

Field Testing Existence Values for Riparian Ecosystems

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Abstract—This paper presents preliminary findings on a cash and contingent valuation (cv) experiment. The study replicates major elements of an earlier (1990) experiment, which solicited hypothetical and actual donations to benefit instream flows for Montana fisheries. Extensions of the earlier work include: repeat contacts to increase response rate, follow-up of the contingent valuation question to explore respondent certainty, and several question format treatments (payment card, as in the original study, and dichotomous choice). The sample populations are subsamples of licensed Montana resident and nonresident anglers. Dillman mailing procedures (five contacts) were used to reach potential respondents. Treatments included a replication of the 1990 payment card (PC) question format (mailed to an initial 1,250 resident and 1,250 nonresidents respectively) and a dichotomous choice (DC) format (mailed to 1,250 nonresidents). Response rates were higher for the PC compared to the DC format and for the cv treatments compared to cash. The resident and nonresident angler populations are quite different, with nonresidents tending to be older, richer, more avid and specialized anglers, and more conservation-minded. For the PC treatments, cv donation amounts averaged about double the cash (actual) donation amounts for both subsamples. In constant 2005 dollars, the PC values comparing 1990 and 2005 are similar for resident respondents.

Introduction

This paper describes preliminary results from a field experiment designed to compare responses to a contingent valuation instrument to actual cash donations. This study is in part a replication of an earlier experiment (Duffield 1992; Duffield and Patterson 1991; Duffield and Patterson 1992) aimed at measuring monetary values for provision of a public good. The resource in the 1990 survey was increased streamflow in several potentially important spawning tributaries for two endangered fisheries: a fluvial population of

Arctic Grayling and a population of Yellowstone cutthroat trout.

A limitation of the 1990 study was that the two treatments of most interest were implemented as one-time mailings to simulate typical fundraising solicitations. Both of the latter went out under The Nature Conservancy letterhead and were designed to be very similar in content and wording. As a result of the single mail contact, the response rates were relatively low to these treatments, particularly for the cash response. There was a third treatment (contingent valuation) that paralleled the first two, but went out under University of Montana letterhead and included repeat mail contacts (a total of four) and achieved high response rates (74 percent and 77 percent for resident and nonresident anglers respectively). The University of Montana treatment was used to characterize the population and provide a contrast between a “typical” academic contingent valuation and the other treatments.

The objectives in replicating the 1990 survey in 2005 included achieving higher response rates in the comparable cash and contingent valuation treatments to provide a better measure of potential differences in real and hypothetical economic commitments for this resource and setting.

It was also anticipated that the replication over the span of 15 years would provide an opportunity to measure changes in values, and insights into what, if any, measures of attitudes, preferences, or socio-economic status and characteristics might explain any changes found. (Parenthetically, this aspect of the work relates to a separate multiyear project that may be of interest to readers. The Montana Challenge (<http://fwp.state.mt.us/tmc/reports/ecovalues.html>), directed by Daniel McCollum at the USDA Rocky Mountain Research Station is a state-level case study examining changes in attitudes and values relating to wildlife from a number of social science perspectives. The web citation provides reports including demographics, non-market values, recreation, and a content analysis of newspaper articles.)

Literature and Methods

The comparison of real economic commitments with contingent valuation responses had its beginning in the work of Bohm (1972) and Bishop and Heberlein (1979). There have since been a number of laboratory and field experiments. Studies specifically investigating donation payment mechanisms include Duffield and Patterson (1991), Navrud (1992), Seip and Strand (1992), Brown and others (1996),

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Champ and others (1997), Byrnes and others (1999), Champ and Bishop (2001), and Champ and Bishop (2006).

From a theoretical standpoint, a central feature of the current and 1990 study is that many of the services provided by the resource in question are not excludable. It is anticipated that existence and bequest motives (Krutilla 1967) relating to instream flow in these streams and associated passive use are significant relative to direct use. In fact, it is not very likely that any given angler respondent will ever fish any of the several small streams described in the 1990 and 2005 studies, or experience significantly improved angling in the larger rivers fed by these small tributaries. Nonetheless, direct use may still be an important motive. In any case, the specific payment vehicle used here is anticipated to capture both passive and direct use in a total valuation framework (Randall and Stoll 1983). The choice to make a donation can be modeled in the context of an indirect utility function framework (for example, Boyle and Bishop 1987). The willingness to pay (donate) amount that will just make an individual ambivalent between the current level of services and one with adequate streamflow defines a Hicksian compensating variation welfare measure. Cameron and Huppert (1991) provide an empirical model for estimating willingness to pay (WTP) from payment card interval data. Similarly, parametric or nonparametric methods can be applied for the dichotomous choice models (Hanemann 1989; Kriström 1990; Poe and others 2005).

