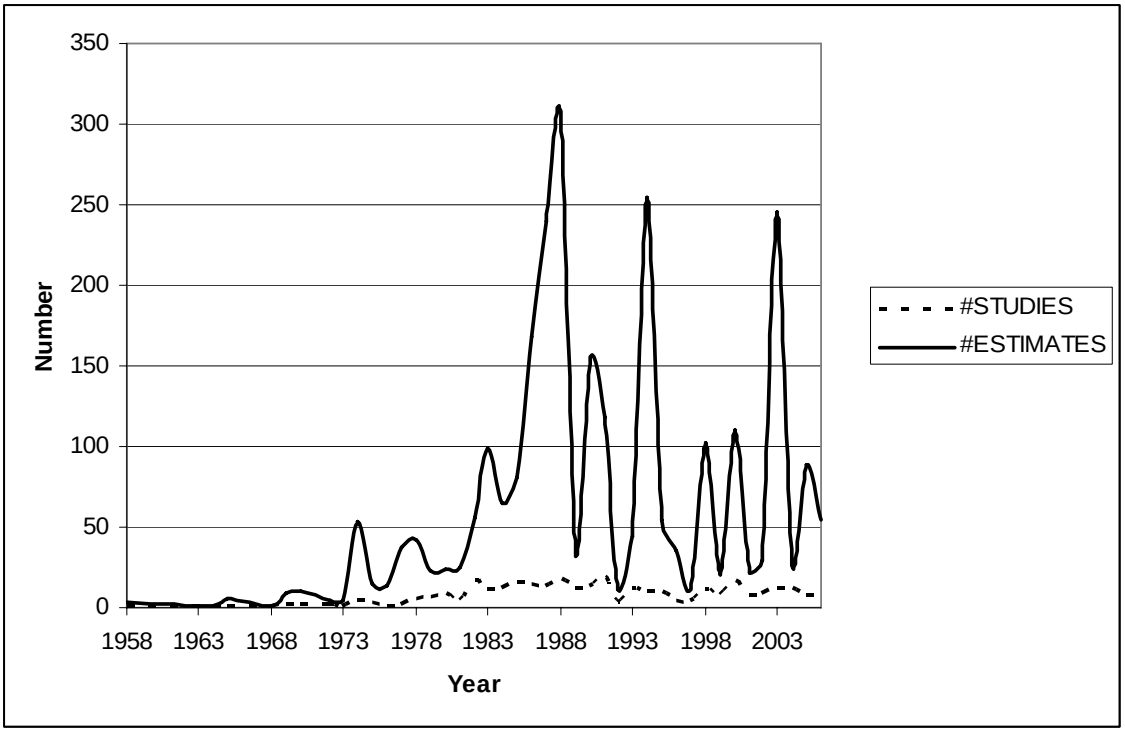

Figure 1. Number of studies and estimates over time.

