proposed running title: Joint Estimation of Catch: Thoughts

Joint Estimation of Catch and Other Travel-Cost Parameters - Some Further Thoughts[1]

Edward R. Morey and Donald M. Waldman

Department of Economics, Campus Box 256, University of Colorado,

Boulder, Colorado 80309-0256

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Abstract:

Morey and Waldman propose and use an estimator that jointly estimates catch rates and the parameter on those catch rates. It is designed for situations where there is limited catch data for some of the sites in the choice set and takes advantage of the fact that trip patterns reflect variations in catch rates: anglers do not like to fish at sites with few fish. Train, McFadden and Johnson note that this estimator is particularly sensitive to omitted variable bias and suggest an alternative estimator, but their estimator effectively eliminates poor sites from the choice set.

Choosing an estimator is rarely a simple task; both sides of this debate on how to best model catch and estimate the parameters of a travel cost model are right given their respective assumptions. One needs to understand the fine print. As a rabbi once said to two men debating a point: “you are both correct”. At which point, the rabbis’s wife noted, “They both cannot be correct,” and the rabbi responded, “You are also correct.”

Train, McFadden, and Johnson [6] (hereafter TMJ) point out in their comment on Morey and Waldman [3] (hereafter MW) that if there is a large amount of catch data for each site in the choice set there is little need for the MW estimator, that is, the standard practice of estimating expected catch at a site solely on the basis of the hours of observed catch at the site generates consistent estimates of the catch parameter. We agree. But, this point is often of little relevance. It is difficult to collect large amounts of catch data at bad fishing sites where few anglers fish. And sites are often bad because of pollution and injuries. Anglers vote with their cars and feet and do not go to such sites. The MW estimator was motivated by this fact.

In the MW application [3], approximately 2,700 hours was spent collecting catch data at 25 sites. Catch data was collected on 4,757 hours of fishing. At the four most popular sites, 2,085 hours of catch data were collected in 445 hours of interviewing. At the four least popular sites, 68 hours of catch data, in total, were collected in 450 hours of interviewing. Excluding them would have excluded from the choice set three of the sites that were the subject of the study that motivated the estimator, a natural resource damage assessment for the State of Montana [4]. Eliminating injured sites from the choice set also significantly reduces the variation in site characteristics across sites. The estimator that TMJ suggest for this situation requires that one effectively eliminate bad sites from the choice set.

The MW estimator is both consistent and asymptotically efficient under the assumption that the model includes all important site characteristics, as TMJ note, so dominates the standard estimator in these cases. See Table I, rows 1 and 2, and columns 1 and 4. The standard technique is not efficient because it does not use all of the information provided by economic theory. If there are significant omitted characteristics the MW estimator is inconsistent (row 2, columns 2, 3, 5,and 6).

Table I here.

TMJ identify a set of conditions under which the standard technique is consistent, but the MW estimator is not (column 2).With significant omitted site characteristics, the standard technique is consistent *only if* the omitted site characteristics are uncorrelated with the included site characteristics. So, the defense of the standard procedure rests on there being many hours of catch data for all sites, and omitted variables that are uncorrelated with the included variables. Important omitted variables that are uncorrelated with included variables (the shaded cells in Table I) is generally thought to be unlikely (see, e.g.[5, p. 550],[2, p. 404]).

In support of the standard estimator, if the omitted variables have little correlation with catch rates the "degree" of inconsistency with the standard estimator is likely less than with the MW estimator. The potential for omitted variable bias is greater with the MW estimator.

Besides efficiency, the MW estimator has other potential advantages:

(1) The average of the sample catch rates at site j is an unbiased estimate of the expected catch rate at site j, but the confidence interval on this estimate is large if the number of observed catch rates at site j is small. The standard technique does not take this into account and assumes that an estimate of expected catch based on *n* observations on catch contains as much information as an estimate based on 100*n* observations. The MW estimator does take this into account ([3:

equations (17) - (20)]).

(2) The MW estimator takes account of the fact that trip patterns provide information about expected catch rates, while the standard technique does not.

(3) When there are bad sites in the choice set and significant omitted variables, the MW or the standard estimator can dominate in terms of mean square error. It will depend on the application. Minimizing mse is a relevant criteria for estimators for damage estimation in policy and litigation.

(4) Consider cases where the number of anglers in the sample approaches infinity and the number of catch observations approach infinity at some but not all of the sites - The right half of Table I. In such cases, and when all significant site characteristics are included, the MW estimator is consistent and efficient, while the standard estimator is neither (Table I: column 4). Since one typically collects catch data for only a subset of each angler's trips - in our application one - the number of observed trips at each site approaches infinity faster than the number of catch observations at each site.

TMJ propose a fix to the standard technique for those situations where the "amount of catch data rises with sample size for some sites and yet remains fixed for other sites." Table I: row 3. Specifically, they suggest [6, p. 9],

> With the judicious use of site-specific constants, the procedure (the standard procedure) can be made consistent even though the amount of catch rate data is fixed at some sites. In particular; include a site-specific constant for each site that has a fixed amount of catch rate data. The estimated constant absorbs the measurement error, and the catch rate coefficient is estimated only on the sites whose catch rate data increases with the sample size.

Like us, they are proposing a new estimator for travel cost models, but one where the investigator must exercise prior judgement by first choosing a subset of the sites on which to place a site-specific constant. Then the conventional method is applied. Note that this TMJ estimator is never efficient.

As they note, with such site-specific constants for bad fishing sites, the catch coefficient is estimated only with the data from the sites without the site-specific constants. It needs to be pointed that this is also true of every coefficient of a site characteristic. That is, in addition to the catch coefficient, the coefficient on variables such as size, flow, and the presence of facilities will be estimated only with the data from the sites that do not include a site-specific constant. This is because a site characteristic that varies across sites (but not across individuals) is effectively a site-specific fixed effect, and once a site-specific constant is included it picks up the influence of all the site's characteristics. In the extreme, it is analogous to (a full set of) individual effects in the panel data model--the effects of all time-invariant characteristics are lost. See [1, pps. 11-12]. In summary, inclusion of site-specific constants for bad fishing sites excludes much of the data provided by including such sites in the choice set.

Consider the application of the TMJ estimator for the MW data set [3: Table I]. The recommendation would be to include site-specific dummies variables for those sites with the fewest hours of catch data, but how few? Is 30 hours of observed catch enough to preclude a dummy variable, or should the line be drawn at 100 hours? The choice is essentially arbitrary, but the parameter and welfare estimates could be sensitive to the choice. Either of these lines would effectively eliminate many or most of the six sites from the choice set that were the focus of the empirical study [3].

References

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Table I - Consistency

Estimators	Complete Overlap $m \to \infty \Rightarrow L(j) \to \infty$			Partial Overlap (TMJ Situation B) $m \to \infty \Rightarrow L(j) \to \infty$ for some but not all j		
	Significant Unobserved Site Characteristics?			Significant Unobserved Site Characteristics?		
	No	Yes		No	Yes	
		Uncorrelated	Correlated		Uncorrelated	Correlated
Standard	**T**	**T**				
MW	**TT**			**TT**		
TMJ	**T**	**T**		**T**	**T**	

T = consistent, **TT** = consistent and efficient

Footnote.

1. We thank the referees and the editors for their comments. edward.morey@colorado.edu , http://spot.Colorado.EDU/~morey/index.html , and donald.waldman@colorado.edu .