The current 2005 study includes payment card treatments for both resident and nonresident Montana licensed anglers that were conducted in cooperation with Trout Unlimited. This provides a replication of the earlier payment card treatments done in cooperation with The Nature Conservancy. Table 1 summarizes and compares study methods between 1990 and 2005. The 1990 University of Montana treatments were not replicated.

Extensions to the 1990 study include a question on respondent certainty as a follow-up to the contingent valuation responses (following Champ and Bishop 2001), and testing responses across several question formats. As noted, the latter included payment card formats for both resident and nonresident subsamples (providing the replication to 1990), as well as a dichotomous choice treatment for a second nonresident subsample. Based on the pretest and 1990 study, cash treatments were oversampled relative to contingent valuation in anticipation of lower relative response rates.

An important change in survey methods for the payment card treatments was to use Dillman method repeat mail contacts. The 2005 study included five contacts: an initial letter, first survey mailing, reminder postcard, second survey mailing, and a third survey mailing.

The basic structure (and most of the original questions) of the 1990 survey instrument was retained for 2005. The sequence was as follows: initial set of questions on angling use, questions designed to measure attitudes and preferences, valuation question sequence, and questions addressing respondent socioeconomic characteristics. The decision was made to use the same set of payment card amounts as in 1990 (10, 25, 50, 100, 250, other).

The revised instrument was pretested in the fall of 2004 with a mailing to a sample of 300 anglers. One important finding from the pretest was that the subsample of the 2003–2004 nonresident season angler license list made

available to the researchers by Montana Fish, Wildlife and Parks included nonresidents who held season licenses by virtue of a “combination” elk and/or deer hunting license that included season fishing. The latter group had very low response rates to the 2004 pretest, and had not been included in the 1990 sample frame. For the main 2005 survey, this group was excluded from the nonresident season license subsample.

The initial contact letter for the 2005 survey was mailed on January 21. The reminder postcard went out February 8, the first survey package January 27–31, second survey package on February 25, and third survey package on April 13.

The following discussion of results summarizes responses received and identification of undeliverable mail returns as of May 27, 2005. Preliminary results for the uncertainty follow-up and dichotomous choice questions are not reported here.

Preliminary Findings

Tables 2 and 3 summarize the 1990 and 2005 response rates, with table 3 summarizing the allocation of the total initial mailing list (of 3,750 anglers) across the various treatments. Not surprising, using five mail contacts in 2005 (compared to one in 1990) significantly improved response rates. The overall response rate is 47 percent. The cash response rates were higher than anticipated and average about 85 percent of the corresponding contingent valuation treatment response rate. The dichotomous choice response rates were also systematically lower (and also about an 85 percent ratio) compared to the corresponding nonresident payment card response. Sample sizes for each treatment are close to the study goal of about 200 in each cell for the contingent valuation treatments and well in excess of that number for the cash treatments (table 3).

Table 4 provides some detail on the declining marginal effect of subsequent respondent contacts on response rates. There is considerable consistency across treatments. Figure 1 shows a plot of five-day moving average responses per day for residents and nonresidents. The three spikes in response rates correspond (with a five or so day lag reflecting mail delivery time) to the mailings of the initial survey package plus reminder postcard and the next two survey mailings. Note that well after each mailing, a low level of response continues.

Table 5 summarizes selected respondent characteristics by subsample. Age, percent female, median education, and median income level are similar across cash and contingent valuation subsamples within each treatment. Table 5 also shows characteristics measures aggregated for residents and nonresidents. Preliminarily, it appears that nonresident anglers are older, less likely to be female, better educated, and richer than resident anglers.

Table 6 summarizes other respondent characteristics by residency including measures of angling use, angling specialization, angling avidity, recreational property ownership in Montana, importance of adequate streamflows, and measure of environmental and wildlife-related attitudes and preferences. It appears that nonresidents are more avid, more specialized, and have preferences more favorable to conservation initiatives. One notable result is that 20.5

Table 1—Comparison of study methods: 1990 and 2005 studies.