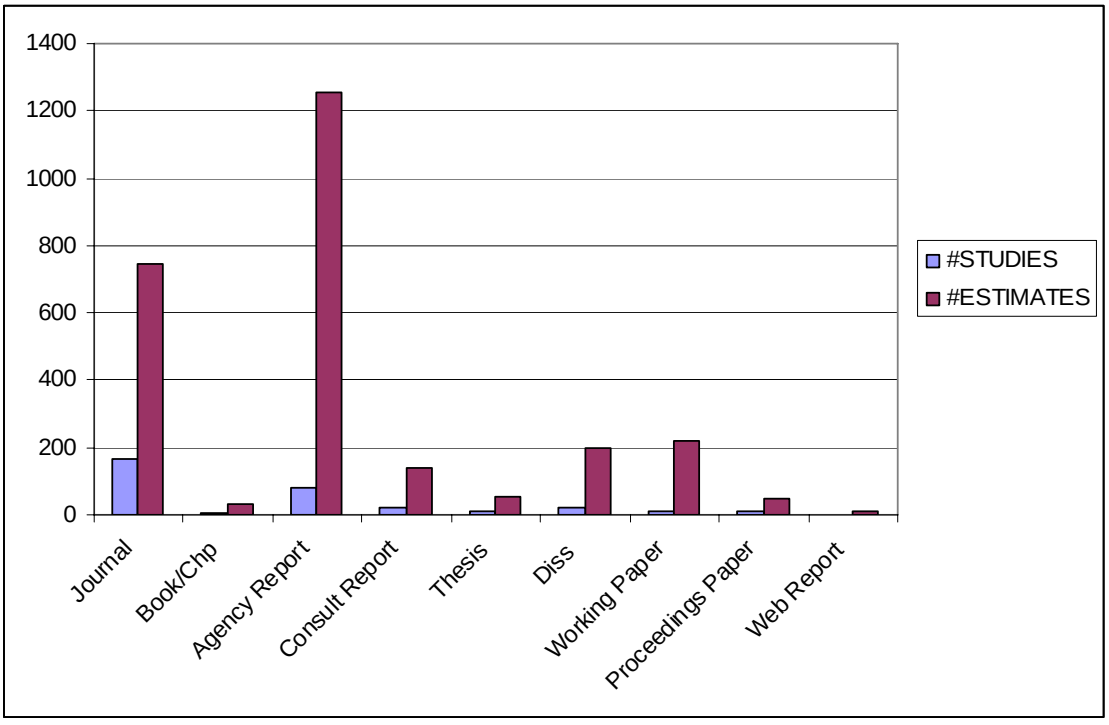

Figure 2. Number of studies and estimates by document type.

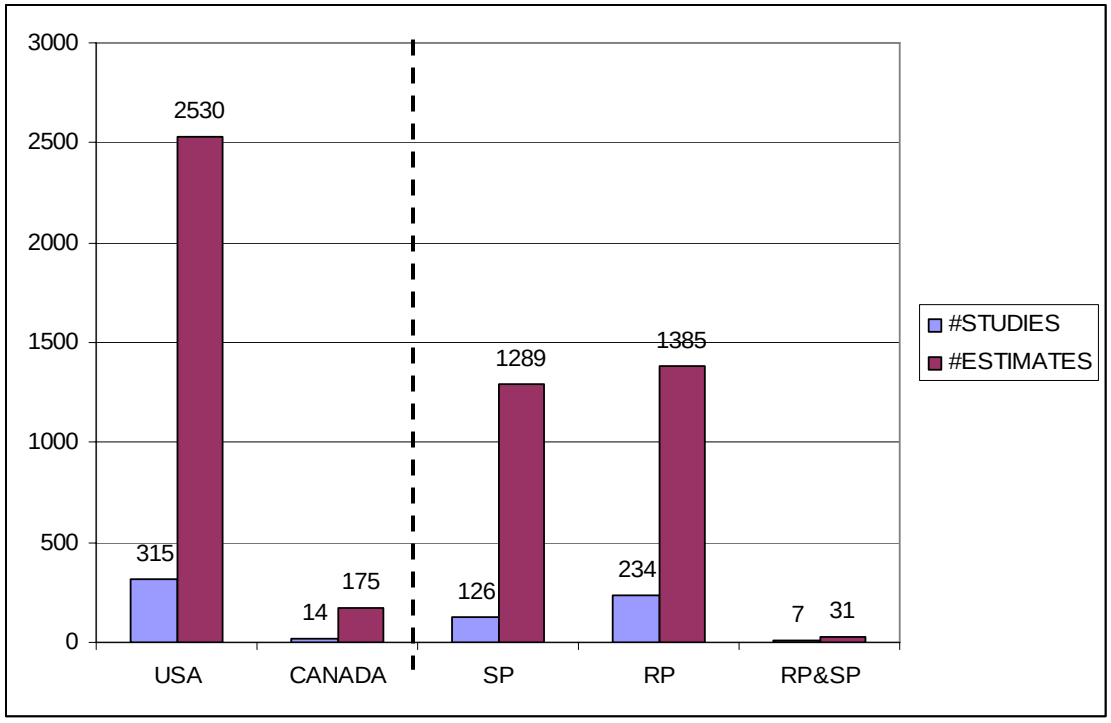

Figure 3. Number of studies and estimates for USA, Canada, stated preference methods (SP), revealed preference methods (RP), and methods that combine RP and SP data (RP&SP).