Study characteristic	1990 Study	2005 Study
Resource examined	Instream flows / Threatened fisheries	Instream flows / Montana fisheries
Cooperating group	The Nature Conservancy	Trout Unlimited
CV question format	Payment card	Payment card and dichotomous choice
Surveys mailed	7,662	3,750
Survey contacts	One	Five
Sample frame	Licensed anglers	Licensed anglers

Table 2—1990 study response rate statistics.

Statistic	Residents		Nonresidents	
	Cash	Hypothetical	Cash	Hypothetical
Surveys mailed	2,622	1,166	2,682	1,192
Undeliverable	344	153	310	138
Potential respondents	2,278	1,013	2,372	1,054
Useable returns	205	193	306	288
Response rate	9.0%	19.1%	12.9%	27.3%

Table 3—2005 study response rate statistics.

Sample	Surveys mailed	Bad Addresses	Delivered	Surveys returned	Response rate
Resident payment card			<i>Percent</i>		
- Cash sample	850	53	797	350	43.9
- Hypothetical sample	400	24	376	181	48.1
Subtotal-resident payment card	1,250	77	1,173	531	45.3
Nonresident payment card					
- Cash sample	850	79	771	378	49.0
- Hypothetical sample	400	46	354	204	57.6
Subtotal-nonresident payment card	1,250	125	1,125	582	51.7
Nonresident dichotomous choice					
- Cash sample	850	110	740	311	42.0
- Hypothetical sample	400	47	353	173	49.0
Subtotal-nonresident dichotomous choice	1,250	157	1,093	484	44.3
Entire resident sample	1,250	77	1,173	531	45.3
Entire nonresident sample	2,500	282	2,218	1,066	48.1
Entire sample	3,750	359	3,391	1,597	47.1

Table 4—Marginal effect of subsequent respondent contacts on response rates.

Sample	Wave 1 response	Wave 2 marginal response	Wave 3 marginal response
Resident payment card		<i>Percent</i>	
- Cash sample	24.0	14.3	4.9
- Hypothetical sample	27.1	13.0	6.9
Nonresident payment card			
- Cash sample	28.3	16.1	5.4
- Hypothetical sample	37.6	14.7	6.5
Nonresident dichotomous choice			
- Cash sample	20.1	16.4	5.5
- Hypothetical sample	30.9	12.5	5.7
Entire sample	26.6	14.9	5.6

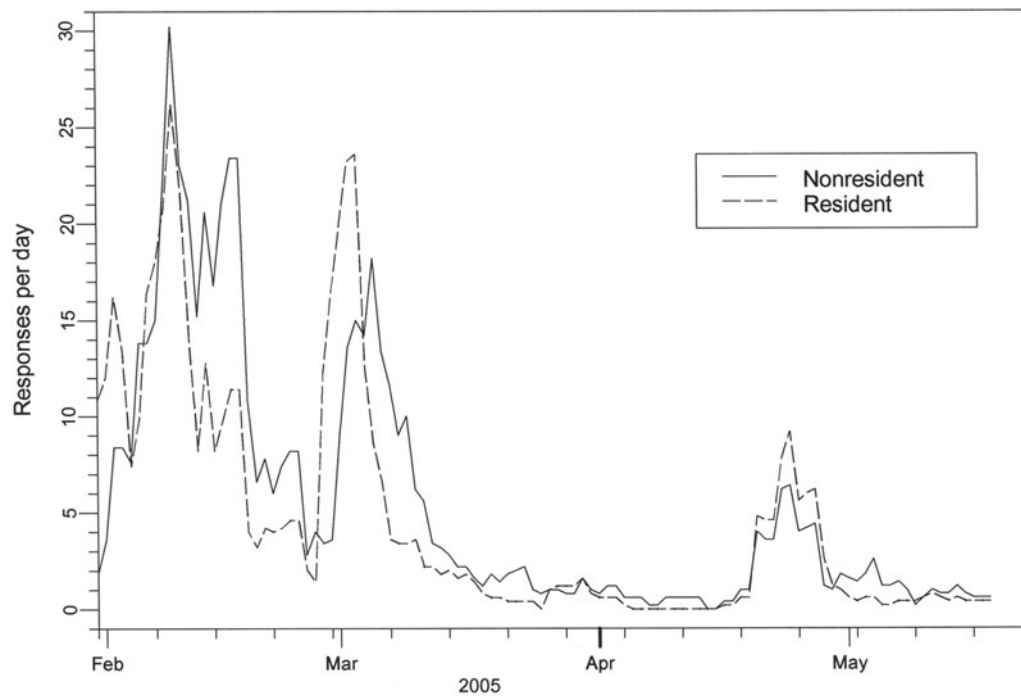


Figure 1—Payment card responses per day, 5-day moving average.

Table 5—Respondent characteristics, by subsample.

Sample	Mean age	Percent female	Median education	Median income level
Resident payment card				
- Cash sample	47.9	24.2	Some college	40 to 60
- Hypothetical sample	46.7	25.0	Some college	40 to 60
All resident payment card	47.5	24.5	Some college	40 to 60
Nonresident payment card				
- Cash sample	55.2	14.1	Finished college	60 to 75
- Hypothetical sample	54.1	15.4	Finished college	75 to 100
All nonresident payment card	54.8	14.6	Finished college	60 to 75
Nonresident dichotomous choice				
- Cash sample	53.9	13.4	Finished college	75 to 100
- Hypothetical sample	55.2	11.5	Finished college	75 to 100
All nonresident dichotomous choice	54.7	12.2	Finished college	75 to 100

percent of residents but 67 percent of nonresident anglers fly fish only.

Both resident and nonresident anglers favor rainbow and brown trout fisheries over native cutthroat and bull trout fisheries as far as a priority for improved streamflow (table 7). Nonresidents are more certain about their preferences on this allocation issue.

Turning to the preliminary valuation findings, only results for the payment card treatments are summarized here. Additionally, all reported values are simple means of the respondent indicated contingent valuation or actual donation amounts, not WTP values. These simple means are the correct approach for identifying the actual average amount of money raised in the cash transaction treatments.

Tables 8 and 9 summarize for the 1990 study the mean donations per respondent and per delivered mailing, as well

as the relative frequency distribution of contributions across payment card bid amounts. On a per respondent basis, the ratio of the cash to hypothetical mean donation amount was 0.48 for residents and 0.73 for nonresidents. The ratios on a per delivered basis are much lower, reflecting the disparity in response rates between the cash and contingent valuation treatments (table 8).

Table 10 provides relative frequency and mean donation per respondent for the 2005 payment card treatments. Here the ratio of cash to contingent valuation is 0.52 for residents (similar to 1990) and 0.45 for nonresidents (much lower than in 1990). The cash donation amounts for nonresidents are approximately six times higher than those for residents in 1990 and five times higher in 2005.

Table 11 compares the 1990 and 2005 donations in current (survey year) dollars, while table 12 provides a constant 2005

Table 6—Selected respondent characteristics, by residency.

Characteristic	Residents	Nonresidents
	Percent	
Percent of respondents who fished 25 days or more in Montana in 2004.	8.1	10.3
Percent who only fly fish.	20.5	66.7
Percent who say fishing is their favorite outdoor recreational activity.	11.4	35.9
Percent who own or lease recreational property in Montana.	14.1	24.5
Percent who say that adequate streamflows are "very important" for the future of Montana fisheries.	74.6	87.5
Respondents who said they knew either "a fair amount" or "a great deal" about existing conservation trust fund efforts.	41.6	53.2
Respondents who "strongly agree" with the statement "I'm glad there is wilderness in Montana even if I never get to see it."	51.6	63.7
Respondents who agreed with the statement "I feel I should be doing more for Montana's rivers and streams."	38.5	45.5
Respondents who agreed with the statement "Private conservation organizations should play a major role in protecting our environmental resources."	54.8	75.4
Respondents who strongly disagreed with the statement "I think most Montana rivers already have enough water in them to be a healthy resource."	22.4	17.9
Respondents who strongly agreed with the statement "Rivers have spiritual or sacred value for me."	11.0	18.1
Respondents who agreed with the statement "I would be willing to contribute money or time to help Montana rivers even if I could never visit them."	25.5	39.3

Table 7—Respondent opinions on fisheries and streamflows, by residency.

Characteristic	Residents	Nonresidents
	Percent	
Respondents who think rainbows and brown trout fisheries should be a priority for improved streamflow.	33.3	38.7
Respondents who think native cutthroat and bull trout fisheries should be a priority for improved streamflow.	22.5	28.4
Respondents not sure how best to prioritize improved streamflows.	37.6	26.4
Respondents who ranked Arctic grayling as a lowest priority for streamflow improvement.	24.2	30.4

Table 8—1990 study mean donation amounts.