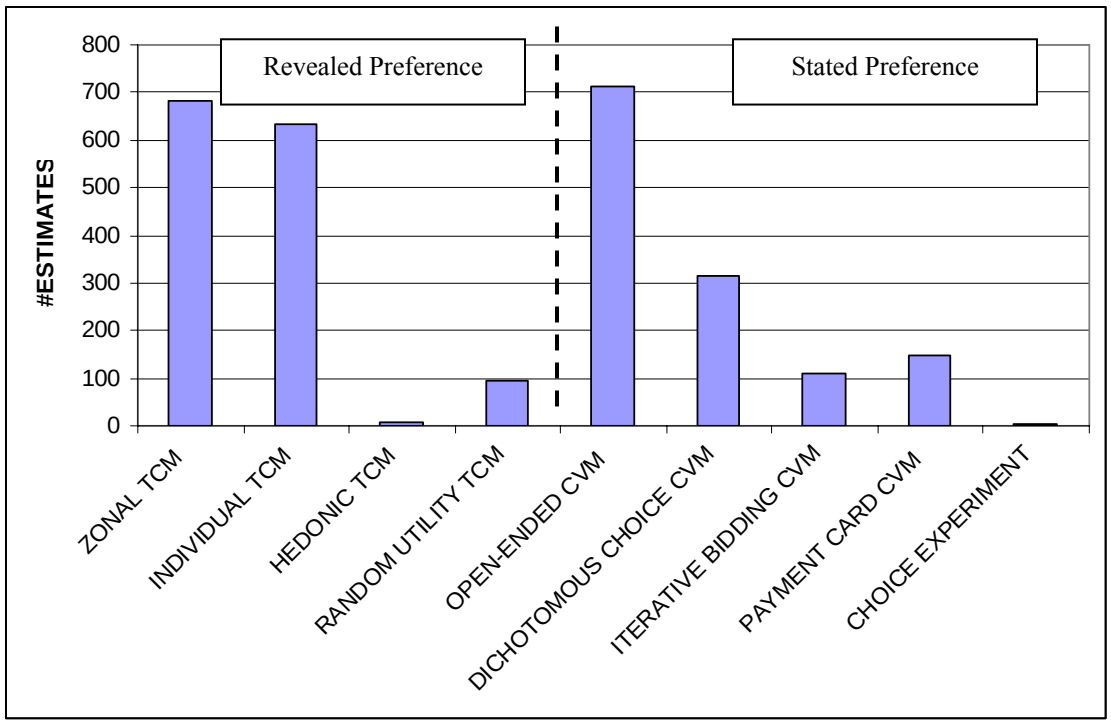

Figure 4. Number of estimates by revealed preference or stated preference methods.

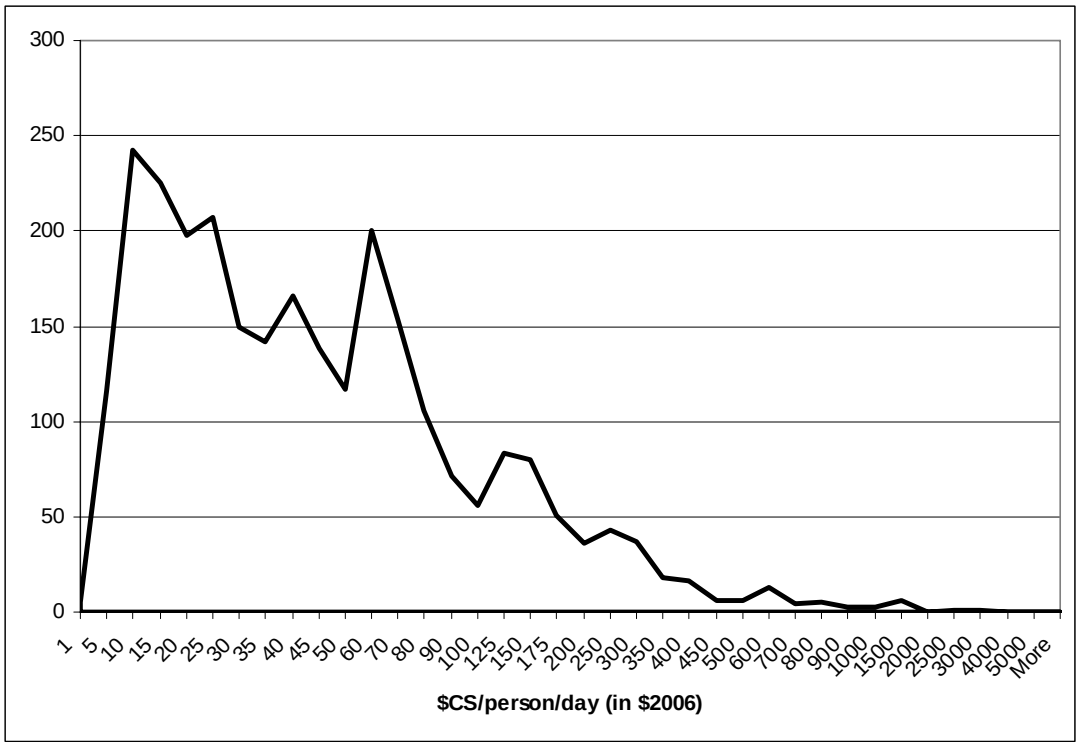

Figure 5. Distribution of consumer surplus per person per day estimates (in 2006 dollars) for entire dataset (N=2,705).

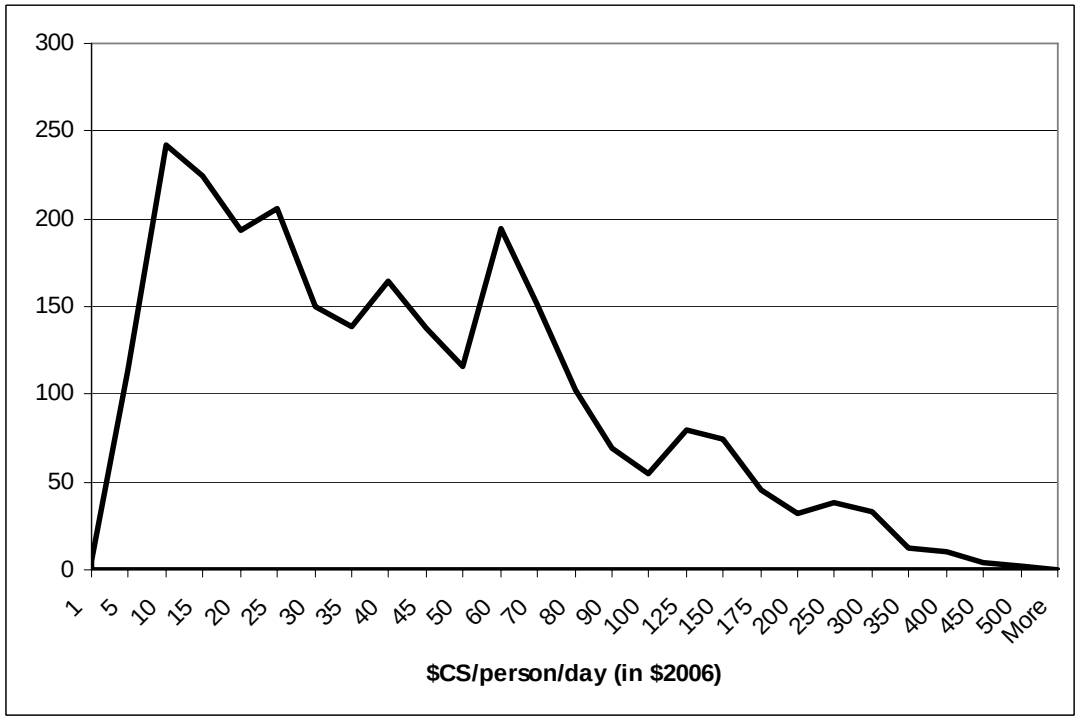

Figure 6. Distribution of consumer surplus per person per day estimates (in 2006 dollars) for outlier-trimmed dataset (N=2,594).