Statistic	Residents		Nonresidents	
	Cash	Hypothetical	Cash	Hypothetical
Donation per respondent	2.24	4.64	12.60	17.36
Cash/Hypo ratio	0.48		0.73	
Donation per delivered survey	0.20	0.88	1.63	4.74
Cash/Hypo ratio	0.23		0.34	

Table 9—1990 frequency distribution of contributions (percent of all contributions).

Bid	Residents		Nonresidents	
	Cash	Hypothetical	Cash	Hypothetical
\$10	54%	75%	41%	39%
\$25	42	18	35	36
\$50	4	7	17	17
\$100	0	0	6	8
\$250	0	0	1	1
Average contribution	\$17.69	\$14.92	\$28.43	\$31.85
Average per respondent	\$2.24	\$4.64	\$12.60	\$17.36

Table 10—Relative frequency distribution (in percent) for amount contributed, payment card.

Amount(\$)	Resident		Nonresident	
	Cash	Hypothetical	Cash	Hypothetical
0	89.8	73.3	69.4	48.1
1		1.1		
10	5.0	15.9	8.4	7.2
15			0.3	
20	0.6		1.0	1.0
25	3.5	6.3	9.2	20.2
50	0.3	2.3	6.3	11.5
100	0.6	1.1	4.7	9.1
200	0.3			
250			0.8	2.4
500				0.5
<i>n</i>	343	176	382	208
mean	\$2.80	\$5.44	\$13.19	\$29.28

Table 11—1990 and 2005 mean payment card donation (current dollars).

Study/Statistic	Residents		Nonresidents	
	Cash	Hypothetical	Cash	Hypothetical
1990 study	2.24	4.64	12.60	17.36
Ratio		0.48		0.73
2005 study	2.80	5.44	13.19	29.28
Ratio		0.52		0.45

Table 12—1990 and 2005 mean payment card donation (constant 2005 dollars).

Study/Statistic	Residents		Nonresidents	
	Cash	Hypothetical	Cash	Hypothetical
1990 study	3.22	6.68	18.13	24.98
Ratio		0.48		0.73
2005 study	2.80	5.44	13.19	29.28
Ratio		0.52		0.45

dollar comparison (correction based on the CPI-U average for November-December 1990 versus February-March 2005).

Based on the constant dollar comparison (table 12), the resident cash and the resident and nonresident contingent valuation donation means differ by 15 to 20 percent across the 15-year period. The cash nonresident values declined by almost 40 percent.

Figure 2 is a plot of cash payment card mean contribution (11-day moving average) for both residents and nonresidents. The pattern for residents shows a strong downward trend in mean cash donations over time. It also appears to be roughly parallel to, but much lower than, the nonresident, and goes to zero shortly after the second survey mailing. The nonresident is more variable, but also appears to show a gradual decline in mean donations, but donations do not go to zero over the period plotted.

By contrast, in figure 3, the contingent valuation means for both groups show no obvious downward trend. (Certainly there is greater variability in the means shown late in the survey period as marginal samples are declining (table 4).

Discussion

The preliminary results presented here are just that, preliminary. Obviously they have not yet been subject to any rigorous statistical analysis or modeling. Nonetheless there appears to be some interesting consistency with the 1990 payment card format findings.

The simple mean cash transaction measures tend to be around 50 percent or better of the contingent donation measures. The large differences in values across the two angler populations (resident and nonresident) are replicated. The direction of the differences is also consistent with what one would expect from economic theory given differences in some potential covariates for WTP models (income, avidity, etc.).

It is obvious that there is strong selection bias reflected in the pattern of mean cash donations over time. For residents, cash contributors show up early then disappear altogether by the last wave of respondents. Nonresident cash contributors also are a lower and lower share of the response over time.

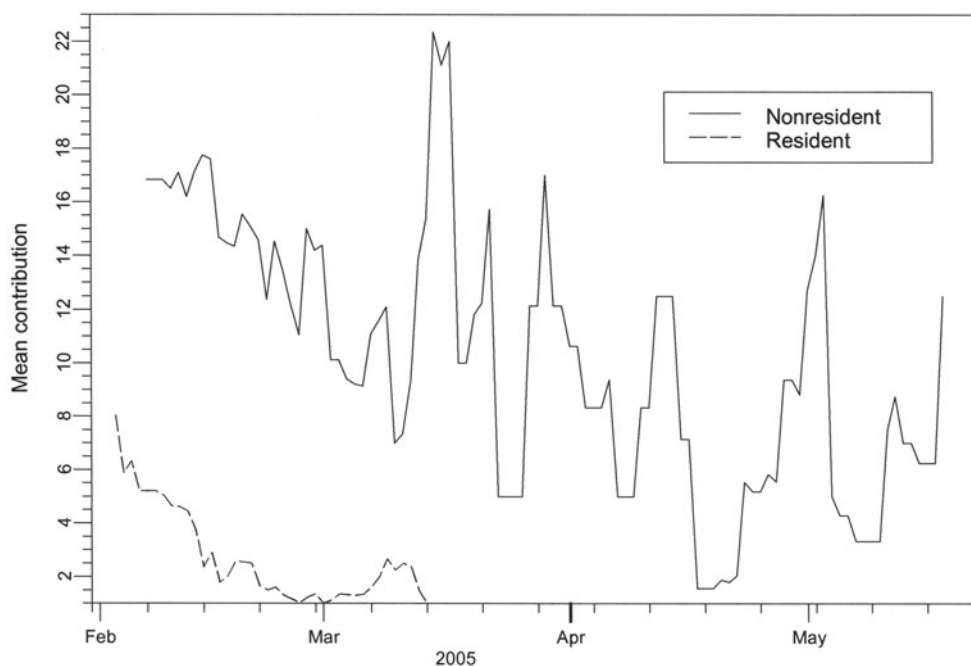


Figure 2—Cash payment card mean contribution, 11-day moving average.

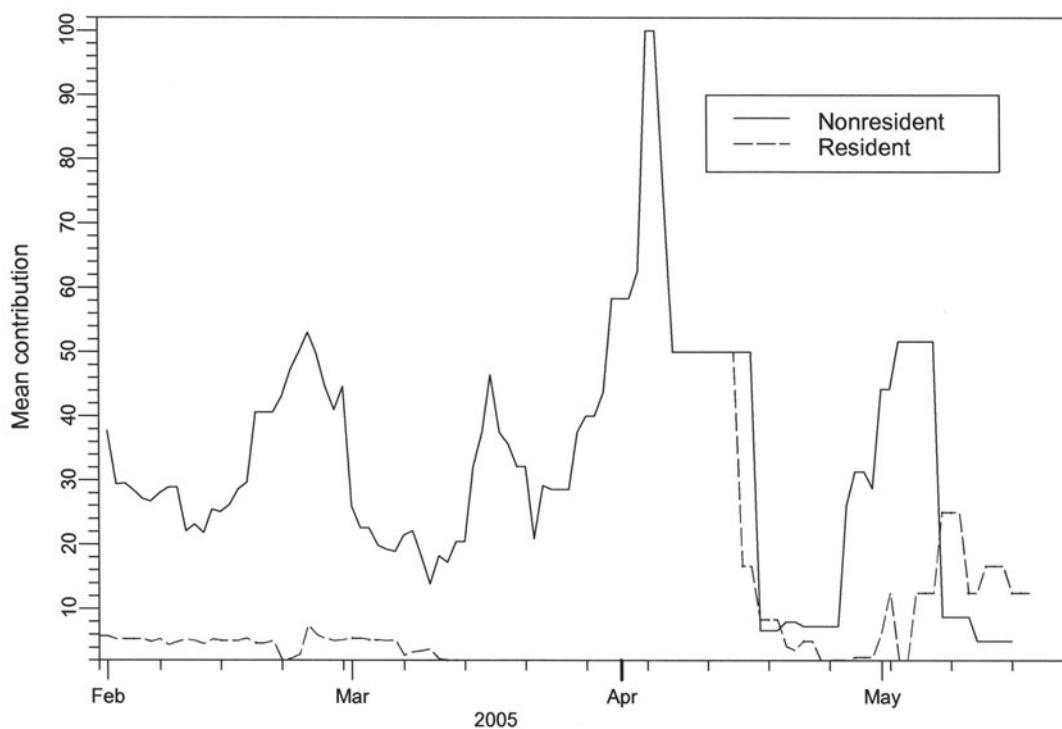


Figure 3—Hypothetical payment card mean contribution, 11-day moving average.

By contrast there appears to be a more stable persistence of contingent donations over time. These two patterns are consistent with a decline in the cash/contingent donation ratio across waves, and may partly explain the 2005 results relative to 1990 (tables 11 and 12).

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