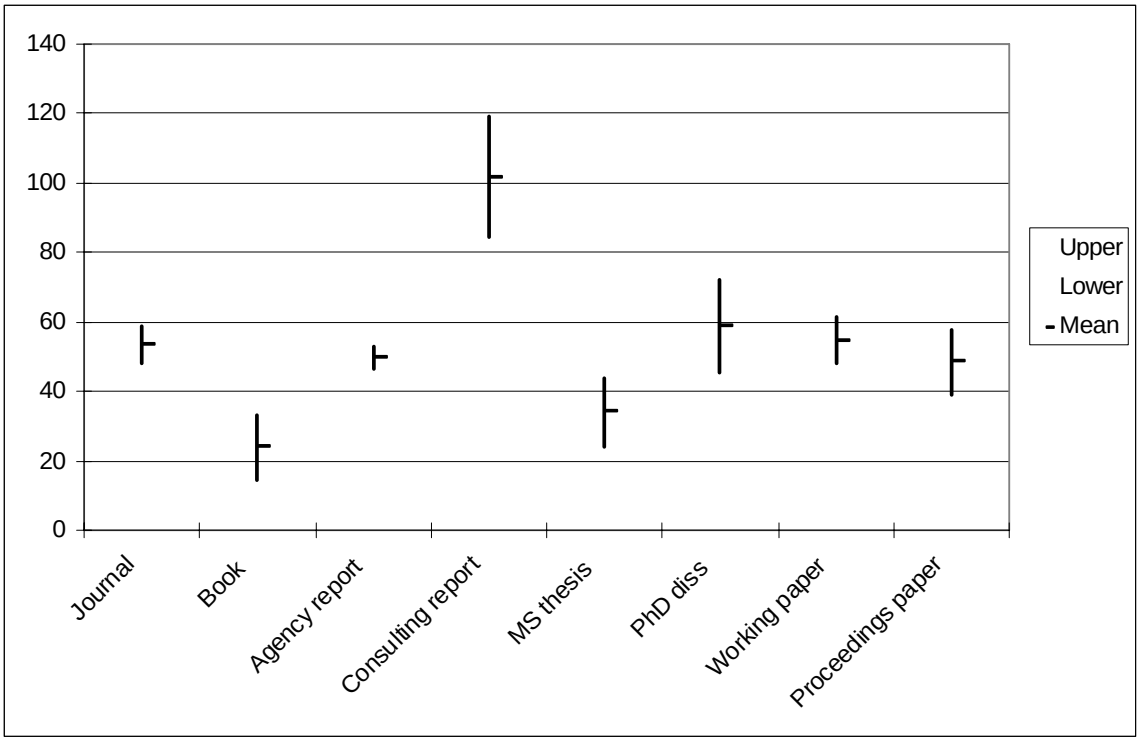

Figure 7. Mean and 95% confidence intervals for average consumer surplus per person per day (in 2006 dollars) by document type.

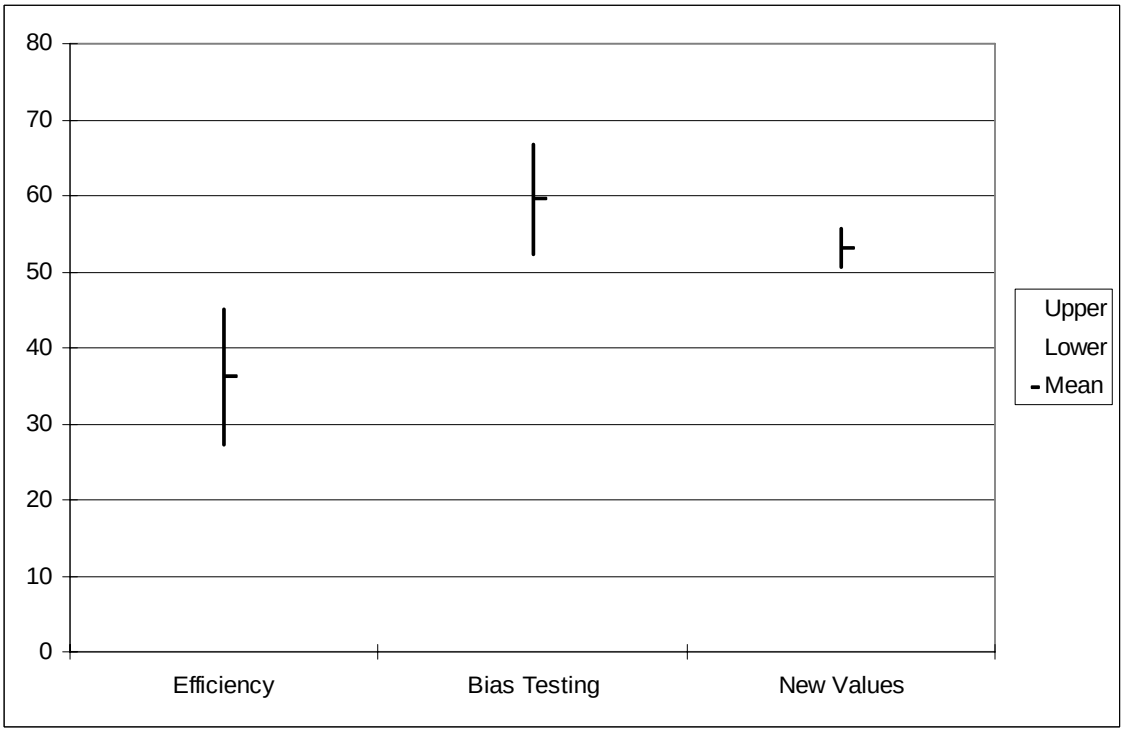

Figure 8. Mean and 95% confidence intervals for average consumer surplus per person per day (in 2006 dollars) by primary contribution.